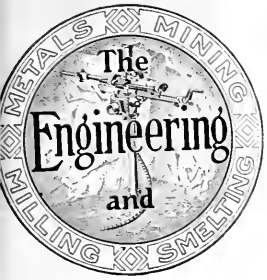

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July 1 to December 31, 1915

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INDEX TO VOLUME C

July 1 to December 31, 1915

Explanatory Note

Illustrated articles are denoted by an asterisk (*), book notices by a dagger (†).

The intention is to make this index comprehensive, embodying a liberal selection of news notes together with more important articles, but at the same time **very concise.** Much pains are taken to bring together matter relating to the same subject so that when a reader looks up an article he will be cited to related data. Under these conditions some further explanation of the method will be useful as an aid in finding leading articles quickly. Series of simple page numbers following names of mines or companies usually refer to news notes and other lesser matters. Descriptive articles are appended under titles (often abbreviated) begining with dashes. When the minor references are numerous, as in the case of "Anaconda," they are sometimes separately designated as "notes." The unspecified entries may, however, be important; occasionally, for instance, an editorial or other article is entitled simply by a proper name. Thus, the entries relating to the "Mexican situation" begin with a number of major ones, not distinguished in detail, followed by others which are so distinguished and by a group of notes at the end. (Additional notes on Mexico might, of course, be found elsewhere under the names of particular mines, etc.) With a major entry or series of entries may be placed several minor ones relating to the same subject in order that its history may be followed. This plan is employed the more readily when the important articles begin the series. The asterisks denoting illustrated articles assist in finding them and if the author's name be known it is the simplest means of reference. Productions are indexed under names of metals and countries or states, in important cases under both. The mere juxtaposition of a mineral and geographical name usually signifies an output but may cover other statistical or news matter.

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The Engineering and Mining Journal

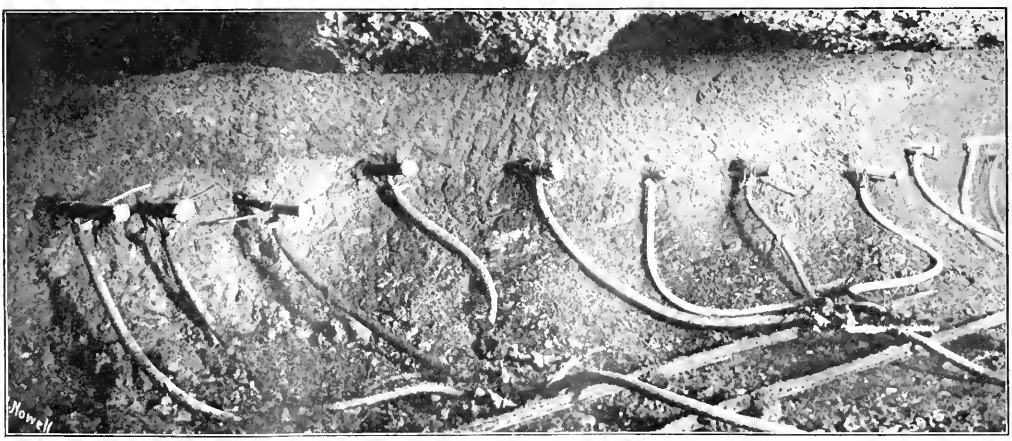
VOLUME 100 JULY 3, 1915 NUMBER 1

Thawing Methods at Fairbanks

By Hubert I. Ellis*

SYNOPSIS—Thawing the frozen paystreak is one of the most important details of mining at Fairbanks. Wood fires were formerly used, but had obvious disadvantages. The efficiency of steampipe methods was accidentally discovered in principle, and has been developed into the only feasible procedure. Full description of principles and practice is given.

After the "opening up," or development, of a typical Fairbanks placer mine, the next step, leaving out of consideration for the present the washing plant, is putting in the first "thaw." Since thawing the permanently frozen material of the paystreak is one of the most important and expensive items entering into the cost of mining—averaging about 20% of the total—the history and development of the steam point will be briefly discussed.



A Battery of Steam Points at Work in the Gravel

Thawing with Wood Fires

Before the discovery of gold at Dawson there had been considerable mining in the great region tributary to the Yukon, notably at Circle, Kewkuk, and on the Stewart River. Where the heat of the sun was not available for thawing, wood fires were used. The slow, easy-going methods of the old timers did not meet with the approval of the eager Dawson stampeders, however, and they cast about for some more efficient scheme for removing the frost from the gravel.

The first attempt to thaw underground, otherwise than with wood fires, seems to have been made on Bonanza Creek in 1898. Pipe boilers of 10-hp. capacity were used to generate steam for siphons and injectors, by means of which warm water was played against the frozen face. The larger rocks were picked loose as fast as they thawed from the matrix and were thrown back to serve as support for the roof. Subsequently pipe boilers of 20 and 25 hp. were introduced, and pulsometer pumps were used to force the water against the face.

This method was applied especially to bench deposits opened by adit, and was used to some extent during winter. The gravel was thawed at night and the rocks removed, and during the day the fine gravel was shoveled into 6-in. sluice boxes supplied with water by the pump used at night for thawing. The tailings were discharged into a box outside the mine, from which they were shoveled into wheelbarrows and wheeled to the edge of the dump. Water, being a scarce article on the benches both in winter and in summer, was used over and over. In driving tunnels with the pulsometer pump an advance of 8 to 10 ft. per day was easily made. The pump as a means of thawing did not give satisfaction, however, chiefly on account of the unavoidable thawing and sloughing of the roof.

Discovery of the Steam-Point Principle

The principle of the steam point was discovered by accident. An engineer noted that the exhaust of the engine he was using had thawed a hole in the surface muck with

*4352 Ninth Ave., N. E., Seattle, Wash.

which it came in contact. This aroused his curiosity and led to casual experiments, which proved that live steam was an effective agency for thawing the muck. The big problem, however, was to thaw the gravel, since the muck handled was comparatively insignificant in amount and could be removed by picking. The inference was obvious that steam, if it would thaw muck, which is more than 50% ice, would likewise thaw gravel, in which the proportion of ice is much less. But here arose another difficulty—that of getting the steam to the interior of the deposit of gravel to be thawed. Since ordinary pipe could not be driven into such resistant material, the first method that suggested itself was to drill the holes with ordinary hand steel and insert the steampipe afterward; but the prohibitive cost of labor prevented serious consideration of this possibility. Then it was remembered that, although frozen gravel was as resistant as concrete, a pick or crowbar could be driven readily into the gravel once it was thawed, and the idea of using hollow drill steel carrying live steam followed as a logical consequence. No drill steel of this kind being at hand, there was substituted the ingenious but ineffective makeshift shown in Fig. 1. This

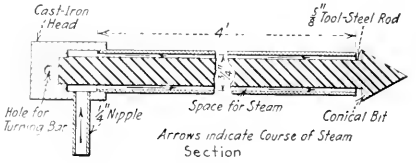


FIG.1

THE FIRST STEAM POINT

consisted of a 4-ft. iron pipe with a ⅝-in. tool-steel rod passing through the center and ending in a conical bit larger than the outside diameter of the pipe. The point had a cast-iron head with a ¼-in. nipple tapped in to admit steam to the annular space between the pipe and the rod. The conical bit cleared away the ground in front of the pipe, much as a churn-drill clears the way for the

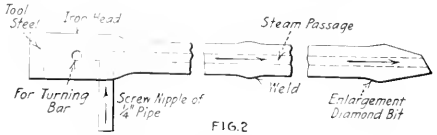


FIG.2

TWO GUN BARRELS WELDED TO MAKE A STEAM POINT

casing, except that the gravel was pushed to the side instead of being removed. This point was driven by means of a wooden mallet, and although fairly satisfactory at that time for soft ground, it could not be used successfully where driving was hard. It added further proof of the value of the principle, however, and served to pave the way for an improved tool.

The next step in the development of the steam point consisted of welding together two gun barrels, welding on an iron head and a tool-steel bit, and tapping in a ¼-in. pipe for the admission of steam (Fig. 2). This form of steam connection proved unsatisfactory under the heavy hammering to which the point was subjected, and what was known as the boiler-rivet nipple was substituted, as shown in Fig. 3. The rivet was placed and caulked to prevent leakage of steam and the steam passage was drilled out afterward. In a later design the rivet was welded to the head of the point, but this was soon replaced by the modern nipple point, which is described in what follows.

The gun-barrel point having proved, in an experimental way, the value of the principle underlying the design, hydraulic pipe (XXXX) was obtained for the barrel of the point, a tool-steel bit and a rolled-steel head being welded on, as shown in Fig. 3. Hollow drill steel was later substituted for the hydraulic pipe, and it became unnecessary to weld on a tool-steel driving point. Fig. 4

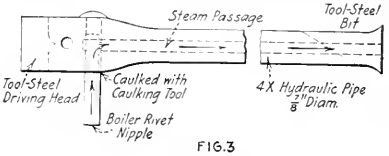


FIG.3

THE THIRD STEAM POINT

Hydraulic pipe with tool-steel bit

shows the entire modern nipple point and Fig. 6 illustrates the details of the head and nipple.

DESIGN OF STEAM CONNECTIONS

The steam connection has been the source of more trouble than all the rest of the point. Many connections have been invented and used to a greater or less extent in practice; some operators prefer one, some another. The nippleless-socket point with drop-forged connections, one type of which is shown at A, Fig. 5, has found a wide market in a great variety of designs. For all-around purposes, however, the nipple point has much to recommend its use. The chief objection to the yoke and other socket-type points, aside from the cost, is that the nuts constantly work loose under the hammering in driving and require frequent tightening. This takes but a moment's time, but

FIG.4

MODERN STEAM POINT

Hollow drill-steel barrel, cold-rolled steel head and solid-welded nipple

the threads on the yoke gradually become worn and the yoke itself frequently crystallizes and breaks. Since it is not convenient for the pointman to put on a new yoke underground, owing to the loss of time involved and the unfavorable conditions for such work, the point must be disconnected and withdrawn and another inserted. With the nipple point the only part to work loose is the clamp, and this is fastened to the point head by baling wire to prevent its coming loose suddenly and scalding the operator with hot steam. In my experience the clamp requires less attention than the nuts on the yoke of the nippleless point, and the nipple point never has to be sent to the surface on account of poor connections. The hose, further, can be disconnected from the point as easily as from the crosshead, which is not the case with the other points, and which may be important where "sweaters" are used, as described later. In the matter of cost, too, the nipple point has a great advantage, since it costs only $10 or $12, against $20 for the corresponding sizes of the others. The projecting nipple is subject to being broken by a misdirected blow from the hammer; but this is an accident that is too rare to be worth mentioning.

The points used at Dawson before the Fairbanks operators developed a slightly different and more efficient

practice were 5 and 6 ft. long. Those used at Fairbanks are 8, 10, 12, 16 and 20 ft. long. The longer the point, the heavier must be the steel required to prevent buckling and bending, the more cumbersome becomes the point with its attached hose, and the harder it is to drive. The 8-ft. length is most popular at Fairbanks at present, partly because it is easier to regulate the depth of thaw with short points; but longer points are often used in driving tunnels. In using long points the holes are started with short points, which are withdrawn to permit

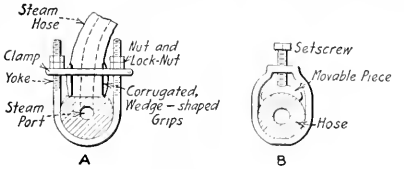


FIG.5

POINT WITHOUT NIPPLE

A, Yoke clamp. B, Screw clamp

the insertion of the long ones, and after steam has been turned on for several hours, depending on the character of the gravel, the point is drawn back about half its length to insure a uniform thaw.

DRIVING METHODS AND BITS

Wooden mallets were first used for driving, then the single jack of the quartz miner was adopted, and later double-hand hammers of 7 to 16 lb. weight were used. The heaviest hammers are too hard on the points and are used only where driving is especially hard; the 10-lb. size is most used at present. As a general thing, heavy blows will not send the point "home" any faster than lighter blows at shorter intervals, since it is impossible to drive the point faster than the gravel thaws ahead of it; as noted in the foregoing, however, this rule regarding heavy blows does not hold for exceptionally tight ground.

Three types of bits are used on the point—the "diamond," or square bit (Fig. 2), the chisel bit, such as is used on ordinary hand steel (Fig. 3), and the four-cornered, or Burleigh, bit. For easy-driving ground it has been found that the rocks are more easily pushed aside, when the surrounding material has been thawed, than drilled through, and the diamond point is preferred. Boulders too large to be pushed aside are often split wide open. When driving is harder and it is necessary actually to drill out much of the gravel the ordinary chisel bit is used, or if this is too hard to turn, as frequently happens, the four-cornered bit is employed. With the growth of the practice of driving each point to its full length before starting another, the diamond-bit, formerly almost exclusively used, is becoming a rarity on many of the creeks.

Up to the present time all driving has been done by hand. Power drills offer an attractive possibility to the operator looking to reduce his working costs, but their use has never been attended with success. In the first place, few of the mines can afford an air compressor, and drills must be run with steam, with the attendant disadvantage of the sloughing of the roof due to exhausting steam into the air. The first attempt was made on King Solomon Hill, at Dawson, with a reciprocating drill. This was a failure, and it was years before the next trial. In 1911 William Burns, of Little Eldorado Creek, Fairbanks district, installed a Chicago compressor and tried the Leyner drills. Failure was due partly to the freezing of the exhaust, no provision having been made to deliver dry air to the drill, and partly to the fact that the drill was not powerful enough to pull back through the gravel that constantly dropped around the point and wedged against the bit. A larger machine might have overcome this difficulty to some extent, but it is improbable that any type of reciprocating drill would give satisfaction. In 1913 and 1914 E. M. Keys, of Chatanika, tried out an Ingersoll-Rand BC-26 hand-hammer drill, steam-driven, with a measure of success, the principal disadvantage that developed being that two men were required to operate it. One of the large drill-manufacturing companies is now working, with every promise of success, on a rig to be handled by one man. This machine will probably be placed on the market during the current year, and it is not unlikely that hand-driving will soon be largely supplanted by machine-driving.

USE OF HOT WATER FOR DRIVING

The use of hot water for driving—steam being turned on after the points are "home"—was formerly a popular practice, and some operators still follow it. Its chief advantage is the absence of steam from "blowing back" while driving, which makes the work easier and more agreeable for the pointman and decreases the sloughing of the roof. Its disadvantages are that the water washes the sediment from the gravel and prevents effective plugging, as will appear later; that the system is very cumbersome, requiring duplication of pipe lines; and that the increased amount of water draining away from the face is an inconvenience, often causing trouble with drains, timbers, and car track. As a whole, driving with water is not to be recommended except under unusual circumstances.

The steam line is carried through the tunnels on the posts of the sets and is laid on the floor 10 ft. or more back from the face when thawing. Care must be exercised to keep it out of water at all times; otherwise there will be a large loss from condensation and sloughing from steam turned into the atmosphere. Steam lines under-

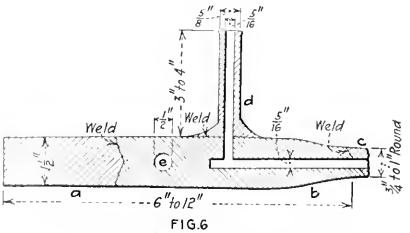


FIG.6

DETAIL OF MODERN NIPPLE POINT

Main part of head is of cold-rolled machine steel, drilled, with tool-steel head to receive blows. Nipple is welded on solid and steam passage drilled afterward

ground are never protected by any insulating material. All joints are smeared with graphite in oil when connected in order that they may be taken apart more easily. Pipe of ¾-in. diameter is most used for the various leads underground.

Fig. 7 shows a crosshead and connections to points and steam line. The point hoses are of Gorham or Goodrich manufacture, ⅝ in. in diameter, and fit over a ⅜-in. nipple on the crosshead, to which they are attached by clamps of the type shown at *B*, Fig. 5. The crosshead is

attached to the line by a ¾-in. hose. Crossheads of fittings one size smaller than those shown are sometimes used, but have no advantage other than decreased weight, and are more likely to be broken by falling rocks. All pipes are rapidly corroded and usually do not last longer than two or three years. Galvanized pipes are never employed, probably because of failure to appreciate their advantages.

Manner of Driving Steam Points

The easiest place to drive a point is neither in gravel nor in bedrock, but right where the two join, except where the bedrock is so badly decomposed as to be a sort of mush when thawed, or where there is a layer of large rocks just above the bedrock. The amount of bedrock taken up depends chiefly on the nature of it. If blocky, gold will be found to a considerable depth, but if soft, gold will not penetrate so far. The top of the bedrock is usually carried 1½ to 2 ft. above the floor. The ease of driving

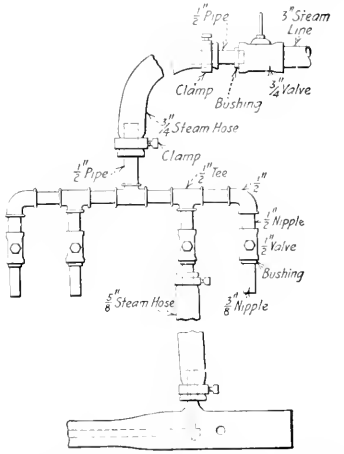


Fig. 7. Crosshead and Connections

Wheels are removed from valve stems to prevent binding by falling rock. The wheel is carried by the foreman or opened with a pair of tweezers

varies greatly with different ground, and even at the same face. At some mines, such as those on Engineer Creek, one man easily thaws the ground for 16 or more shovelers and has time to shovel waste; at the mouth of Dome and Cleary, on the other hand, six men may be required to do the same work. In easy ground two men working separately can accomplish more than two working together; but the usual practice of the district is for pointmen to work in pairs, one striking while the other rotates the point. The men change places every few minutes.

It was formerly the practice to start a number of points, usually the total number required for a single face if the supply was sufficient, and to drive them alternately as far as they would go without resistance. In this way one or two men could drive many points without the heavy hammering sometimes necessary where each point is driven alone, which is easier on the rigging and easier on the pointman. The increased use of "sweaters," with only new points for drilling the holes, has discouraged this practice, however, and it is now usual to drive but one point at a time.

In driving, the point-hose is connected to the crosshead and the point is placed against the face at the proper height. The head is supported on a "horse," Fig. 8, or on a box, or is held across the knee by the assistant, dry gunnysacks being used for protection from the heat. A little steam is turned on and the hammerman strikes the head, gently at first, while the assistant rotates the point back and forth through an angle of 90° to 180°, depending on the type of bit used. At first much steam "blows back" around the point and fills the workings, causing the roof to slough and rendering vision difficult unless the stoped-out area is large. The point is usually so low that the hammerman must stoop to strike, and frequently he must keep his face close to the head of the point in order to see well enough to strike accurately. As the steam escapes into the atmosphere the temperature rises and there is a constant shower of gravel from the roof. Boulders of various sizes, up to a foot or more in diameter, seek with strange fatality the head of the hapless pointman as a place on which to drop. A careful pointman therefore keeps a weather eye on the roof at all times and knocks the larger rocks down before they have a chance to fall on him; but in most ground it is impossible to avoid being struck with distressing frequency. Owing to the

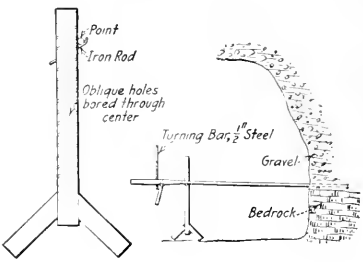


Fig. 8. Horse Sometimes Used in Point Driving, and Its Manner of Application

excessive amount of water vapor the candles flicker dimly and the pointman, fumbling around in the faint light, finds point, pipe, and hose red-hot to the touch. Gloves soon become soaked with water and offer scant protection from the heat. A tool laid to one side and forgotten for a few minutes is buried beyond hope of recovery beneath the falling waste. All in all, the pointman's lot is not particularly attractive, yet there are many who prefer that job to any other in the mine—possibly because the pay is usually a dollar more a day. Lest it be said that the preceding description is overdrawn it may be noted that it takes no account of the low roofs in some mines, where there may be no chance for hours to straighten the kinks from the back, and that the air is sometimes so thick with water vapor that a candle cannot be made to burn; in which case electric lights must be installed or a fan provided to assist ventilation. Breathing this air, however, causes no immediate distress and appears to have no injurious effects other than those due to excessive perspiration.

Use of "Sweaters" in Thawed Holes

When the point has been driven "home" it is withdrawn and used to drill another hole, and in this manner the entire face is drilled. The spacing varies from 2 to 4 ft.

at different mines, with 3 ft. as an average. When the point was first invented it was the custom to leave each in place as it was driven; but at some mines it was found that the gravel settled so tightly after thawing that the point could not be withdrawn. It was thus not only in the way of the shovelers, but was unavailable for further use until the thaw was removed. To have 50 or 60 points, each worth $10 to $20, tied up in this manner, and to require another set for putting in another thaw, involved a prohibitive expense for equipment. Thus arose the practice of withdrawing the point as soon as it was driven and replacing it with a "sweater" of ¼- or ⅜-in. pipe (Fig. 9). These sweaters, besides decreasing the investment in equipment, are less in the way of the shovelers, since they can be bent to one side without damage.

Points, while easily bent warm, are difficult to straighten cold and are usually taken to the surface if badly kinked. They may, however, be straightened underground by passing steam through until warm, laying on a plank and striking with a hammer. If this is attempted cold, the steel is very likely to break. Points also frequently become clogged in driving, and if they cannot be cleared by drawing back a foot or two and tapping with the hammer they are withdrawn and a stiff wire—telephone wire is excellent—is run up the steam passage to

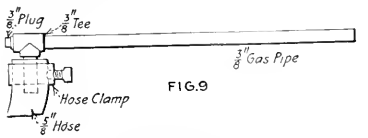


FIG. 9

A "SWEATER"

Solid plug to tap sweater in case it does not enter the point hole easily. Sometimes tee and plug are omitted

dislodge the obstruction. If this does not have the desired result, the point is sent to the surface, it being a waste of time to attempt other than the simplest repairs underground.

Many operators still leave the points in place, but the better practice is to use sweaters. These are placed in the holes drilled by the points and tested with the breath to see that they have not become clogged in entering. They are then carefully "plugged" in the following manner: Jute strips are prepared by rolling up a gunnysack tightly into a cylinder and cutting off 2-in. sections with a sharp axe. The sweater is drawn back a foot or two and one or more jute strips wrapped tightly about it some distance from the end. The sweater is then rammed "home," the jute wrapping being held in place by means of a "calking tool," which is essentially a long-handled, spoon-like affair made to fit roughly over the sweater. More strips are wrapped about the pipe and pushed in against the other if needed. The work is tested by sucking through the pipe with the mouth or by turning on steam. If it is properly done and the gravel is "tight," practically no steam will escape. It is possible in some cases, after the ground is well "warmed up," to open all valves wide to the boiler, or "back the pressure up to the boiler," as the pointmen say. This expression is not based on fact, however; the truth is that some gravel is capable of absorbing steam as fast as the pipe line will deliver it. When water is used for driving, it washes much of the clay, or sediment, out of the gravel around the point and makes it impossible to plug the sweater tightly. Points left in place are also more difficult to plug than are sweaters.

Careful Regulation of Steam Flow

The pipe line having been laid, the lead hoses of the crossheads are connected and the point hoses attached to the sweaters. Steam is then turned on all the sweaters in the face at once. Each sweater and each crosshead has a separate valve, and fine adjustment is therefore possible. The sweaters of each crosshead are regulated so that each takes the same amount of steam, and then the various crossheads are adjusted to equality. Once the valves have been properly adjusted and each sweater is taking exactly its correct share of steam they are left strictly alone, all further regulation being from the line valve or from the boiler. Adjusting the valves to equality is the most difficult part of point work for the beginner. If a valve is the least bit too wide open, that sweater will take too much steam, in which case it will very likely "blow back"; and by robbing its fellows on the same crosshead it may cause some of them to cease feeding or "go dead." The sweater may be withdrawn to observe the exact amount of steam passing through it; but a better way is to judge by putting the hose to the ear, which, however, requires considerable experience.

A series of points or sweaters may be working along perfectly when a temporary decrease in the boiler pressure or some other change in conditions will cause several of them to stop feeding, the steam passage filling with condensed steam. Consequently the points require inspection from time to time, for it is important that a "dead point" be detected at once if the thaw is to be even. In time the point will become cold clear back to the crosshead, when its condition is obvious; but it is better to make sure at an earlier stage by placing the hose to the ear. If the point is dead there will be a gurgling sound, much as is made by blowing under water with a straw; if it is feeding, the steam passes through with a clear hissing sound. Some pointmen also tell whether a point is working properly by taking the hose between the thumb and finger and feeling the "pulse"; if the steam passes through with a recurrent pulsating effect the point is feeding properly. This pulsating effect is interesting, and is probably due to the pressure at the end of the point increasing above normal and forcing the steam out into the gravel with comparative suddenness, thus decreasing the pressure for a moment.

Time and Steam Required for Thawing

The time required for thawing depends on several factors other than the depth of thaw and the closeness of spacing the points, chief among which are the character of the gravel and the effective pressure of steam. If the gravel is loose and comparatively free from clay or sediment, a 5-ft. paystreak can sometimes be thawed in 10 hr. for a distance inward of 9 ft., with the points 3 ft. apart, and with a boiler pressure of 100 lb. As the proportion of clay increases, the time required increases, as much as 40 hr. being necessary to thaw some ground. Of course, if extra-long points are used, or if the depth of pay is unusually great, more time is required. Thus in the Prest ground on Vault Creek the pay extended so far into the roof that it was impracticable to thaw all of it; when the next thaw was put in some of the roof thawed and came down, and was removed with the new thaw.

The amount of steam necessary to run a point varies considerably; but it is usually estimated that one boiler-horsepower will run one point. Thus a 30-hp. boiler should, with good dry wood, run 30 points. C. W. Purington states ("Bull. 263," U. S. Geol. Surv., 1905, p. 92) that the boiler horsepower required to run a point varies from one to two, with an average of 1½. This, however, was before more careful attention to this detail of mining led to the development of more efficient methods, and 1 hp. to the point is probably accurate for the present time. The amount of water taken into the boiler is surprising until one becomes accustomed to it. Thus, a plant on Engineer Creek, thawing about 110 cu.yd. of gravel a day with a 40-hp. boiler, had one ¾-in. injector running continuously and another intermittently while the points were steaming.

Thawed Gravel Should Cool in Place

After the gravel has been thawed it retains its heat for a considerable length of time, and where possible a "thaw" should be left five or six days before removing. This very often is not feasible, however, owing to limitation of working faces, and much gravel is stoped while still warm. In many instances in the past the shovelers have started on a thaw immediately steam was turned off and the waste shoveled back, gravel being shoveled into the wheelbarrows while too warm to hold tightly in the hand. The practice of working in hot ground is one that cannot be too severely condemned; like the roundabout runway and the submarine wheeling plank, it is characteristic of the failure, and not of the paying mine.

Thawing, as noted in the foregoing, is estimated to account for about 20% of the total cost of mining in the Fairbanks district to date—say $6,000,000 in round numbers, on the basis that half the gold extracted was profit. In no other department of drift mining is there so much diversity of practice, and in no other—unless it be sluicing—is there so much room for improvement. Some operators take great pride in their work and have reduced thawing to a science. It is on the methods of such that the most emphasis has been laid in this paper rather than on the haphazard and less commendable method—or lack of method—of others. Labor and fuel are the principal items entering into the cost of thawing, and the introduction of a successful hammer drill for driving, as is promised within a year, will mean a great saving. Until the Government railway makes possible the use of coal for generating steam, however, the cost for fuel must inevitably become greater and greater.

Mineral Production of Great Britain

The British authorities have issued a sheet containing the production of minerals in the United Kingdom from mine workings under the Coal Mines Act and the Metalliferous Mines Act for the year 1914. The figures given do not in all cases represent the total production for the year. Some quantities of important minerals—such as iron ore, limestone, sandstone, slate, clay—are obtained from quarries and open workings under the Quarries Act, the returns from which are not yet available. The totals for coal and for the ores of copper, lead and zinc may be regarded as substantially complete.

Coal Mines

The quantity of coal mined, which was 287,411,869 tons in 1913, fell to 265,643,030 tons in 1914, a decrease of 21,768,839 tons, or 7.6%. The decrease was due chiefly to the falling off in available labor toward the close of the year.

The quantity of minerals other than coal taken out under the Coal Mines Act was, in long tons:

	1913	1914
Barium compounds	4,610	6,265
Clay and shale	457,244	399,810
Fireclay	2,585,763	2,374,068
Igneous rocks	688	634
Iron pyrites	8,864	9,359
Iron ore	7,769,624	7,241,481
Limestone	4,525	6,442
Oil shale	3,280,143	3,268,666
Sandstone, including ganister	144,923	135,718
Total tons	14,199,484	13,442,443

The quantity of ganister included with sandstone in 1914 was 121,168 tons.

Metal Mines

The production of the mines under the Metal Mines Act was as follows, in long tons:

	1913	1914
Arsenic	1,694	1,974
Arsenical pyrites	35	.....
Barium compounds	43,408	39,645
Bauxite	6,055	8,286
Chalk	.....	493
Chert, flint, etc.	5,173	3,844
Clay and shale	133,984	131,190
Copper ore and precipitate	2,705	2,519
Fluorspar	33,833	24,688
Gold ore	4	17
Gravel and sand	12,492	17,331
Gypsum	238,494	220,096
Igneous rocks	57,921	44,299
Iron ore	1,881,853	1,743,011
Iron pyrites	2,463	2,295
Lead ore	24,265	25,988
Lignite	81	300
Limestone	356,316	328,337
Manganese ore	5,393	3,437
Ocher, umber, etc.	6,199	4,463
Rock salt	214,573	189,995
Sandstone	89,718	76,198
Slate	95,271	82,307
Soapstone	40	180
Tin ore (dressed)	6,949	6,622
Uranium ore	95	344
Wolfram ore	182	205
Zinc ore	17,294	15,419
Total tons	3,236,490	2,973,523

Limestone includes 1267 tons of calcspar in 1913, and 630 tons in 1914. In addition to the tin ore reported in 1914, there were 201 tons undressed ore, not included above.

The total of iron ore reported in 1914 from the two classes of mines was 8,984,291 tons. This will be further increased by the quarries report.

Men Employed

The total number of men employed as ordinarily computed was as follows:

	Coal Mines		Metal Mines	
	1913	1914	1913	1914
Under ground	909,834	915,381	16,525	14,426
Above ground	218,056	278,365	10,887	9,283
Total	1,127,890	1,133,746	27,412	23,709

In view of the depletion of mine labor by recruiting in the latter months of the year a special return was made showing the number actually employed on the last pay day in December. The number so returned was 981,264, being 152,182 less than in July and 146,626 less than for the preceding year.

Ferrosilicon and Calcium Carbide will be made at Highlandtown, Md., by the Shawinigan Electro Products Co., a new concern organized as a subsidiary of the Pennsylvania Water & Power Co., of Baltimore.

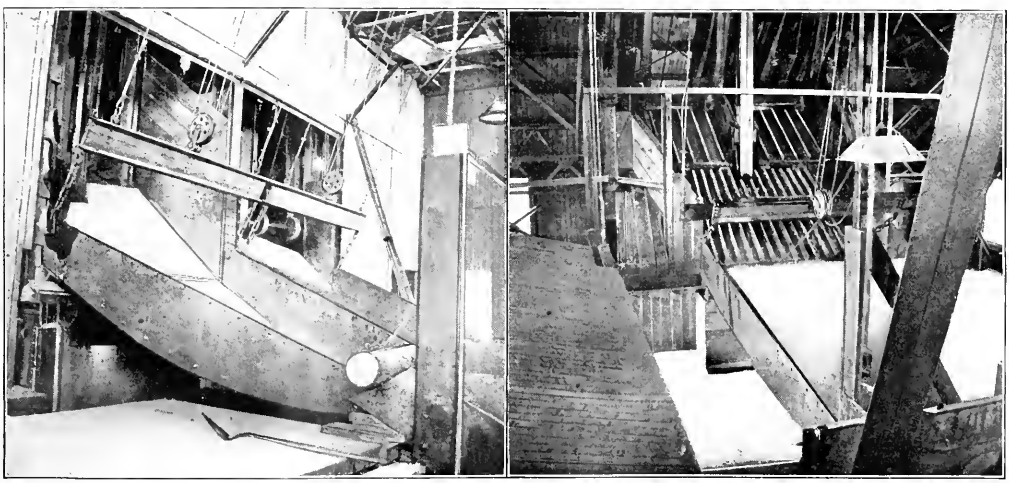
Shaft-Rockhouse Practice in the Copper Country—III

By L. Hall Goodwin*

SYNOPSIS—Rockhouse operations, distinguished from those in the shafthouse, involve handling copper rock and mass copper. Four systems in use, the Calumet & Hecla, the Copper Range, the Quincy and the Hancock. Characteristics, criticisms and advantages of the Calumet & Hecla. The tilting pan. Unusual construction of Ahmeek Nos. 3 and 4 shaft-rockhouse. Development of the Calumet & Hecla crusher. Hancock system uses a traveling link-belt grizzly.

Among the several operations carried on in the shaft-rockhouse, those which have to do with handling copper rock and mass copper are alone rockhouse processes; the shafthouse processes, such as changing conveyors, hoisting water and lowering supplies, have to do with hoisting and are presumably so classified in the cost sheet. It would also seem logical to include handling poor rock in the shafthouse operations, since if the rockhouse were in a detached building it would not handle poor rock except what little was sorted out from the copper rock. It is now intended to review the rockhouse processes of the district as a whole; there are four broad systems which will serve as a classification to which all examples may be referred. Photographs have been shown illustrating the four most recent examples; namely, Mohawk No. 6, Ahmeek Nos. 3-4, North Kearsage No. 1, and Hancock No. 2. It is only necessary to substitute in this list of recent construction the Quincy No. 2, built in 1908, in place of the North Kearsage No. 1, the latter being similar in design and operation to Ahmeek Nos. 3-4, and we have examples covering in a broad way the rockhouse practice of the entire district. Our classification will then be: The Calumet & Hecla system, of which Ahmeek Nos. 3-4 is an example; the Copper Range system, employed in the new Mohawk No. 6; the Quincy system, perfected in Quincy No. 2; and the Hancock system, of which Hancock No. 2 is the only example. The first three of these systems are used largely, almost to the exclusion of other methods; Hancock No. 2 is almost in a class by itself, as the only other instance of conveying copper rock from the hopper bin to the crusher by means of a traveling conveyor was taken up under the topic of detached rockhouses in Part I.

It will be understood that none of these mines uses a hard and fast system in all of its rockhouses. Different rockhouses of the same company, even when they were constructed at about the same time, are differently designed and operated, and often a company will employ entirely different systems; thus, the Copper Range employs the Calumet & Hecla system in two of its rockhouses, and in turn the Isle Royale group, controlled by Calumet & Hecla, uses the Copper Range system.



Ahmeek North Kearsarge

Fig. 7. Arrangements of Tilting Pans

The Calumet & Hecla System

Since the Calumet & Hecla with its subsidiary companies forms the dominating interest among Lake Superior copper mines, its rockhouse methods are used more extensively than those of any other company. The distinctive feature of its system is the tilting pan, a large scoop-shaped steel apron, hinged at its lower end, and tilted by means of friction clutches, so as to feed the rock into the crusher. A grizzly is always used, but its

*Assistant with Allen H. Rogers, 201 Devonshire St., Boston, Mass.

position relative to the tilting pan varies, as it may precede, follow or form an integral part of the pan. In the last case the grizzly bars form the bottom of the pan; this scheme was used at the time the tilting-pan system was being installed and the available space was limited; it is not used where it can be avoided. At the new North Kearsarge shaft-rockhouse the grizzlies precede the pan; at the new Ahmeek Nos. 3-4, however, the grizzlies follow. Two types are shown in Fig. 7. The grizzlies, as is the universal custom in this district, are formed of round iron bars, and in the case of the Calumet & Hecla mines these are set with 4-in. spaces to correspond to the setting of the crusher jaws.

The tilting pans are made of heavy iron, ¾ in. thick on the bottom, ½ in. thick on the sides, and both bottom and sides are protected by a ⅜-in. removable steel liner. The bottom of the pan is not flat, but is laid off on two curves, that at the top of the pan being steeper than that at its mouth; the pans are about 9 ft. wide at the top and less than 4 ft. wide at the mouth; thus they taper toward the mouth, both along the sides and in the pitch of the bottom. When the apron is full of rock and is tilted, this tapering has the effect of causing the rock near the top to push along that at the bottom, which aids in regulating the feed to the crusher.

The pan is raised by an I-beam attached to its top by chains and operated by a winch clutched to a pulley on the main line-shaft, by means of a powerful friction grip. The weight of the pan is partly counterbalanced and the ratio of the pulleys is so large that the tilting of the pan causes no noticeable strain, although the pan contains seven or eight tons of rock.

When the grizzly is placed between the tilting pan and the crusher, as is the case at Ahmeek Nos. 3-4, operations proceed as follows: When copper rock is being hoisted, the skip dumps upon a heavy iron dumping plate, from which the rock slides directly into the tilting pan, which is large enough to hold easily a skip load; the rock is prevented from passing through the pan and into the crusher by means of a rough log of wood suspended by chains across the pan mouth. The rockhouse men now pick out the waste and the mass copper, and when this operation is completed, the log is raised by a friction-clutch arrangement exactly like the one which tilts the pan, and the pan is tilted until the rock begins to slide out of the pan and into the crusher. These operations require the services of two men, one to operate the friction winches, the other to pick out the mass and waste, clean down the grizzly, etc. The large crusher permits the rock to be fed rapidly, and the whole operation of feeding a 7-ton skip load should not consume more than 2½ min.

With the grizzly in other positions, the operation is the same, except that the rock first passes over the grizzly and then the tilting pan feeds directly to the crusher. The plan of having the grizzly follow the pan was adopted at the Ahmeek Nos. 3-4 because the unusual design of that building, to be discussed later, did not permit the grizzlies to be placed before the pan. This arrangement would appear to be particularly advantageous, because the rock is fed to the grizzly slowly, and a much larger proportion of the undersize goes through than is the case where the dumping skip hurls its whole load on the grizzly bars at once. The wear on the bars is also less, since they may be set at a steeper angle; finally a more uniform mixture of stamp rock is secured in the bin because the grizzly is near the crusher. The method is not proving so satisfactory as expected, however, for the reason that the rock as it leaves the pan does not have enough initial velocity to take it over the grizzly, and some of it remains there, causing trouble. Hence the management in later installations will stick to the old custom of having the grizzly precede the pan.

Criticisms of the System

The system is freely criticized, but the criticism usually comes from those who are acquainted only with the earlier developments. Originally the pans were made of comparatively light iron, which required to be frequently renewed; there were two pans and two crushers for each double-compartment shaft—that is, one pan and crusher for each skip; the pans were tilted by air cylinders, which were wasteful of power; and the small crushers used at that time did not permit of rapid feeding. As made at present the pans can resist heavy wear and tear; the friction-clutch mechanism consumes less power and causes less trouble than did the old air lifts; only one pan and one crusher are used for two skips, which reduces the equipment and the large crusher permits rapid feeding.

The most valid criticism would appear to be that no storage capacity is provided before the crusher, so that if anything goes wrong with the single crusher or pan, hoisting must be immediately suspended. The reply to this is that with the massive type of crusher used, and with proper maintenance of other equipment, accidents which would delay hoisting are not supposed to occur. This statement, although it sounds rash, would perhaps appear to be more reasonable after an inspection of the equipment of one of these rockhouses; and as a matter of fact little trouble is caused in this way. It must be remembered that where a hopper bin is used it is never of sufficient size to hold the product of more than an hour or two of hoisting operations, so that it provides storage capacity to carry the rockhouse over minor accidents only. The power consumed in tilting the pan must be considerable, but with the friction clutch the power required is probably not much if any greater than that required for the several inefficient air lifts used where a hopper bin is employed.

Advantages of the System

The great advantages of the system are the small amount of hard work required of the rockhouse men and the speed with which the rock may be fed to the crusher, thus permitting two men to take care of a large tonnage. At the Allouez No. 2 rockhouse, two men easily handle about 500 tons of rock per eight-hour shift, and one of them performs the function of the lander, so that under ordinary conditions there are only two men in the shaft-rockhouse. The new Ahmeek Nos. 3-4 employ five men—that is, two rockhouse men for each shaft and one lander to attend to both shafts, or two and one-half men per shaft. The reason for the small amount of labor required is that the rock feeds to the crusher automatically, and there is no form of chute opening in which the rock can get wedged. All other methods require a bin opening, and it is true that more or less trouble is always encountered in getting the rock through that opening. The principal wearing parts are confined to

the dumping plate, grizzly bars, and the tilting pan; and the heavy construction of these requires only a small amount of repair work to keep the equipment in first-class condition. Friction winches of the present form have in some cases been in place four years, and in no instance has the smaller of the two pulleys had to be renewed or repaired, while in only a few cases have the larger ones needed attention.

Ahmeek Nos. 3-4 Shaft-Rockhouse

The accompanying elevation, Fig. 9, of the new Ahmeek Nos. 3-4 shaft-rockhouse, furnished by H. C. Felver of the local office of the Worden-Allen Co., the builders, will show the general dimensions and the structural features of that building. The plant is a novelty in that it serves two incline shafts, each having two hoisting compartments and serving a mine of large ultimate output. As there are two shafts there are also two tilting pans and two crushers; the stamp-rock bin is of about 2500 tons' live capacity, and is served by two railroad tracks. The whole building is, of course, much larger than the usual incline-shaft headworks, and is comparable to those over the vertical shafts having several hoisting compartments. There were used in its construction 615 tons of structural steel, which compares with about 700 tons in the Tamarack No. 5 vertical. Fig. 8 shows the plant under construction.

The peculiar relations existing between the boundary lines between the Mohawk and Ahmeek companies and the strike of the Kearsarge amygdaloid lode made necessary the adoption of several interesting features in the design of this building. In this vicinity the Ahmeek property is bounded by section lines running north and west from the southeast corner of section 28, and in this southeast corner the property does not carry the outcrop of the Kearsarge lode, but is underlain by it at a depth of roughly 1000 ft. The property line running north from that corner makes an angle of about 52° with a line parallel to the strike of the lode, and the property line running west makes an angle of about 38°. To meet these conditions the company decided to locate two shafts in the extreme southeast corner of the property and to start these shafts from the same point, the northerly one was pointed so as to run along the eastern boundary of the property but diverging from it, the southerly one so as to tap most advantageously the rest of the property. The shafts thus form a V with each other, at an angle of 41° 50'; their dip at the surface is 80°, and they continue on this dip until a depth of 980 ft. is reached, where they assume a curve with a

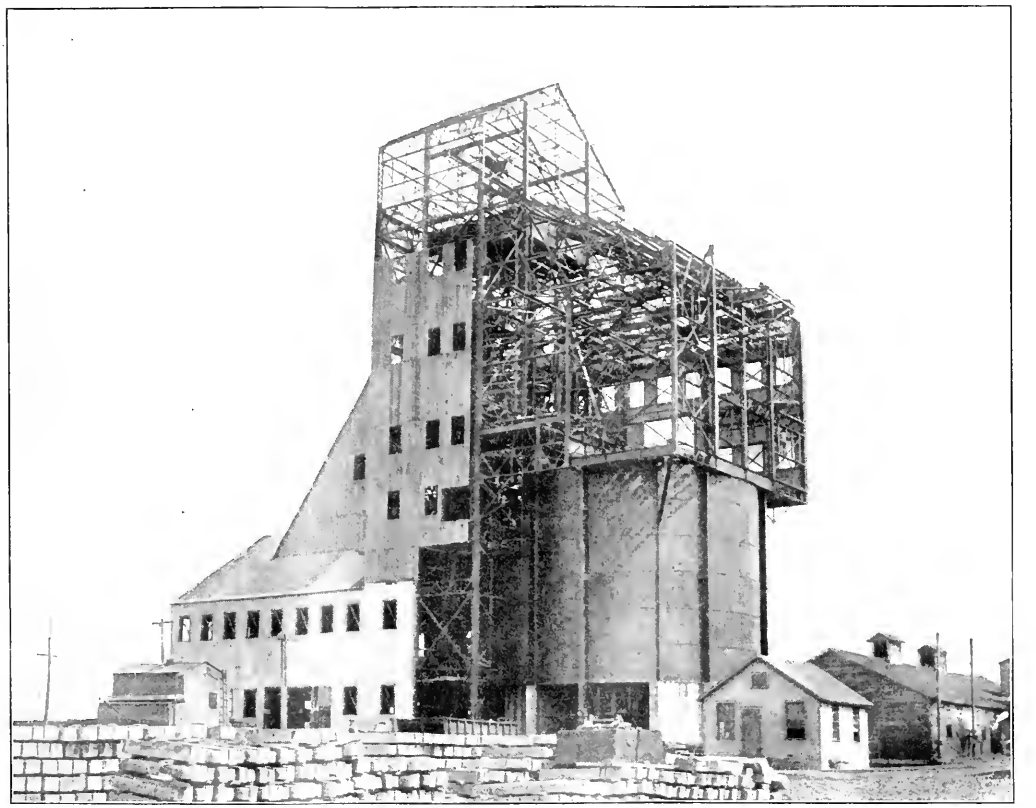


Fig. 8. Ahmeek Nos. 3 and 4. Shaft-Rockhouse during Construction

radius of about 400 ft., which takes them into the lode at a depth of about 1215 ft., after which point they follow the dip of the lode, which is variable, about 31°.

The hoisting plant in this case is on the hanging side of the shaft-rockhouse, because the company does not own the land on the opposite side. This requires a different headframe bracing than the ordinary shaft-rockhouse, the head sheaves being supported by a four-post frame such as is often used over vertical shafts, while the back brace constitutes the sloping roof of the building. The plane passing through the centers of the drums and the hoisting rope in the shaft are not perpendicular to the earth's surface on account of the peculiar arrangement of shafts and hoist; for this reason the head sheaves have to be tilted into a plane which departs 3½° from the perpendicular. This was not allowed for in the structural steel work, but is taken care of by the boxes carrying the sheave axle, one of which is set higher than the other.

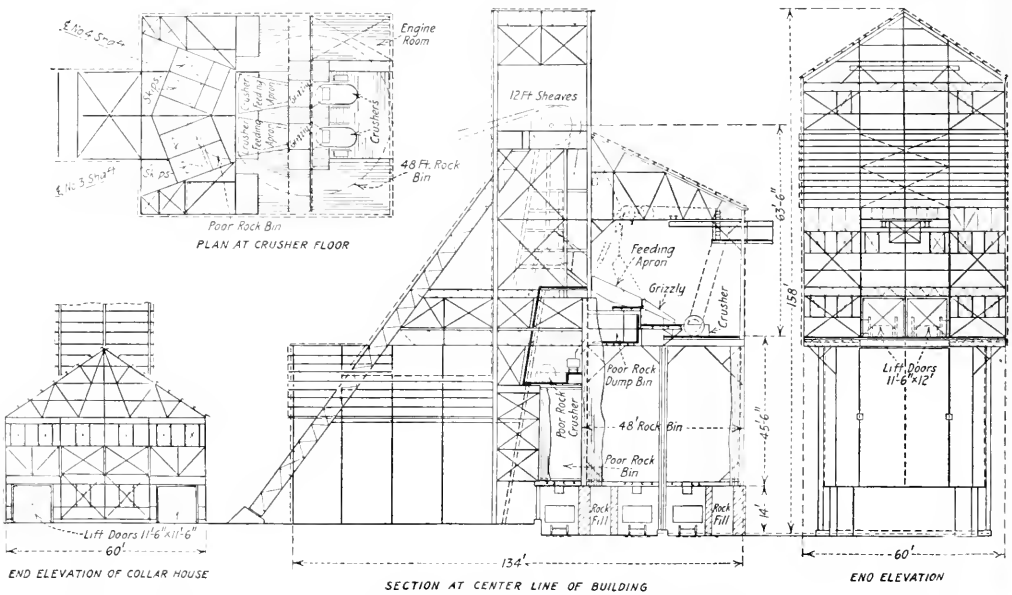


FIG. 9. PLAN AND ELEVATIONS OF AHMEEK NOS. 3 AND 4 SHAFT-ROCKHOUSE SERVING TWO SHAFTS

The design of the building is further complicated by the fact that the skip tracks in the two shafts do not lie in a single plane. Their relative position may be visualized by assuming that the tracks in the two shafts form the elements of adjacent faces of a truncated triangular prism, the angle between these adjacent faces of the prism being 138°. Taken all in all the building must have furnished some interesting problems in structural design.

CALUMET & HECLA CRUSHER

I have already spoken of the new design of Blake crusher made by the Calumet & Hecla. The principal improvement over the usual type of Farrell crusher consists of a one-piece ribbed frame, which is strengthened by three 5-in. bolts running along either side, by three 4-in. bolts across the front end, and by two 4-in. bolts across the rear end. These bolts, as well as the 8-in. hexagonal nuts which tighten them, are put in place hot, and this causes a considerable initial compression in the frame, which renders it extremely resistant to rupture. By this means the weight of the crusher is kept down to 40 tons, which is the same as that of the usual 24x36-in. Farrell crusher, while its size is increased to 24x48 in., and its capacity is also increased.

Minor improvements in design consist of a new toggle and toggle bearing, by which a rolling action in the bearing reduces the wear caused by the usual sliding action; the weight of the pitman is taken from its bearings by springs suspended from a yoke attached to the crusher frame, which causes less wear on the bearings, reduces the power, requires less oil, and eliminates the necessity of cooling the pitman by dripping water, as is often done; the angle between the jaws is increased, which allows a smaller depth of frame for the same jaw opening, and is particularly beneficial in preventing the clogging of the crusher by pieces of mass and in aiding in the extraction of mass that does become wedged between the jaws; this contingency is also guarded against by the simple expedient of marking an arrow on the end of the shaft to show the exact position of the eccentric, so that if the crusher does get clogged, the men may easily tell which way to move the flywheels to open the jaws. The jaws are not corrugated, which also aids in the extraction of mass, as it permits it to be worked sideways.

The ability of this 40-ton crusher to take boulders ranging up to 24x48 in. in size and to stand up for long periods under the strain of reducing them to 4-in. size is enough to commend it highly. It is probable that this crusher has been a large factor in enabling the Calumet & Hecla to perfect its tilting-pan system, by

avoiding the necessity of providing storage capacity before the crusher. The points mentioned as aiding in the extraction of mass copper which has clogged the jaws have been beneficial in reducing the number and length of the temporary shutdowns due to that cause. I was told of one case in which, during the absence of the rockhouse foreman, several men were kept busy for 20 hr. in a vain endeavor to remove a mass by force from the jaws of a crusher, and in so doing nearly removed the crusher from its foundations; the mass was finally removed by turning the flywheels through a quarter revolution and thus loosening the jaws, an operation

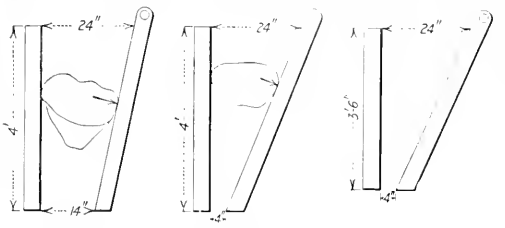


Fig. 10. Development of the Copper-Country Crusher

probably requiring about 15 min. With the slight eccentricity used, it is impossible to tell by inspection which way the flywheels should be turned to loosen the jaws, unless some special provision is made.

The mechanical advantages of this design as compared with earlier ones may best be shown by a comparison of the friction loads, that is, the horsepower required to run the crusher at normal speed when no rock is being crushed. In the case of the new crusher the friction load is about 16 hp., while that of a smaller crusher of the design previously used is 29 hp. This considerable saving is due chiefly to the improved toggle, the suspended pitman, and the lighter weight. The capacity of the crusher is indicated by a test run at one of the amygdaloid rockhouses, during which an average of 105 tons per hr. was crushed for four consecutive hours.

Evolution of the Crusher

The statement made in Part I that the original designs of the Blake crusher were not strong enough to reduce large sizes of rock to 4-in. size in one operation should perhaps be modified to read that people thought they were not strong enough to do this. A few years ago it was thought that no crusher could be made strong enough to resist the strains imposed by this operation, but that this opinion had no basis in fact and that no great amount of thought had been put on the subject will be made evident by a consideration of Fig. 10, which is plotted to scale and which shows diagrammatically the increase in the angle between the two jaws of the crusher in the later designs. *A* represents the original conditions existing at the Calumet & Hecla where it was the practice to break first in a 24x36-in. crusher, set to crush to 14-in. maximum size, and to finish the operation in a 17x24-in. crusher breaking to 4 in. A rock house foreman who took the pains to study the matter decided that the 24x36-in. crushers could be made to reduce large boulders to the 4-in. size in one operation. Perhaps he drew a sketch corresponding to *A* and *B* which showed that a greater strain is produced on the crusher when the jaws are set to break to 14 in. than when they are set to break to 4 in., since in the former case the advance of the swinging jaw is opposed by a force acting nearly perpendicular to its face, while in the latter case this opposing force acts at a smaller angle. The disadvantage of course comes in the smaller capacity of the crusher, but on investigation it was found that during a 10-hr. shift the crushers were actually working about three hours only, so that the smaller capacity was not a disadvantage in this case. When these facts had been established, all of the old 24x36-in. crushers at the Calumet & Hecla mines were remodeled with longer toggles and made to crush to 4 in. in one operation; these crushers are still giving good service.

Hancock No. 2 Shaft-Rockhouse

The Hancock method of handling copper rock cannot be taken as a typical system, because it is at present almost unique among Lake Superior methods, and it was adopted because of special conditions which perhaps will not lead to its being copied extensively. The building and method are worthy of consideration, however, as being thoroughly modern examples of how adverse conditions, such as confronted the Tamarack mine in the early days, have been overcome. The Tamarack property, it will be remembered, carried the underlay of the Calumet & Hecla conglomerate lode at a depth which required some of the deepest shafts in the world to reach. The problem confronting the Hancock was somewhat different, but at this time it will suffice to say that it was necessary to sink a vertical shaft 3600 ft. before it tapped the famous Pewabic lode, from which the neighboring Quincy mine has paid over $20,000,000 in dividends.

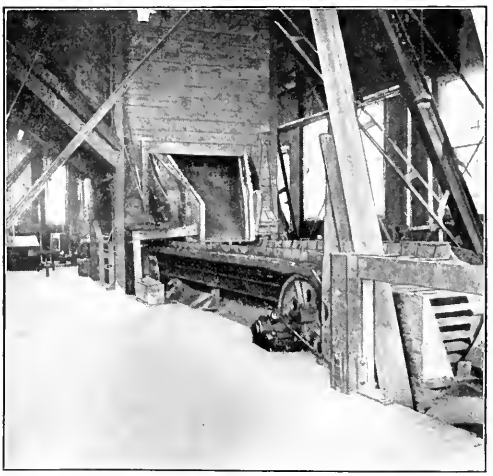


Fig. 11. Link-Belt Grizzly at Hancock No. 2

The Hancock No. 2 shaft has six compartments, in four of which hoisting is done in 8-ton Kimberley skips working in balance. The shaft is not yet working at anything like its ultimate capacity, but hoisting is being regularly conducted. It was this large hoisting capa-

city, together with the fact that the mine is dependent upon an outside railroad for its transportation facilities, which determined the management to provide extra large storage capacity in two steel bins of the usual type, each holding 800 tons of rock. In turn it was this factor of two large bins which determined the method of handling copper rock used.

The four skipways are in a row, and the skips all dump in one direction, the rock going into a small hopper bin with a V-shaped bottom which divides the rock from the dumping skip in two portions, to feed two crushers set on opposite sides of the hopper bin. From the bin, openings 2 ft. high and 4 ft. long having chutes without gate deliver the rock to a link-belt conveyor, Fig. 10, traveling at the rate of 18 ft. per minute, the links of which form grizzlies having 2¾-in. spaces. Each conveyor feeds automatically to a 24x36-in. crusher. Power is furnished by a motor-generator set; each crusher is run by a 50-hp. induction motor, each conveyor by a similar motor of 10 hp. The conveyor motors may be started and stopped easily, so that there is no danger of feeding the crusher too rapidly, and power is not consumed by operating the conveyor when not necessary.

The operation of the system is simple. The rock from the bin spreads itself evenly on the conveyor in a bed about 10 in. thick. A large proportion of the undersize goes through the grizzlies just under the chute from the hopper bin, the remainder of it is easily worked through by the crusher men, who, by using hooks a little, stir the rock sufficiently to cause the undersize to go through.

The advantages and disadvantages of the method are similar to those of the Calumet & Hecla. Although a hopper bin is used, it is too small to furnish storage capacity over any length of time; and the link-belt conveyors consume considerable power. The great advantage comes in the automatic feeding of the rock to the crusher and the small amount of other work required, which enables two men to handle easily a large quantity of rock.

(To be concluded)

Pan-Americanism

By Glen Levin Swiggett*

During 1915 two great Pan-American gatherings will have convened in Washington under the auspices of the United States Government. The first of these, the Pan-American Financial Conference, took place the week of May 24, 1915. In this conference delegates from the Latin-American countries conferred with representative bankers and business men from our nation at the Pan-American Union, on invitation of the Secretary of the Treasury, on financial questions of pertinent interest that must have far-reaching beneficial results to Pan-American banking and commerce.

Of greater interest to the engineering world, however, is the scientific congress that will convene beginning Dec. 27, 1915, and concluding its sessions on Jan. 8, 1916. Through the splendid cooperation of the Latin-American countries the second Pan-American Scientific Congress, held under the auspices of the United States Government through the Department of State, bids fair to be not only thus far the greatest Pan-American Congress, but the most important international scientific congress ever held in the United States. The first congress of this name was held in Santiago, Chile, in 1908. It had its origin in earlier Latin-American scientific congresses; and at the time of the Santiago congress was enlarged through the generous initiative of the Latin-American countries to include the United States. This congress was well attended by visiting delegates from the United States. On its adjournment, entirely unsolicited on the part of the latter, Washington was designated as the place of meeting of the second congress.

This honor has a singular appeal to our nation at this time. The present European war has brought the Western Hemisphere suddenly face to face with grave economic problems that invite the serious attention of scientists and experts in the various fields of applied science. The scientific congress will concern itself with the constructive discussion of these, as well as with the contributions in the domain of pure science, wherein great advance has been made since the last congress held in Santiago, Chile.

The significance of the congress is greatly enhanced through the international reputation of the persons chosen to arrange for the programs of the different sections of the congress, most of whom have an intimate, first-hand acquaintance with the local resources, development and scientific interest in the various Latin-American countries.

Washington offers unusual advantages for a congress of this nature. It enjoys an enviable distinction among the world capitals for the keen scientific interest and investigation in its various Federal bureaus, the varied and extensive nature of its libraries and museums, the beauty of its buildings and the growing importance of detached but semi-official institutions and bureaus engaged in work of international scope. Among these none occupies a position of greater importance than the Pan-American Union, the governing board of which, composed of the diplomatic representatives of the participating Latin-American countries, with the Secretary of State of the United States as ex-officio chairman, has signally honored the Second Pan-American Scientific Congress by authorizing the use of its beautiful building for the office and sessions of the congress. The board also, in response to the request of the President and the Secretary of State of the United States, has authorized John Barrett, the director-general of the Pan-American Union, to act as secretary-general of the scientific congress. He has doubtless done more than any other American in the establishment of commerce and comity among the republics of the Western world.

*Assistant secretary of the Congress.

Record Rate of Loading Iron Ore

Special Correspondence

In May a new loading record was made at the Duluth, Missabe & Northern docks. Ten boats were loaded in one 10-hr. shift, taking away from the pocket 86,000 tons of ore. During the same period 1213 cars were unloaded into the ore pockets.

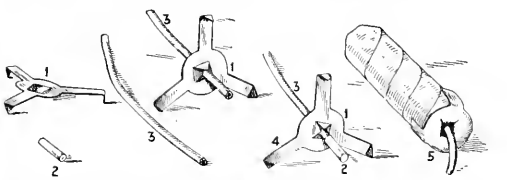
A new record has been made this month at the same docks, when a total of 109,800 tons was loaded in 9 hr. and 45 min., 15 boats being loaded and sent away. The average rate of loading was 11,262 tons per hour and the average loading time per boat was 39 min.

Details of Practical Mining

Clip for Detonator

The method of inserting the detonating cap in a stick of dynamite so that it will have no tendency to pull out is often a subject of both trouble and discussion. The best method advocated by the manufacturers of explosives is to insert the primer in a hole made in the powder by a pointed stick, after having unfolded the end of the paraffin paper wrapper, and then gathering the covering around the fuse and tying with a string. There is no objection to this method except the time required to do it. It is a fussy job to do this. The miner is liable to find that his fingers are all thumbs when it comes to tying a knot in a fine piece of string, and although he and the foreman may both start out with more or less zeal, patience is soon exhausted, enthusiasm wanes and back they go to the old method of lacing the fuse through the stick of dynamite, with all the attendant risks of burning out holes and the usual disadvantageous results.

In the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa, Vol. 14, page 366, W. Cullen suggests a clip he has devised that is extremely simple and accomplishes all of the much-to-be-desired results with a minimum of trouble and effort. This clip consists of a



CLIP FOR PRIMER CARTRIDGE, SHOWING, 1, CLIP; 2, CAP; 3, FUSE; 4, ALL ASSEMBLED; 5, ASSEMBLED WITH CARTRIDGE

circular sheet of thin malleable metal, like copper, with three equidistant arms projecting from the circumference and a star-shaped, pronged hole punched in the center. Each of the equidistant arms has its end sharply pointed and the point turned up. In use, the fuse with the detonating cap attached is pushed through the hole, the detonator is crimped on the fuse by pliers in the usual way, and the cap is then inserted in the hole punched through the end of the stick of powder, wrapping paper and all. Then the arms are folded down about the cartridge and the pronged points piercing the wrapping paper clinch the clip so that it cannot be pulled off the stick of powder. This prevents the detonating cap and fuse from being pulled out of the star-shaped hole.

This method is much quicker than lacing the fuse through the stick of dynamite and is much better in every way. These clips can be stamped out of thin sheet copper at the mine or in any local machine shop, and it is expected that they will soon be put on the market by an Eastern manufacturing concern. Their use is advocated, and the method of using is fully shown in the accompanying illustration.

Cold-Air Intake Duct for Air Compressors

It has often been observed that the output of an air compressor is greater in winter than in summer; that is, it seems that a machine which has had to "hustle" to furnish air in summer, may be able to maintain the required pressure at a reduced speed during the winter. The reason for this is often asked, and R. S. Bayard, in *Power*, May 25, 1915, discusses the matter in detail.

This difference can be observed only when the compressor takes its air through a duct leading from the outside air, because it is due to the effect of the difference of air temperature between the compressor intake and that air about the compressor.

Imagine a cylinder having a perfectly tight piston held, we will say, at midstroke, and the half-cylinder full of air at atmospheric pressure and at a temperature of 60° F. The atmospheric pressure is, with 30-in. barometer, 14.7 lb. per sq.in. With the piston held rigidly and leak-tight, assume that we can heat the cylinder so that the air inside will become 100° F. This will cause the air to expand and try to occupy more space, but if the piston will not move, the air cannot expand, so it will increase in pressure. Mathematically, the pressure produced in this way will be

$$14.7 \times \frac{100 + 460}{60 + 460} = 14.7 \times \frac{560}{520} = 15.84 \textit{ lb. per sq.in.}$$

That is, the new pressure, absolute, will be equal to the first pressure, absolute, multiplied by the ratio of the absolute temperatures.

If, in the cylinder we are considering, the piston is allowed to move as the air expands and if it has no friction, so that the air pressure does not increase, the final volume will be larger than the original volume in the ratio of the absolute temperatures. If the original volume was, say, 10 cu.ft., the final volume after the piston has moved, due to increase of air temperature, is

$$10 \times \frac{100 + 460}{60 + 460} = 10 \times \frac{560}{520} = 10.77 \textit{ cu.ft.}$$

At the usual room temperatures (about 520° F. absolute) the increase of volume is, roughly, 1% for every 5° F. increase of temperature.

Let us see how the foregoing applies to a compressor plant. Irrespective of the outside temperature, the air in the shop pipe lines will be nearly at the temperature of the room by the time it reaches the tool. Suppose in winter this temperature averages 68° F. and that the air finally reaches the tool at this temperature. If the compressor takes in 1000 cu.ft. of free air (air at atmospheric temperature and pressure) directly from the room, it will also deliver 1000 cu.ft. of free air at the tool, because the final temperature is the same as that at which it entered the compressor.

In summer the same conditions apply as long as the compressor takes its air from the same room in which the compressed air is used; but if the compressor is provided

with an intake duct leading from the outside air, the result will be quite different. First, consider the winter condition. Suppose the shop temperature averages 68° F. and the outside air 30° F. If the air is used at 68°, its volume will be considerably greater than the volume taken into the compressor from the outside air at 30°. If it requires 1000 cu.ft. of free air per minute at shop temperature to run the tools, the compressor will have to take in only

$$1000 \times \frac{30 + 460}{68 + 460} = 1000 + \frac{490}{528} = 929 \; cu.ft.$$

which is a saving of over 7% in air capacity, speed and horsepower. In summer, when the outside temperature is practically the same as the temperature indoors, there would be no saving by using the intake duct except, as is often the case, when the compressor takes its air supply directly from the hot engine room. Thus it is seen that the compressor would run at a speed about 7% lower in winter than in summer. The colder the climate, the more pronounced this effect would become.

An actual case where the application of an intake duct to a compressor represented an appreciable saving recently came to my attention. An air compressor furnishing an average of 2500 cu.ft. of free air per minute to a machine shop took its supply from the basement of the engine room, where all the year round the air, heated by a network of steam pipes, averaged 95° F., while the shop averaged 70° F. During the winter months the outside air averaged 32° F., and in summer 70°. Based upon the average consumption of 2500 cu.ft. per min. for 10 hr. a day, the air used amounted to an average of

$$2500 \times 60 \times 10 = 1{,}500{,}000 \; cu.ft.$$

per day at the shop end.

As the compressor-intake temperature averaged 95° F., the compressor was obliged to run fast enough to take in

$$1{,}500{,}000 \times \frac{95 + 460}{70 + 460} = 1{,}500{,}000 \times \frac{555}{530}$$
$$= 1{,}570{,}500 \; cu.ft.$$

of engine-room air per day.

The cost of compressed air in this plant was found to be 2.8c. per 1000 cu.ft. at the compressor. Thus the cost of furnishing air to the shop was

$$\frac{1{,}570{,}500}{1000} \times 0.028 = \$43.97 \; per \; day$$

By putting in an intake duct and furnishing air to the compressor at 30° F. in winter, the compressor could have been run slower and would have had to take in only

$$1{,}500{,}000 \times \frac{30 + 460}{70 + 460} = 1{,}500{,}000 \times \frac{490}{530}$$
$$= 1{,}387{,}000 \; cu.ft. \; per \; day$$

At a cost of 2.8c. per 1000 cu.ft. at the compressor intake, the average cost of air for the plant during winter would then be

$$\frac{1{,}387{,}000}{1000} \times 0.028 = \$38.84 \; per \; day$$

During the summer, when the outside and inside temperatures both averaged 70° F., the compressor would take in only the amount used in the shop, or 1,500,000 cu.ft., which at the cost of 2.8c. per 1000 cu.ft. at compressor intake would be

$$\frac{1{,}500{,}000}{1000} \times 0.028 = \$42 \; per \; day$$

With the intake duct in use we then have a daily cost for air of $38.84 for winter and $42 for summer. The average for the year may then be taken at $40.42 per day, as against $43.96 with the compressor taking air from the engine-room basement.

During a working year of 300 days, the annual cost for air would then compare:

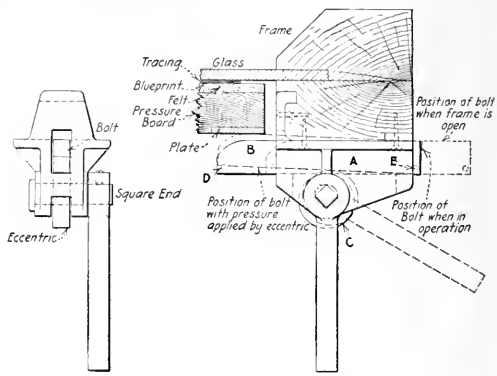
Without intake duct	$43.96 × 300 = $13,188
With intake duct	40.42 × 300 = 12,126
Giving a net saving with the duct of	$1,062

Capitalized at 10%, this would justify installing an intake duct costing $10,620. As this figure approaches more nearly the cost of the compressor than it does the cost of the duct, the conclusion is obvious.

Incidentally, the saving of $1062 per year amounts to more than 8% of the yearly cost for air. It certainly appears to be worth while to install an air-intake duct under such conditions.

Clamp for Blueprint Frame

F. J. Hibberd in the *American Machinist* describes a clamp for blueprint frames for use in those drafting-rooms where the electric blueprinting machine has not been introduced, but where the old-style sun frame still exists. There are many devices used for clamping the pressure board down on the back of the frame so as to give the necessary close contact between the tracing and



Details of Blueprint Clamp

the glass. The common door-bolt, which is the device generally used, is a most unsatisfactory means of securing this contact.

The illustration shows an improved method. It is composed of a brass bracket *A*, which is fastened by screws to the side of the frame. It has a sliding piece *B*, which can be moved in and out by hand like a "bolt" and is so designated in the illustration.

Underneath this bolt is an eccentric disk *C*, which is fastened to a pin and has a hand lever fitted in its square end. When the bolt is shot into place, the lever is pulled over to the right, as shown by the dotted lines, and the eccentric disk forces the bolt up in the direction of the pressure board, thereby pressing the tracing against the glass of the frame. There are pegs, *D* and *E*, to limit the movement of the bolt. Of course in actual use the whole appliance is reversed and remains so till the clamping is complete.

Engineering Notes and Methods at Miami

By H. P. Bowen*

SYNOPSIS—Kinks about underground surveying, best instruments, tapes, reels, etc., to use; methods of taking and keeping notes, filing them for office use and recording them on maps and assay plans; use of tracing cloth, blue-print and black-print papers.

The graduate of any one of our technical schools leaves college with a more or less clear idea of how to perform certain field and office engineering work with extreme accuracy. All the training he has received tends to that one end. He is theoretical rather than practical in his work, and it is generally some time before he begins to realize how large a structure of practice must be erected upon his small foundation of theory.

Practical engineering is a science of approximations. Absolute accuracy is as impossible here as elsewhere, and near-accuracy is often economically wrong. The first point to be decided in the laying out of any work is to what degree of accuracy the work in question should be done; the second, how to do it as quickly as possible with the least work and the least chance of error. For example, the elevation of a certain point is required. This may be obtained in the three following ways: The elevation within from 5 to 10 ft. can often be scaled off a contour map; an accuracy within 1 or 2 ft. may be obtained by a stadia shot or two from a known bench mark; or the elevation may be accurately determined by running a line of levels to the point in question. While more accurate, either of the latter methods would mean time and work wasted were only an approximate elevation desired.

Everyone makes some errors in his work. They must be found before the work has gone far enough to cause trouble. An engineer cannot afford to let pass any opportunity of checking his work. No matter how monotonous the work, one must not fall into the mistake of doing it mechanically, or some error will creep in and pass by unnoticed.

If in plotting or checking a piece of work it does not *seem right*, it should be checked and rechecked, preferably by someone else, for the chances are in favor of there being a mistake in it.

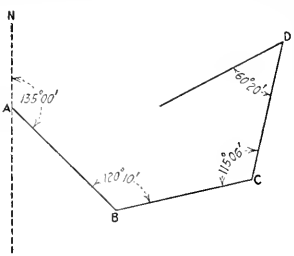
Every engineer has a favorite among the various makes of surveying instruments, but it must be borne in mind that a good engineer can do good work with a poor instrument, while a poor one cannot do good work with the best instrument made. The class of the instrument and the shape it is in will affect only the time and care necessary to do the work right.

Ordinary underground work consists mostly of putting in line-plugs for drifts and crosscuts, lining up timbering and a certain amount of leveling. The class of transit I have found most convenient for this work is a small instrument with U-shaped standards and no compass box. The chance of error in reading the horizontal circle has been lessened by having it graduated only one way from right to left and from 0 to 360 deg. It has a horizontal, vertical and two diagonal cross-wires and two stadia wires. Cross-hairs and graduations are made coarser than usual to make them easily read in the poor light underground. For shaft plumbing and long connections a larger and more finely graduated instrument is used.

*Care of Miami Copper Co., Miami, Ariz.

Tapes and Reels

The question of tapes and reels is one that is hard to decide. I have yet to see a reel that is perfectly satisfactory and will stand up under the hard usage it receives underground. Reels for 500-ft. tapes are too heavy and clumsy to carry around. All reels fall down when used underground on account of the grit cutting out the bearing surfaces. For the latter work a reel should be of the size necessary to take a tape 50 ft. longer than the one used. This will keep it from binding with the dirt and grit it picks up. For surface work a 500-ft. wire tape $\frac{1}{8}$ in. wide graduated on brass sleeves for every foot of its length is used. This is better than a shorter tape, especially in a rough country. For underground surveying a heavy $\frac{5}{8}$-in. tape heavily etched to feet, tenths, and hundredths is giving the best satisfaction. A thin tape will not stand the rough usage and a $\frac{1}{8}$-in. tape, besides being difficult to read, crystallizes after some use and becomes brittle. For the samplers, heavy $\frac{5}{8}$-in. tapes etched to feet are preferable. Graduations on babbitt, copper or brass soon wear off and cannot be read.



A Traverse by Azimuths

The bearing is carried underground by jiggling in line with two wires suspended in the shaft. A quick method of "jiggling in" is as follows: Set the instrument tripod as near as possible in line with the two wires, having two of its legs parallel with and one at right angles to the line of the wires. Put on the transit head and level up the instrument. Now if the transit is nearly in line as it should be, it is possible to jiggle in by raising or lowering the tripod leg which is at right angles to the line of the wires, and then leveling up the instrument. By moving the tripod leg instead of the transit head it is possible to move the transit a minute distance, and the subsequent leveling lessens this. Size No. 6 piano wire is used for plumbing raises and shafts up to 200 ft. and size 8 for greater distances. Weights for plumbing can be made from short lengths of iron pipe filled with lead. Slots cut in the pipe will permit the insertion of tin vanes, which should project about an inch beyond the pipe, causing the weight to come quickly to rest when in use.

Our underground stations in the Miami company's mines consist of spads either driven in caps or in plugs set in holes drilled in the rock. In the former case such a station is never used for work of importance without checking back on stations set in the rock. A cap will sooner or later move more or less, no matter how solid the timbering may appear. In an entirely timbered working, an intermediate point put in line with any two stations will prove by lining up at any time whether any one of the three points has moved. In such workings permanent stations can often be made by punching a point in a moil driven into the floor. Spads are made from No. 4½ horseshoe nails. Larger sizes split the plugs. The heads are hammered flat and slots for the plumb-bob cord cut with a hacksaw.

Every angle in an underground traverse is doubled and both the original and doubled reading are recorded on cards carried for that purpose. These cards are carried in a tin holder and are filed away in the office daily.

Bearings by Azimuths

In the hurry of underground work, mistakes in calculations, especially those that must be made on the ground, are easily made. A method that will make the calculations almost entirely mechanical will result in the fewest errors. For this reason we figure our bearings by azimuths. By the azimuth of any course I mean the horizontal angle turned to the right between the first station, on a course due north, and any other station on the course. To get the azimuth of any course in a traverse, take the azimuth of the preceding course from back sight to station set on, add 180° and the horizontal angle read to the right between the station set on, back sight and fore sight, and the result will be the azimuth required, unless it is greater than 360°. In this case subtract 360° if the result is not greater than 720°, and 720° if it is, and the difference will be the azimuth.

To illustrate, take the courses in the figure, *A, B, C, D, E,* then:

		Deg.	Min.
Azimuth AB	=	135	00
		180	00
Angle ABC	=	120	10
		435	10
		360	00
Azimuth BC	=	75	10
		180	00
Angle BCD	=	115	06
		370	16
		360	00
Azimuth CD	=	10	16
		180	00
Angle CDE		60	20
Azimuth DE	=	250	36

To obtain the bearings from the azimuths is simple, as the following will show:

When the azimuth is from 0 to 90° azimuth = N.E. bearing.
When the azimuth is from 90 to 180 180 — Az. = S. E. bearing.
When the azimuth is from 180 to 270 Az — 180 = S.W. bearing.
When the azimuth is from 270 to 360 360 — Az. = N.W. bearing.

Station and Level Designations

All stations are numbered by numbers stamped on 1¼-in. copper disks, which are nailed to the plugs or caps. Aluminum tags soon become covered with a white coating, probably a sulphate of aluminum, making it difficult and sometimes impossible to read them. Stations on each level are numbered from zero up in the order in which they are put in, and in the case of replacing a station an entirely new number is used to avoid confusion.

Drifts and crosscuts are plotted on the mine maps once a month from rights and lefts taken at that time. This can be done most rapidly by using four men. Plumb-bobs are hung from two stations and the tape stretched between them and held. The third man measures the distance from the tape to the walls of the drift with a stick graduated to feet and calls them out to the fourth man, who records them along with distance of each reading from the starting point and the name of the level drift and stations used. A record will read as follows:

370 LEVEL, N. 600 W. 400 N.
Stations 69-70

Distance from Station, Ft.	Distance to Left, Ft.	Distance to Right, Ft.
10	2	3
25	4	2
30	6	1
50	10 S.E. cor. raise	3
54	2	3

Stopes are measured up every few days and sketched on cross-section cards carried in a loose-leaf holder. These are then transferred to the office maps and the cards filed.

Up to the present time there have been about three thousand working places in the mine, and this necessitates a certain definite arrangement both for matter of record and to designate the working. The levels are named from the distance they are to the surface in the shaft that first entered the orebody. A zero point was established on all levels at this shaft and the workings named in accordance with their relation to it. The name of each working is composed of three parts—first, the level; second, the distance north, east, south, or west from the zero point, and, third, the direction in which the heading is being driven.

Following are the names of some of the drifts: 370 Level E 200 N; Level E; Level N 300 W 50 E; Level W 150 S.

If the footage of each drift were measured from the intersection of the coördinates at its starting point, it would result in double-measuring every crossing. To obviate this, the workings running north and south or east and west from the zero point are measured from that point and all others from the sides of the drift from which they start. This also renders it possible for the samplers to measure and sample the drifts before transit lines are put in.

Vertical raises are measured from the top of the rail in the drift from which they start.

Mapping and Office Kinks

Assay plans and sections made on a scale of 40 ft. to the inch will enable the assay percentages to be entered inside of the lines of the drifts in case such percentages do not consist of more than three figures. At this property assay plans are made of each level and sublevel, and vertical sections are made on the 50-ft. coördinates each way. These sections face the east and north.

As the greater part of our tracings are used for the purpose of making blue or white prints, colored inks are not used on them with but one exception. Old timbering that is to be replaced is sometimes represented by green ink lines. These show as faint blurred lines on the blueprints.

Where very many tracings are to be made it will pay to buy tracing cloth cut in sheets, with the border, title, and even the coördinates, printed. The cloth costs but a few cents a sheet, and besides the saving in time will

more than pay for itself in the saving of tracing cloth ordinarily lost in cutting.

All paper and tracing cloth shrink after being unrolled, due probably to the tension applied in rolling them up. For large tracings or drawings where accuracy is necessary cut the paper or cloth to the required size and leave it loosely rolled for several days before using. In the case of tracing cloth, strip off the selvage edges before setting it away.

To plot coördinates, lay off one of the lines and erect two perpendiculars to it at opposite ends of the drawing; measure equal distances along these perpendiculars and draw a fourth line parallel to the first completing the quadrilateral. Check this up, subdivide the sides and draw in the coördinates. If this is not all done at one sitting the coördinates will be found to be out, as the paper or tracing cloth will stretch or shrink from day to day, especially during changes in the weather.

Blueprint papers vary in cost, due principally to the quality of the paper used in its manufacture rather than to any difference in the emulsion used. Some of the cheap papers are not tough and tear easily when wet. Blueprint papers are classed as rapid, electric-rapid, or regular, according to the time necessary to print them. In bright sunlight this varies in this locality from 3 min. for the regular to 20 sec. for the electric-rapid. By using the latter a saving in time is effected and prints can be made quickly on cloudy days if required. More care must be taken in using the more rapid papers to keep them from being exposed, so they do not keep so well as the slower kinds.

Direct black-print papers and cloths are printed directly from the tracings, and after being finished by washing in water give blue-black lines on a white background. They are much more expensive than blueprint papers and cloths, but are very useful for many purposes. Additions in pencil or drawing inks may be made to these prints, and they may be colored with either water colors or crayons. Black-print papers and cloths require from 4- to 8-min. exposure in the sun—the cloth a little longer than the paper; and it is not usually advisable to try to get a print on a cloudy day. Under-exposure leaves the ground purple after washing and in an over-exposed print the heavy lines are a light gray and the light ones print out. All white-print paper I have used becomes brittle if kept several months before using. Most, if not all, of this paper is imported from Germany, and the difficulty in obtaining paper that has not been kept in stock until it is brittle and worthless has kept many from using it. Apparently the cloth does not deteriorate with age.

An easy and rapid way of coloring white prints and drawings is by the use of wax crayons and gasoline. Go lightly over the space to be colored with the crayon, moisten a piece of cloth with gasoline and by rubbing it over the colored surface smooth the color and extend it to the edges of the space to be colored. If the color is smeared beyond the required limits it can be removed by a pencil eraser. The probable explanation is that the crayon, being a mixture of wax and ground pigment, has the wax dissolved by the gasoline, which leaves the pigment as an impalpable powder to be rubbed evenly over the surface. Some colors work much better than others, namely, the yellows, purples, slates and greens.

Convenient weights for holding down drawings can be made from 4x4-in. canvas bags filled with shot.

In an office of any size much time can be saved by the use of a tracing table. This consists of a glass-topped table under which are placed several large electric lights (we use 100-watt tungstens). With this it is even possible to trace through heavy cloth-backed drawing paper. The number of uses to which such a table may be put will be found to increase from day to day.

When it is necessary to put coördinates on a tracing it will be found advisable to place them on the opposite side of the cloth from the rest of the map. If this is done the coördinates will not be affected by any erasures.

These comprise some of our methods in use at the present time, for they are constantly changing. Frequently slight modifications are made to adopt a better method to our particular needs. Often a better procedure is adopted and more rarely a new one is originated and developed.

Missouri's New Mining Law

By A. L. H. Street*

At the recently adjourned session of the Missouri Legislature the mining laws of that state were increased by several different acts. One of the measures provides for official inspection of mines other than coal mines, to determine whether dust is present in the air in quantities injurious to miners. If such a condition is found, provision is made for requiring the owner or operator to install and maintain an independent water line, fully equipped and in good serviceable working order, leading up to the face of any and all drifts where such dust is produced, or so close to the face of the drifts that by the use of suitable hose extension or sprinkling attachments (to be supplied by the owner of the mine), the mineral or earth in and adjoining the face of the drifts can be sprinkled by water from the pipe line. It is made the duty of every person drilling, squibbing or blasting in such mine to keep the face, surface and drill holes in such drifts moist to such a degree as to prevent as far as possible dust rising from the workings. Violation of any provision of this act is punishable by a fine of from $5 to $50.

Another law requires owners and operators of lead and zinc mines to provide suitable dressing rooms with lockers for the use of employees. Adequate washing facilities and benches must also be afforded, and the rooms must be kept properly heated. A fine of from $5 to $25 may be assessed for disobedience of this act. Under a separate act, owners or operators of lead and zinc mines are bound to provide sanitary drinking devices if 10 or more men are employed.

Another law makes it the duty of the chief state mine inspector and his assistants to stop the operation of any mine or part thereof, where poisonous damps exist, where rotten ropes or unsafe cages are used or where a safe escapeway is not provided for all employees. A penalty of fine or imprisonment, or both, is prescribed for infractions of this act.

The Dexter White Caps Mining Co. of Manhattan, Manhattan, Nev., for the year ended Mar. 31, 1915, reports a production of 3106 tons of ore having a gross value of $56,272. The receipts from the sale of ore and royalties amounted to $45,867. The expenses were $65,683, thereby making a deficit of $19,816. Current liabilities amounted to $17,669 over current assets.

*Attorney, St. Paul, Minn.

Details of Milling and Smelting

Smelting Storage-Battery Sediment

By Walter C. Smith*

Several years ago I had occasion to treat considerable storage-battery sediment or mud in a 10-in. circular lead blast furnace. The charge for furnace averaged 850 lb. of ores, fluxes and returned slags. Fuel varied from 10% to 14% of weight of charge.

With normal conditions we had little or no trouble from the furnace top working hot, but whenever the charge carried 100 lb. or more of battery sediment the furnace would develop a hot top. Increasing the percentage of coke, lowering the blast pressure or wetting down charges would not correct the hot top. The furnace ran well, the slags were hot, tuyeres were bright, and had plenty of coke at tuyere level. By substituting any other lead-bearing material for battery sediment, the top would cool rapidly; replacing battery sediment on charge would, within one hour, develop a hot top accompanied by heavy fume losses.

The cause of this hot top was a matter of some discussion, the conclusion being that battery sediment, consisting principally of lead peroxide (PbO_2), breaks down under moderate temperature into litharge (PbO) and oxygen (O_2). This liberated oxygen immediately combines with CO in gases to form CO_2 and generates a large amount of heat at or near top of charge, thereby rapidly heating charge until a hot top develops, with no apparent increase of fuel consumption.

To prove this a small amount of battery sediment was slowly heated in a tube; well below a red heat, the reddish-brown PbO_2 changed to yellow PbO and a test of the gas showed the presence of large amounts of oxygen.

I finally treated battery sediment as follows: First, adding 75 lb. or less to each charge, wetting charge thoroughly; second, heating sediment in roasting furnace or kettle until it had turned yellow and then charging into furnace as lead ore.

*Silver-refinery superintendent, Chrome, N. J.

Delta Crucible Tongs

The New Jersey Foundry & Machine Co., of 90 West St., New York, has put a new type of crucible tongs on the market which is so constructed as to take a six-point bearing on each side of the crucible, regardless of wear. This is attained by having three curved plates mounted on a three-armed frame, which has play enough in its mounting always to bring these three plates against the crucible.

In addition each of the plates has a concave surface, and this, with a little play in the individual mounting, insures a bearing of at least two points for each plate. This sextuple bearing should eliminate a great deal of premature cracking of crucibles through poorly fitting tongs.

Smelting Data of British Columbia Copper Co.

Frederick K. Brunton, in describing* the British Columbia Copper Co.'s smelting plant at Greenwood, B. C., gives some interesting operating data of that works prior to its closing in 1914 on account of the decline in the price of copper. The company smelts the lowest-grade ore of any North American smelting works, the average copper content being 0.85%. The plant treats about 2250 tons per day, or 17.5 tons per man per day.

The equipment includes three blast furnaces and two converting stands. Two of the blast furnaces are 51x360 in. at the tuyeres and the other is 51x240 in. The vertical distance from feed floor to the center of the tuyeres is 16 ft. The 30-ft. furnaces have 72 tuyeres, 4 in. in diameter but bushed to 3¼ in., and receives about 25,000 cu.ft. of air per minute at 16- to 24-oz. pressure.

A typical furnace charge is shown in the accompanying table. The most variable factor is the Motherlode ore, which sometimes changes abruptly from a lime gangue to an iron gangue carrying about 30% magnetite, so that the furnaces require constant watching. The 5000-lb. charge shown gave 4300 lb. of slag that would carry 0.23% Cu, or about 10 lb. of copper, leaving 34.7 lb. for the matte, which required one-fourth of its weight, or 8.7 lb., of sulphur. By reason of the poor construction of the furnaces for handling ores so low in sulphur, 88%, or 160 lb., of the sulphur was volatilized in the furnace, leaving 23 lb. for the matte. Since the copper took 8.7 lb. of sulphur, there was left for iron 14.3 lb. of sulphur, requiring 1.75 times its weight, or 25 lb. of iron. The matte, therefore, contained: Cu, 34.7; S, 23.0; and Fe, 25.0 lb., and assayed 42% Cu. The slag ran approximately as follows: SiO_2, 42.7; Fe, 19.7; CaO, 21.2; Al_2O_3, 9.0; and Cu, 0.23%.

TYPICAL FURNACE CHARGE AT GREENWOOD, B. C.

Ore		SiO_2 Per Cent.	SiO_2 Lb.	Fe Per Cent.	Fe Lb.	CaO Per Cent.	CaO Lb.	S Per Cent.	S Lb.	Cu Per Cent.	Cu Lb.
Motherlode	2500	32	800	18	450	22	550	2	50	1.0	25 0
Rawhide	1600	36	576	16	256	19	304	3	48	1.2	19.2
Napoleon	500	30	170	30	150	7	35	17	85	0.2	0.5
Republic, SiO_2	400	80	320			7	28	..	..	....	....
Total	5000	..	1846		856	..	917	..	183	...	44.7

FURNACE OPERATING DATA

Tons smelted per day	2250 0
Tons smelted per square foot of hearth area, average	6.62
Tons smelted per square foot of hearth area, maximum	35.70
Tons smelted per man per day	0.8 to 1.2
Cu on charge, per cent	30.0 to 45.0
Cu in matte, per cent	0 22 to 0.27
Cu in slag, per cent	2 00
S on charge, per cent	85 00 to 90.00
S burnt off, per cent	12.00 to 14 00
Coke used on charge, per cent	20 00 to 28.00
Coke ash, per cent	25,000
Blast, cubic feet per minute	2,500
Cooling water for jackets, gallons per minute	21 0
Men per 8-hr. shift	1.65
Matte, per cent. of total charge	38 to 45
Slag, per cent. SiO_2	13 to 20
Slag, per cent. Fe	20 to 26
Slag, per cent. CaO	6 to 9
Slag, per cent. Al_2O_3	

*"The British Columbia Copper Co.'s Smelter, Greenwood, B. C.," a paper to be read before the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

The labor required in the furnace department per shift is: One shift boss at $5.25, three furnacemen at $4, three furnace helpers at $3, one slag motorman at $3.10, one slag switchman at $3, three charge motormen at $3.15, three head loaders at $3.15, three second loaders at $3, one feeder at $4, one bin man at $2.75, one power-house man at $3.40—a total of 21 men and of $70.70 in wages per shift. In addition there are on day shift only, four men in the briquetting plant and four men on slag-track grading at a total daily wage of $23.50. These two crews are used when needed in general roustabout work so that not all of their time was really chargeable to furnace work.

Powdered Coal

At the seventh annual convention of the International Railway Fuel Association, W. L. Robinson, supervisor of fuel consumption of the Baltimore & Ohio R.R., presented a paper outlining the advantages that might result from the use of powdered coal in locomotive furnaces, from which the following costs of pulverizing are taken:

The cost of preparing powdered coal will vary with the cost for the raw coal and its moisture content. However, a general average from available data covering periods of the past five to ten years at cement and metallurgical plants has made it possible to present the following conservative estimate, assuming the cost of the raw coal at from $1 to $2 per short ton, and that it will require crushing and have a moisture content of from 5 to 10 per cent. when placed in the drier:

Capacity of Plant in Short Tons per Hour	Average Total Cost for Preparation per Short Ton
2	From 25 to 50c.
3	From 20 to 45c.
4	From 16 to 40c.
5	From 14 to 35c.
10	From 12 to 30c.
25	From 10 to 20c.

The fuel reqnired for drying the coal will average from 1 to 2% of the coal dried. The distribution of the total may be approximately stated as follows:

Fuel for drying	10%
Power for operation	30%
Labor	30%
Maintenance and supplies	25%
Interest, taxes, insurance and depreciation	5%
Total	100%

The cost of preparing powdered coal should be more than offset by the ability to utilize mine refuse and sweepings, run-of-mine, screenings and slack grades of coal that cannot be used to good advantage otherwise, and inferior grades of sub-bituminous coals, lignite and peat of relatively lower cost per ton than the readily salable commercial fuels.

Coal in a finely divided or powdered state represents the most advanced method for producing perfect combustion. While a cubic inch of solid coal exposes only 6 sq.in. for absorption and liberation of heat, a cubic inch of powdered coal exposes from 20 to 25 sq.ft., which enables the more uniform gas production from the volatile matter in the coal and the more prompt and perfect intermingling of gas and air, thereby improving combustion and reducing smoke. Furthermore, there is no cooling of the fire by heavy intermittent charges of fresh coal, as is the case with hand or stoker firing on grates.

Powdered coal may be burned by either of two generally defined methods—the long-flame method, constituting a progressive burning of the coal such as is employed in cement and openhearth furnaces, and the short-flame method, which is the latest development and is used in metallurgical and similar metal-heating work or under boilers where a similar furnace volume obtains.

Welding Up Scrap Nickel Anodes*

Some important experiments in the welding of nickel anodes by the oxyacetylene process have just been concluded in the large plating department of the Prest-O-Lite Co., Inc., at its Indianapolis plant.

The anodes used by the Prest-O-Lite Co., Inc., are castings of 90% nickel, 8% carbon and 2% iron. They are elliptical bars, approximately 1½x3½ in. in cross-section and 30 in. long, and weigh about 30 lb. Their market value varies between 46c. and 50c. per lb.

By welding up old anodes which have been in the solution, and which have a junk value of between 22c. and 25c. per lb., the company is now converting its entire pile of scrap nickel into what are practically new anodes at a total cost for gas and labor of less than 6c. per lb. This estimate is based on a recent test at Indianapolis in which 421 lb. of scrap anodes were welded up at the following cost:

463 cu.ft. oxygen, at 2c.	$9.26
480 cu.ft. acetylene, at 2c.	9.60
24-hr. labor, at 25c.	6.00
Total	$24.86

In view of the fact that this test was made before any experience in the operation had been gained, it is apparent that better results and greater savings are sure to be the result of practice.

The method of handling this operation is about as follows: As the anodes are eaten away by the solution they are turned over to an oxyacetylene welder, who "tacks" on scraps of old anodes by welding to increase the surface.

The welding flame is also employed to remove the brass hooks which are used to support the anodes while in solution. Under the intense heat of the oxyacetylene flame (approximately 6300° F.) the solder melts away rapidly, leaving a pure nickel bar, which is later welded up.

No flux is employed, as this has been found to be unnecessary. The pieces of scrap are simply melted on or "fused" together, using another piece of nickel as a filling rod. The welding process is a great benefit in obtaining perfect fusion, which is essential, as all joints must have electrical conductivity equal to that of new anodes.

Another great advantage is the fact that no skill or experience in the art of oxyacetylene welding is required to weld up scrap nickel anodes: in fact any workman with average intelligence can do the work without any previous knowledge of the process. The apparatus needed to do the work is inexpensive.

Many other attempts have been made to utilize scrap nickel anodes, the most common practice being to drill holes through several pieces and bind them together by means of lead rivets. This method depends on the contact of the wire or rivet and the piece of scrap to conduct the current, and is therefore of uncertain value, and in many cases a flat failure. If for any reason the contact is bad and offers too much resistance to the current of electricity, the metal will not dissolve.

*From data furnished by the manufacturers.

The Cost of Doing Things

La Rose Consolidated

The La Rose Consolidated Mines Co., Cobalt, Ont., shows a combined profit of $208,939 for 1914 and dividend payments aggregating $171,000. Shipments totaled 1995.4 tons, averaging $333.20 in value per ton, after deducting $90,584 for smelting charges. The total reported cost of producing silver was 37.2c. per oz., made up of 23.08c. for mining, 9.69c. for concentrating, 7.42c. for marketing, 0.77c. for depreciation, 0.09c. for general expenses, and 0.64c. for advances to the University mines—a total of 41.69c., less a credit of 4.49c. for ground rents, discount and interest. The marketing expense was made up of 5.07% of the gross value of the ore for deductions on silver, 4.39% for treatment charges, 2.85% for freight and 1.65% for assaying and sampling, etc., or 13.96% total, based on $727,075, the gross value of the ore, including cobalt, paid for. Dividends paid to date by the La Rose Mines amount to $6,519,409 and by the La Rose Consolidated, $5,162,326. The mill treated 54,020 dry tons of ore and produced 1,271.76 dry tons of concentrates containing an average of 443 oz. of silver per ton. The average assay of mill heads was 13.12 oz., and tailings averaged 2.75 oz., indicating an extraction of 79.5%. Mill costs were $2.45 per ton milled. Ore reserves are estimated to contain 47,464 tons having a net value of $166,781. It is stated that the property has been almost exhausted of high-grade ore.

*

East Butte

The East Butte Copper Mining Co., Butte, Mont., for 1914 reports a net surplus of $222,252 on operations. Copper production amounted to 9,175,579 lb. from 72,853 wet tons of ore, or 71,918 dry tons from the company's mines, and 39,074 dry tons of custom ore. There were also produced 242,347 oz. of silver and 2219 oz. of gold. The gross value of metals shipped was $1,291,675, and other income amounted to $163,779, which made a total income of $1,455,454. Operating expenses amounted to $1,048,856; interest payments, $36,500; depreciation and losses, $11,744; additions to equipment, $71,002; and exploration and development, $65,099. The cost per pound of copper was 11.11c. Mining, including development, averaged $5.39 per ton of ore. The main shaft was sunk 185 ft., making a total depth of 1770 ft. Owing to the war the property only operated 220 days in 1914.

*

International Nickel

The report of the International Nickel Co. for the year ended Mar. 31, 1915, shows a net profit of $5,598,071, after deducting all expenses, depreciation, exhaustion of minerals and all other charges. During the year $595,376 was expended for additional property. Dividends amounting to $534,756 were paid on preferred stock and dividends on common stock aggregated $4,753,937. The consolidated balance sheet shows current assets of $11,117,881 and current liabilities amounting to $2,770,073. The number of stockholders increased from 3752 to 4465 during the year.

*

Chino Copper in 1914

The report for 1914 of the Chino Copper Co., Hurley, N. M., shows a production of 53,999,928 lb. of copper from 1,926,705 tons of ore. Dividend payments amounted to $2,169,065, while the actual amount available for dividend payments from 1914 operations was $2,298,246. The mill treated 1,907,300 tons averaging 2.1151% copper, and 19,405 tons were shipped direct to the smelters. The average net yield in refined copper per ton of ore was about 28 lb. The accompanying table gives a summary of Chino's production for the last three years:

Year	Tons of Ore Treated	Yield of Refined Cu per Ton	Total Lb. Refined Cu Produced	Ore Reserves — Tons Ore	Ore Reserves — Average per Ton
1912	1,122,666	24.7 lb.	27,776,088	90,000,000	36 lb.
1913	1,942,760	26.0 lb.	50,511,661	90,000,000	36 lb.
1914	1,926,705	28.0 lb.	53,999,928	90,270,155	35 lb.

The company owns 2645 acres of mining claims, of which 2412 acres are patented. In addition to this land the company owns 160 acres of agricultural land adjoining its mining claims. Including various water rights in connection with its mill site, the company also owns or controls 18,074 acres at Hurley. There were issued 9400 shares of capital stock during the year for the conversion of the remaining outstanding first mortgage bonds. The total outstanding capital stock now amounts to 869,940 shares. Dividends to date have aggregated $4,088,135. The profit as shown in the report for 1914 was $3,222,519, but other expenditures for deferred operations, bond redemption and investments reduced the amount available for dividends to $2,298,246 as shown in the following statement, which has been prepared in order that the financial transactions as shown by the statements in the report may be easily understood:

TOTAL RECEIPTS AND TOTAL EXPENDITURES OF THE CHINO COPPER CO. DURING 1914

Receipts		
From sale of metal products		$7,247,197
From miscellaneous sources		179,588
From capital stock at par value		47,000
From premiums on sale of capital stock		187,850
Total receipts from all sources		$7,661,635
Expenditures		
Expenditures charged to operations	$4,172,374	
Bond interest and advances paid	31,832	
Property account	1,645	
Construction and equipment	400,625	
Development	34,553	
Deferred stripping	484,178	
Investments	1,680	
Bonds redeemed	236,500	
Total expenditures	$5,363,388	
Paid out in dividends	2,169,065	
Added to quick assets	129,182	
To balance with total receipts		$7,661,635
Balance of quick assets at end of 1913		$2,298,529
Balance of quick assets at end of 1914		2,427,711
Increase in quick assets in 1914		$129,182
Dividends paid in 1914		2,169,065
Amount actually available from 1914		$2,298,247

ANALYSIS OF TOTAL RECEIPTS AND EXPENDITURES

Receipts from operations—current and deferred:		
From sale 53,999,928 lb. of copper at 13.325c.		$7,195,423
From gold produced		51,774
From miscellaneous income		179,588
Total operating income		$7,426,785
Current operations:		
Mining and milling	$1,473,553	
Treatment, refining, freight	2,048,004	
Selling commission	72,805	
Stripping	578,012	
Total operating costs reported		4,172,374
Total income reported		$3,254,411
Less interest and advances paid on bonds		31,832
Net profit shown in report for 1914		$3,222,579
Deferred expenditures to operations:		
For property account	$1,645	
Construction and equipment	400,626	
For development	34,553	
For deferred stripping	484,178	
Total deferred charges to capital accounts		$921,002
Balance over current and deferred expenditures		$2,301,577
Other expenditures:		
Bonds redeemed	$236,500	
Investments	1,680	
	$238,180	
Less receipts from capital stock	234,850	
Net amount paid out from earnings		3,330
Amount from 1914 actually available		$2,298,247
Dividends paid		2,169,065
Balance added to quick assets		$129,182

The total amount of ore and waste removed by steam shovels was 4,192,009 cu.yd. of material in place; 3,173,717 cu.yd. of this was stripping and the remainder was equivalent to 2,114,910 tons of ore. All material removed to date by steam shovels amounts to 13,014,416 cu.yd. in place, of which 10,188,246 cu.yd. was stripping, and the remainder was equivalent to 5,770,356 tons of ore. Of this ore 720,295 tons has been stored in the stock pile. The average cost of steam shovel work was 36.52c. per cu.yd. for all material moved during the year. The cost of handling waste alone was 33.47c. per cu.yd. The cost per ton of waste handled was 16.12c., while the cost of handling ore was 22.13c. There is a total of 24.039 miles of track used in and about the mine in connection with steam-shovel work, of which 23.223 miles was in use on Jan. 1, 1915.

During the first seven months of the year the mill operated 95.3% of possible time for all sections. Owing to curtailment on account of the war, the mill was operated on 66% of possible time during the remaining five months. During the first period the mill averaged 1345 tons per day per section and 1085 tons for the five-month period. During the year the entire plant averaged 5225 tons per day and treated 1,907,300 dry tons. A total of 147,925 tons of concentrates was produced, which corresponds to a ratio of 12.89 tons of ore to 1 of concentrates. The average grade of concentrates was 18.505%, and the mill extraction was 67.858%. The average milling cost was 55.01c. per ton of ore.

Ore reserves are estimated to contain 90,270,155 tons of fully developed ore averaging 1.15% copper. On the basis of operating costs reported, which do not include depreciation, the net cost of producing copper after crediting gold contents and miscellaneous earnings was 7.35c. per lb. as compared with a cost of 8.5c. per lb. reported for the previous year.

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The Franklin Mining Co., Houghton, Mich., for 1914 reports that the only production for the year came from the test-sampling of 7324 tons of rock, which yielded 93,283 lb. of copper. The total expenses were $140,018, and receipts amounted to $357,449, including assessments Nos. 1, 2 and 3. After deducting a deficit for 1913 a balance of $117,165 remained in the surplus account at the end of the year.

Tennessee Copper Co. in 1914

The report of the Tennessee Copper Co., Copperhill, Tenn., for 1914 shows a production of 12,871,113 lb. of refined copper from 185,051 tons of company ore smelted. Net profits for the year, including acid-plant earnings and earnings from all other sources, amounted to $751,893.

This amount was distributed as follows: Dividends, $600,000; reserve for general depreciation, $100,000; reserve for Federal income tax, $1126; and addition to surplus account, $50,767. Dividends to date aggregate $4,465,250. A record of the production from the company's ore for 1901 to 1914 inclusive shows that 4,978,349 tons of ore have been mined, 4,961,673 tons smelted and 155,493,546 lb. of copper produced. Ore reserves are estimated to contain 5,390,661 tons averaging 26.54 lb. of recoverable copper. The cost per ton of ore, not including refining, was $2.74725 made up as follows:

	Per Ton
Mine development	$0.04957
Mining	.37813
Railway expense	.05027
General expense	.18932
Smelting expense	1.31677
Converter expense	.16319
Total	$2.74725

The total cost of producing refined copper was 11.40c. per lb., not crediting the sales of sulphuric acid nor the values of copper in flue dust. The acid plant produced 210,163 tons of 60° Baumé acid. The smelting plant treated 724,822 tons of ore and flux with 38,726 tons of coke. The company has now reduced its bonded indebtedness to $800,000. It now has about 2000 stockholders.

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Tamarack

The Tamarack Mining Co., Calumet, Mich., for 1914 reports a production of 1,074,808 lb. of copper which it sold for 12.8c. a lb. The mine operated at a loss of $174,908. The following table gives a comparison of operations for the last four years:

	1911	1912	1913	1914
Tons of rock treated	392,338	421,385	227,563	57,410
Pounds of mineral	12,793,430	12,118,038	6,206,295	1,743,145
Pounds of refined copper	7,494,077	7,908,745	4,168,743	1,074,808
Per cent. of refined copper in mineral	58.58	65.26	67.17	61.66
Refined copper per ton of rock treated, lb.	19.1	18.8	18.3	18.7
Cost per pound:				
Mining	14.07c.	11.90c.	15.35c.	24.00c.
Construction	.06c.	....	....	3.28c.
Smelting, freight, commissions, office, etc.	1.23c.	1.11c.	1.25c.	1.80c.
Interest	20c.	.14c.	....	....
Total cost per lb.	15.56c.	13.15c.	16.60c.	29.08c.
Cost of mining, transportation, stamping and taxes, per ton of rock	$2.69	$2.23	$2.81	$4.49

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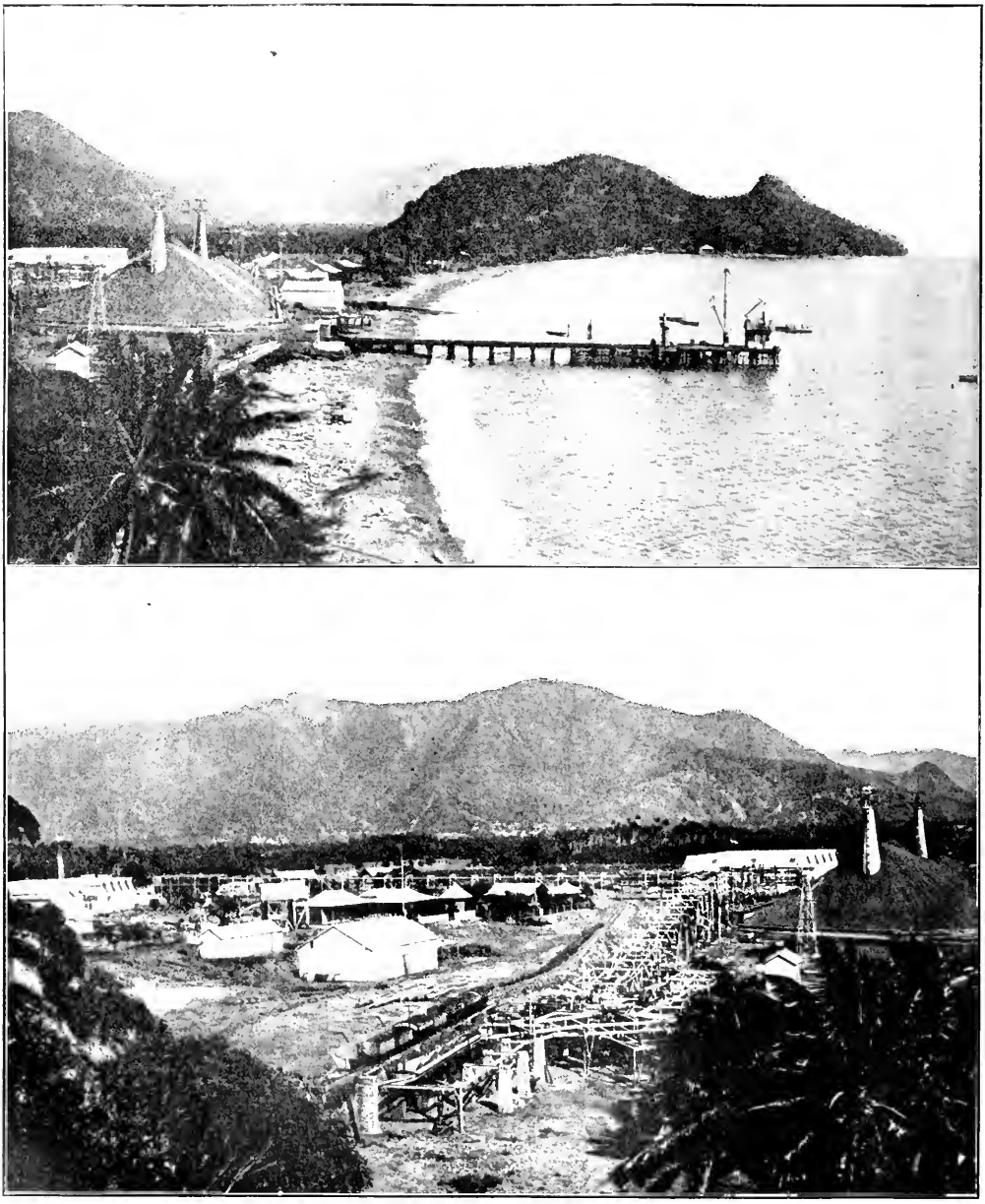
Beaver Consolidated

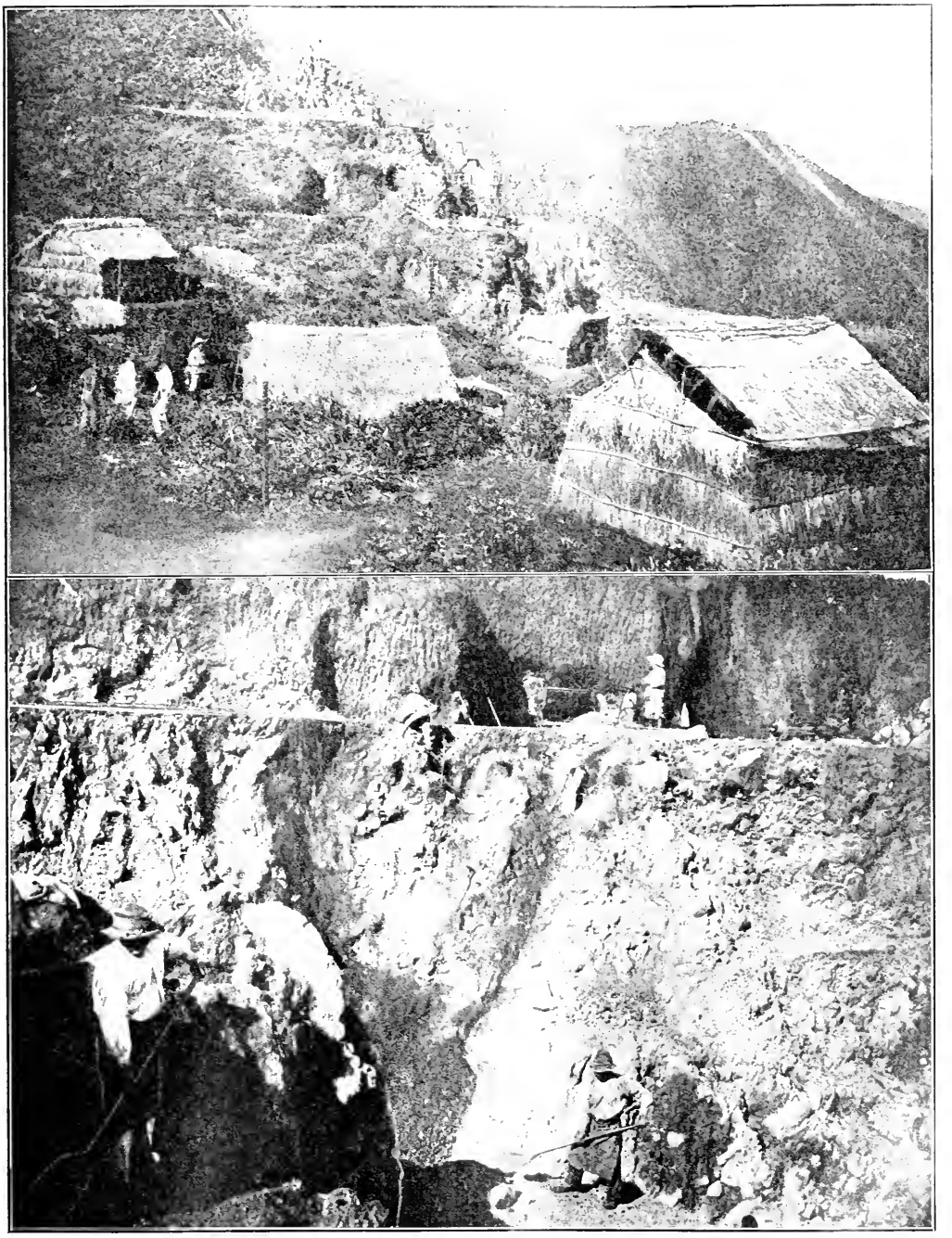
For the year ended Feb. 28, 1915, the Beaver Consolidated Mines, Cobalt, Ont., shows a production of 900,000 oz. of silver, of which 390,878 oz. were sold. The remainder was held in storage by the smelters. The mill treated 26,724 tons of ore, from which 347.95 tons of concentrates were produced containing 415,707 oz. of silver. A profit of $254,768 is shown in the financial statements before providing for depreciation amounting to $13,728. Dividends for the year amounted to $60,000. The cost of production was 21.54c. per oz. of silver.

Photographs from the Field



"Le Nickel," New Caledonia

Famous nickel mines controlled by a French company. The upper view shows the shore and landing at La Mission, the town embracing the company's plant. The lower view shows the works



"LE NICKEL," NEW CALEDONIA

Two views of the Bornet mine, near La Mission, New Caledonia. Mines are connected with the works by a 17-km. aërial tramway over which 50,000 tons yearly are transported. The pylons are 22-25 m. high. The company has refineries at Havre and Glasgow

Correspondence and Discussion

Tin Smelting in Bolivi

I refer to the editorial comment on the article by Mr. Lamb in the JOURNAL of Apr. 3, 1915. As ex-director of the Departmental School of Mining and Engineering of the Republic of Bolivia I can assure the editor that any business in tin done by the Yankees in this country will have to be solely on the basis of properties owned.

The kind of mines which capitalists usually look for—those in working order and with developed ore—are not to be found in Bolivia. Here everybody lives from hand to mouth, without bothering about the morrow; and although one may wish to develop a mine properly, he will not find either competent technical direction or the capital or credit required. The result is that even the large businesses have not the intrinsic value which they appear to have, nor is there life or prosperity assured even for two or three years. Anyone who wishes to succeed here must force his future with his own hand, beginning with the clearing of the titles to property, rectification of boundary lines, investigations, preparation of mines and living quarters, and finishing with the necessary skill for ore treatment.

I know of virgin lands which are good and available for development on a large scale; I know also of abandoned mines which would provide a profit if they were properly developed. The sooner the problem is tackled the sooner and surer will be the success. One cannot lose by giving serious study to the problem and disregarding the gratuitous information given by travelers for pleasure. Anyone considering work of this kind should possess a knowledge of the Spanish language, in order to treat directly with the people, and also to be able to appreciate the value of the facts presented. If such person is capable, cultivated, and will come recommended to me, I will lend him my aid and experience and knowledge, together with much positive information.

Only a short time ago there arrived here a merchant who has passed through New York. Apparently enthused by the prospects which had developed for a tin market, he asked me for information about mines and mining business. From my point of view he was wasting time, and it is a loss of time to bother with going into details with people who are unknown. However I do not doubt that Mr. Burrage might have entered into a splendid business if he had installed his smelteries in Bolivia, taking advantage of the hydraulic power available—for example, that of Pilcomayo.

The greater part of our miners have no resources and are eternally pushed by necessity. Consequently, they deliver their products to the first buyer. Even the companies of some importance prefer to liquidate their concentrates or sorted ore to local buyers for cash, instead of waiting for the results of a sale in Europe, which, in normal times, means a delay of about five months. Taking into account the great saving of freight and insurances, saving in sacks, loss of mineral or ore, and penalties, more or less unjust, for moisture, etc., you can understand why a country which contains the raw material in abundance has not yet arrived at the solution of the problem of the metallurgy of tin. The truth is simply that we in Bolivia are the toy of circumstances and conditions will not change until intelligent technical and commercial skill, conscientious energy and capital in adequate quantities shall enter into and take part in our mineral industry.

JOSÉ JACKOWSKI.

Casilla No. 120, Potosí, Bolivia.

Difference in Buying Zinc and Lead Ores

The producer of small lots of lead ore (galena) throughout the Missouri-Kansas-Oklahoma district sells his output at a certain figure per 1000 lb. and usually gets as much as the operator who sells carload lots. But in the production of zinc ore a different condition entirely exists, the small producer invariably being forced to take a much lower price per ton than the larger producer. A striking example of the wide variation in price between small lots and carload lots of zinc ore has been noted recently since ore prices have soared to such high levels. Carload shipments of uniform grades of blende concentrate have brought as high as $135, basis of 60% metallic zinc, whereas the company selling only a few tons would receive only $85 or $90.

Why there should be such a wide variation in zinc and virtually no difference in lead is explained through the fact that all lead ores of this district respond to simple smelting processes, whereas there is a big difference in the various lots of zinc concentrates from the different small mines, and a conglomeration of such concentrates does not yield as readily to the zinc-smelting process as would concentrates more uniform in character. Zinc smelters do not like to purchase odd lots of concentrates for the reason that their retorts are adapted to a certain character of charge and by varying the metallic composition of this charge the highest efficiency in metal recovery cannot be attained, and also the life of the retort is shortened. This condition explains why the heavy producers of uniform grades of zinc concentrate find a ready market at good prices for their output, whereas the small producer sometimes finds it difficult to dispose of his product even at a greatly reduced price.

A uniform grade of concentrate, whether it be high or low, is the kind that finds the ready market. Certain smelters demand only those concentrates that run high in metallic zinc and low in iron and with a minimum or total absence of lead. The presence of iron is not so undesirable as lead and certain smelters prefer a low-grade concentrate with plenty of iron. Lead content in the zinc is undesirable to all smelters whether they are users of high- or low-grade concentrates.

Competitive bidding for district concentrates is the method of purchasing as there are no contracts in use.

Blende is sold on a 60% metallic basis; calamine on a 40% basis, and galena on an 80% basis.

Joplin, Mo., June 10, 1915. L. L. Wittich.

Kitchen Assaying

Some months ago there appeared in the Situations Wanted column of a New York daily newspaper a notice to the effect that a certain lady was prepared to enter the service of a mining company. It appeared that her qualifications were almost unlimited, including bookkeeping, cooking, assaying, surveying, etc.

If there is to be any great demand for such versatile talent, the correspondence schools, publishers of cookbooks and editors of pin-money pages of the Ladies' Home & Camp Companion Journals should take such steps as may be necessary to disseminate useful information pertaining to the duties of those fortunate or unfortunate female persons who are compelled, either by their roving instincts or by the vicissitudes of fortune, to follow mining as a profession. As a hint the following sample is respectfully submitted:

Rapid Copper Analysis

Break the ore to about the size of half a thimble. Take four bread-pans and place edge to edge in the form of a hot cross-bun. Pour the ore gently with a slight tango-step motion, so that each pan will receive an equal share. Discard contents of two opposite corner pans. Mix contents of remaining two pans and repeat until about one large teacupful of ore remains. Pulverize in a clean coffee mill or meat chopper to fineness of percolator coffee. Mix thoroughly on oilcloth of kitchen table.

Take one leveled teaspoonful of the ore and place in a teacup. Add one tablespoonful of spirit of niter, a few drops of spirit of salt and a pinch of hyperoxymuriate of potash. Bring almost to a boil and then set (not sit) on the back of the range to simmer for about half an hour. Then add gently three dessert-spoonfuls of pure water. Allow to cool and add volatile alkali to suit smell.

Line a glass funnel with a cone of unsized paper porous enough to allow liquids to pass through it. Set the funnel over a milk bottle with a capacity of exactly one pint (this is perhaps 34.6592 cu.in. or possibly 28.875 cu.in., but the absolute value is unimportant).

Pour the contents of the teacup into the paper cone, leaving the dregs or grounds until the last pouring. Wash out cup with boiling water, adding the dish-water to the slops in the funnel. Keep on washing until the pint bottle is nearly full. A mark placed on the bottle will be found convenient to indicate the same quantity of liquid in each case.

To measure the percentage of copper in the ore a set of bottles should be prepared beforehand, using some ore that is known to contain an exact percentage of copper, such as 4%.

Use one batch for a 4% shade. Use another batch and add an extra pint of clear water and mix thoroughly. Then one pint of the mixture will give a 2% shade. Dilute the other pint again for a 1% shade.

For an 8% shade, use two teaspoonfuls of the 4% ore and double everything but the wash water, keeping the total liquid quantity down to one pint, or to the mark on the pint bottle. Beer bottles, whisky bottles, grape-juice bottles, etc., will serve, provided they are of clear glass without tint and all of the same size.

For those who find difficulty in understanding what "percentage of copper in an ore" means, a special recipe may be devised to show the number of grains, pennyweights, etc., in a stone of ore. Sugar is often sold by the stone, ¼ stone being 3½ pounds. So it will be an easy matter to balance the ore with four errands of granulated sugar. (When I was a little boy an errand of sugar was always 3½ pounds.)

Resuming the chemico-culinary topic, it may be stated that to guess the answer to a copper assay or analysis by this easy method one merely causes the sample bottle to promenade up and down the kitchen shelf opposite the stock set, and the color is matched as in selecting ribbons.

By this method a good consulting kitchen-mechanic can guess at the percentage almost as accurately as it can be estimated by a khaki-clad high-priced technical graduate.

T. Montmorency Dillon,
Deficiency Engineer.

New York, June 20, 1915.

Correspondence-School Graduates

In much of the technical and pseudo-technical matter which I have written in the past have been injected a few bits of what was intended to be humor in order to relieve the monotonous tone which might otherwise have prevailed.

Some unkind person has suggested that I cherish a feeling of malicious hatred toward correspondence schools. The imputation is false. Correspondence schools have performed a great service for humanity and have also paid me real money for some of the text-books which I had the pleasure of writing and revising.

What I do abhor is a conceited dolt who, having completed a correspondence course, imagines his dictum to be the last word in science—the final test, as it were. Such a bore is immeasurably more insufferable than a recent college graduate who announces that he is about to put the world on the high-speed gear and cut out the muffler. The latter individual has enough sense to know that the world is "hep" to his game of bluff or else he is sufficiently congenial to "kid" the world into taking him seriously now and then.

The correspondence school question may be summed up briefly in a metaphor—the best incubator in the world will not hatch a cold-storage egg.

New York, June 8, 1915. William B. McKinlay.

Belgian Trade after the War

I should like to inform the Journal readers that several competent Belgian business men have created an organization having a double object: (1) To introduce in Belgium, as soon as the war is over, all American products and manufactures; (2) to employ as agents, representatives, etc., a large number of Belgian manufacturers and business men, who have been partly ruined but still possess enough capital and can give the necessary guarantees as agents, dealers, etc.

Willy Lamot.

Shardhighs, Halstead, Essex, England, June 1, 1915

Mining Conditions in China

By F. Lynwood Garrison*

SYNOPSIS—Consideration of some established facts about the Chinese and their country. Its civilization is the most ancient and its people have developed an anti-military spirit. The country has great agricultural and mineral resources, and economic awakening is likely to make it one of the most important.

The present visit of the Chinese Trade Commission to the United States is likely to renew interest and stimulate our desire to know more of the mineral resources of that great country. As has always been the case when educated Chinamen honor us with a visit this commission is making a most excellent impression upon all who have been so fortunate as to meet its members.

No one who has lived and worked in China, who has striven to know its people and understand their views of life, can have failed to be impressed most favorably by their high character as well as their soundness and saneness of intellect. Despite the fact that my own work in China was cut short by the Boxer troubles of 1900, my interest in this great people has not ceased or flagged, and I have never had reason to change the high opinion of their character first impressions gave me. But in order better to understand the Chinese and China it is desirable, even at the risk of restating well-known facts, for us to consider a moment certain fundamental conditions that are essential to a proper appreciation of the subject as a whole.

Antiquity of Chinese Civilization

Chinese civilization has endured for something like 5000 years. Had the oldest of the other civilizations, the evidence of which archaeologists are now digging up out of dust heaps, endured to the present it is doubtful if any of them would be as old today as is the Chinese nation. Notwithstanding this great age, the Chinese continue to be a strong and virile people; how strong and how vigorous one needs to have lived among them to realize fully and to appreciate that antiquity does not necessarily connote decadence, or that ingrained distrust and disgust for militarism indicate degeneracy. The Chinese in a sense have always been an essentially agricultural people; despite the fact that a few notable mechanical inventions appear to have had their origin with them, the mechanic arts as such appear never to have flourished, to have been encouraged or to have played any notable part in the history of Chinese civilization. Herein lies the essential difference between Oriental and Occidental, or perhaps it would be more correct to say between Mongolian and European, culture, and it brings us to a realization of how this terrible war in Europe is mocking us.

Have we not with smug complacency been sending for many years missionaries to the "heathen" Chinese, and on the whole have they not been kindly received? The Chinese tell us: "These missionaries are very good people, they help us in many ways, and we welcome them, for they heal our sick, cure our maimed and teach our children many useful things; but we are not perfectly sure their ethical views and understandings of life are any sounder or better than our own. With your machines you can do many things we cannot, and you have thus added vastly to your personal comforts and wealth, but we are not certain that in consequence you are any happier or better off. Your educational system is perhaps a stupendous success if the world is to be simply a factory, but we fear it may prove a monstrous failure if the object happens to be more than that. In short, does your Western system of education give sanity to life or even protect it?"

I profess no greater insight into the oriental mind than that possessed by the average Westener, but it seems to me not so difficult to get some fleeting glimpses into its depths if we take the trouble. We all know in our hearts that might as expressed by mere physical force is not necessarily right, and that defenseless China of today is the only great nation in the world that does not believe in physical force as a vehicle through which to assert might. The Chinese do not now and never have asked anything of the world but to live and let live in peace. But that it is a fatuous, dangerous policy in this present state of world civilization we are all now willing to admit. That the Chinese may change this policy and become part of the restless, ruthless mechanical world is not altogether improbable, although I myself believe and almost hope it is unlikely. With this theme in mind let us briefly consider a few facts regarding the natural resources which China can call upon when she sees fit to change her economic policies.

Geography and Topography of China

China with its dependencies has an extent of something like 4,000,000 square miles, and as every geologist knows no such great area of the earth's surface traversed by great mountain chains and intersected with large river valleys exists that does not give promise of extensive mineral deposits. The area of China proper is about 1,400,000 square miles, 200,000 of which are comprised within the alluvial plains of the Yangtze and Yellow Rivers; the remaining 1,200,000 is hilly or mountainous. It has been assumed by some writers that but little is known of the mineral resources of China. As I will endeavor to show, such is not the case, and their exploitation by the Chinese themselves is by no means a new thing. As long ago as the time of Marco Polo in the 13th Century, the Chinese were using what is described as "a black stone which they dig out of the ground and burn like firewood," which of course was coal, and its use thus far antedates any recognition of its value in Europe or in any other country. In fact, as a general statement it may be said that from time immemorial the Chinese have been utilizing their mineral deposits in a small way, but that it has only been within recent years they have come to any sense of realization of their extent and commercial importance.

Chinese Coal Deposits

About the first inkling the Western world received of the vast extent of China's coal fields was from the obser-

*Mining engineer, Philadelphia, Penn.

vations of the American geologist, Raphael Pumpelly, whose reports were published by the Smithsonian Institution in 1866. Three years previously this remarkable man ascended the Yangtze River to Central Hunan and to the frontier of Szechwan; in 1863-64 he examined the coal fields west of Peking and made journeys in northern China and southern Mongolia.

Pumpelly was followed a few years later (1870) by the German scholar and geologist, Baron von Richthofen, who spent many years traveling about China, and whose valuable observations and maps were published in five large volumes. Richthofen's deductions are in the main probably reliable, but the practical conclusions he drew therefrom are open to doubt. He was a geologist of profound learning and some of his work in this country, particularly that connected with the Comstock lode, is notably good.* Coal beds, especially those of anthracitic character, have a habit of faulting, folding and pinching out, or being eroded away, and Richthofen appears to have been somewhat misled in judging the volume and extent of such deposits by the size and character of the outcrops. Our American Government geologists did much the same thing in Alaska. Hence it is evident even the best of geologists and mining engineers, who are unfamiliar with coal mining and estimating, are likely to ascribe an undue continuity and size to coal beds when judged solely from superficial appearances. Moreover, few people realize that in many, if not most, coal-mining operations about half of the coal in the ground is wasted.

Within recent years (1903-04) Willis, Blackwelder and Sargent, working under the Carnegie Institution, Washington, carried out an extensive geological reconnoissance in China proper. Their excellent work was published in three large volumes by the institution in 1907, but is held for sale by this "impecunious" organization at such high prices as to be beyond the reach of the average purse. The work of these geologists is, however, so meritorious that it will doubtless prove to be an immense help in the future to mining engineers engaged in the development of the country.

Geological Characteristics

Bailey Willis likens North China roughly to the eastern United States, and South China to the Western states. The coal fields of Shansi resemble those of Pennsylvania and the gold-bearing rocks of Chihli those of the Appalachian Mountains. The Sierra Nevada and the Coast Range he likens to the Tsin range of Shensi and perhaps also the rocks of Yunnan, Kweichow and Kwangsi. He states there is no one region that may be characterized as especially rich in minerals.†

The central areas of China proper appear to be composed chiefly of the upper Paleozoic rocks, Devonian and Carboniferous, and in the latter as well as in the younger Jurassic coal measures, we find the great coal beds which are certain to make China a tremendous factor in the economic history of the world. There has been so much idle talk in the newspapers on great fundamental conditions of this kind that one almost hesitates to refer to the subject, but nevertheless it is a fact which must be driven home and ever kept in mind, for it is as certain as anything can be that in the future the cheap fuel, cheap and efficient labor, and temperate climate, with the centers of trade and manufacture having free access to seaports throughout the entire year, present a combination of conditions of a most potential character. Add to this an abundance of fairly good iron ores, though rather lean as compared with American standards, the whole presents a field of possibility in this age of steel and cement the importance of which cannot possibly be overestimated. In Szechwan province there is also promise of oil and natural gas, but as yet I have not heard of any great gushers or naturally flowing wells having been tapped, although there is no reason to suppose they will not be in the future. The same geologic conditions which have made Pennsylvania the greatest of our industrial states are to be found abundantly throughout central China. It is needless to mention that coal, iron and oil are the very backbone of our great modern mining and manufacturing industries.

But China is not without many other mineral deposits. It is not my purpose now to go into details, but it may be accepted as a fact that practically everything of a mineral character has been found in some part of that great Empire. Probably, as elsewhere, many, if not most, of these deposits will not be of economic importance—at any rate not for years to come. In timber China is woefully poor. Her forests have been ruthlessly destroyed and not replaced. This, however, is a defect which time and care will rectify, for trees may be planted and forests grow to maturity in a period of time not much beyond the span of the average human life. But time in our human conception can never replace the coal burned and the metals consumed. Hence in a sense, China is younger than the United States, for its mineral resources are practically untouched, whereas we are rapidly depleting both forests and mines. We are, as a nation, something like 4850 years younger than China. These statements may seem fanciful; I admit they are decidedly general, but I fail to see how they may be well disputed. At any rate they afford substantial food for reflection, and it is worth while carrying them in mind.

The Unbalanced Population

There is also another side of this picture. China is over-populated, or at least its population is badly distributed, for until recently it had no railroads by which proper distribution could be accomplished. Moreover, many parts of the northern provinces near Mongolia are arid and can never be expected to support a large population. Irrigation and stream-flow regulation will no doubt do much to overcome this drawback.

Then again, the great plains of China to the south and north of the Shantung promontory are subject to disastrous floods from the Yellow River. This great stream carries out into the China Sea vast quantities of yellow silt from the *loess* or yellow-dust deposits of the northern provinces; and while its waters often bring destruction in one hand their burden of silt carries fertilization in the other, for this *loess* soil contains considerable calcareous and nitrogenous material which enriches the fields upon which it is deposited. It is manifest, therefore, that where this turbulent stream is confined within its banks by artificial means the river bed will rise by reason of the deposition of the silt upon it and the surrounding land will not be fertilized as when it is overflowed and the silt

*It is not generally known that in 1865 Richthofen made an examination of the Comstock lode for the Sutro Tunnel Co. The report was published for private circulation, hence copies are now scarce. Becker draws largely from it and speaks of the work in the highest terms. See "Geology of the Comstock Lode"—G. F. Becker, U. S. Geological Survey, 1882.

†Economic Geology, Vol. III, pp. 5 and 6.

deposited thereon. Evidently the control of the Yellow River will be one of the greatest and most difficult engineering problems in all China. Whether the Chinese themselves are able to cope with anything of the kind either financially or as a matter of engineering is doubtful. Besides the improvements of the Yellow River, there are a number of similar problems of lesser magnitude on smaller streams that will have to be taken in hand. Even now one large American engineering company is engaged in diking the Huai River in Kiangsu Province, and in draining Hangsu Lake, which is in fact part of the low-lying district or delta through which the Yellow River flowed before it changed its mouth in 1852 to where it now empties into the Gulf of Chihli, north of the Shantung Peninsula.

Engineering Opportunities in China

It must not be supposed for one moment that the outside world has been ignorant or indifferent to the great engineering opportunities in China. Since the days of Wharton Barker and Count Miskevitch, who, it is jokingly said, received a concession from Li Hung Chang which virtually gave them all the mineral resources of China, concession hunters have been haunting Peking and securing grants of one kind or another on absolutely scandalous terms by which the natural wealth of the country was practically given away. A few years after the Boxer troubles of 1900 a reaction set in and efforts were made by the Chinese government to get back some of these huge improvident concessions, and in one way or another these efforts appear to have met with considerable success. But there are some concessions, like that to the Peking syndicate, which continue to hold good and are of tremendous value. This particular concession as originally granted to this syndicate included pretty much all the coal in Shansi, which might be compared as approximately equal in value to all the coal, both anthracite and bituminous, in Pennsylvania. This syndicate also received considerable coal areas in Hunan Province and railroad grants of great value.

Realizing the serious mistakes that were made, the Chinese have been using every possible effort to recover what they have so thoughtlessly given away. As a result this reaction, and the very proper but perhaps over-zealous cry of "China for the Chinese," has brought about the enactment of mining laws for the country that are on the whole unwise, restrictive and destined to hamper rather than encourage development. It is evident these enactments have been inspired more by fear than by reason, and as a sensible people we may confidently look to the Chinese for such modifications as will meet any reasonable conditions which foreign capital must demand and receive before undertaking large mining investments in China.

China's future economic importance lies in the development of her coal, iron, cement and oil industries, and with her inexhaustible supply of cheap and good (as compared with India) labor, she is certain some day to be a most tremendous factor in the economic world. This statement in substance has been so often made it is almost trite, but nevertheless it is a prognostication that may not be successfully disputed.

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Elementary Oxygen Imparts a Red Color to an alkaline solution of catechol and ferrous sulphate (C.Journ. Soc. Chem. Ind., Mar. 31, 1915). The reaction may be applied to the quantitative determination of oxygen in gaseous mixtures.

Alaskan Timber Reserve

The President has signed an order establishing a timber reserve, approximately 200 miles in length and from 5 to 10 miles in width, in Alaska to be known as "Alaskan Timber Reserve No. 1."

The reserved timber is upon public lands north of the Chugach National Forest, extending five miles in width along the northern shores of Knik Arm and Cook Inlet between the mouth of the Knik River on the east and the mouth of the Susitna River on the west, thence north five miles on each side of the Susitna River from its mouth on the south to the mouth of the Yentna River on the north. The reserve also embraces the timber on areas five miles in width on each side of the right-of-way of the main line of the proposed railroad through the Susitna Valley to Broad Pass, and similar areas on each side of the right-of-way of the proposed branch line extending into the Matanuska coal fields.

The purpose of the reservation is to prevent the timber needed for the construction of the Government railroad and its branches in Alaska from falling into the possession of individuals or corporations, in which event it would be necessary for the Government to purchase timber which it once owned. It is not the intention of the Government, however, to make any unnecessary restrictions which will tend to retard the development of the Territory of Alaska along the line of the railroad or its branches, and in the withdrawal order the interests of the public have been conserved in every way possible. Only the timber on the land, not the land itself, has been reserved. The land is still subject to location, settlement or entry under the public land laws, and it is provided within the withdrawal order that the Secretary of the Interior may permit settlers in the locality to obtain such timber as they require.

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Russia's Prohibited Exports

By a decree of May 17, all previous prohibitions of and restrictions on the exportation of goods from Russia have been codified. The prohibitions cover the exportations by all frontiers of copper and brass in the form of metal, scrap or manufactures; the exportation by the land frontiers of European Russia and by ports of the Baltic, White and Black Seas, and the Sea of Azov, of coal and coke, pitch, iron ore, manganese ore, naphtha and naphtha waste, benzine, petrol, ligroine, kerosene and other illuminating naphtha oils, spirit, rubber in all forms including manufactures thereof, wire, caps, fuses, saltpeter, nitric and sulphuric acids, and automobiles. The exportation of steel and lead is prohibited by all land and sea frontiers of European Russia.

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Magadi Soda Co.

At the recent meeting of the Magadi Soda Co., Ltd., in London, it was announced that the work at Magadi had practically come to a standstill owing to the war. The railway line and water-works were commandeered by the Government and the employees of the company volunteered and formed a defense force for the colony under the command of the local manager, Major Symonds. The railway line, which extends through from the coast to the lakes, is still under governmental control.

Editorials

American Zinc Smelting Capacity

In the JOURNAL of March 6, 1915, we estimated that the United States had capacity—first-class and second-class—for the production of about 517,000 tons of spelter per annum at the maximum, but pointed out that that figure ought practically to be discounted for several reasons which need not be repeated. A further necessity for discounting that total is the practice, that has developed among several smelters, of redistilling ordinary spelter for the sake of making a high-class intermediate. This not only involves a double use of capacity, but also entails a considerable loss of spelter in the process, reducing the final output of metal by just so much. On the other hand our estimate did not include the dross- and junk-smelting capacity, which without doubt is in excess of 25,000 tons of spelter per annum, reckoning only the commercial concerns, i.e., excluding all which resmelt their own by-products. Some of these concerns have lately been engaged in producing superior grades of spelter. Making all allowances therefore, it is probable that the listed zinc-smelting capacity at the beginning of 1915 was at least equal to the production of 500,000 tons of spelter per annum.

That list enumerated the smelteries of the United States as "active," "operated irregularly," "inactive" and "new." Since that time every plant on the list has been put into operation, while old plants stricken from the list many years ago, some of them idle since about 1901, have been restored to use. Such are one of the old works at Pittsburgh, Kan., and the old plant at Bruce, Kan., while it is now said that the old plant at Nevada, Mo., is to be repaired and put into commission. All of these are small plants and do not add largely to the smelting capacity of the United States. More important are the extensions of going works that are being made. Thus five furnaces are being added at Caney, a large number at Sand Springs, while at Langeloth new furnaces have been put into commission as rapidly as possible. Additions are being made or are contemplated at other works.

We are now coming to the time when new plants are being projected, the construction having been actually begun in one case. George E. Nicholson is building a four-block plant near Tulsa, and a Joplin company is said to be contemplating a new plant at Pittsburgh, Kan.

It is now reported that the new zinc smeltery of the U. S. Steel Corporation at Donora, Penn., will have a capacity for the production of about 40,000 tons of spelter per annum. This implies an ore-smelting capacity of about 100,000 tons, which will make it by far the largest zinc smeltery in the United States. The works are to be erected on a site adjoining one of the large galvanizing plants of the Steel Corporation. The purpose of the Steel Corporation in erecting this plant is to take one more step in its policy of providing its own raw materials.

Apart from the plans of the Steel Corporation, which for reasons of its own are well-founded, it is evident that the willingness of adventurers to take chances in the erection of new works indicates a belief that high prices for spelter and large smelting margins will prevail for a long time. However, we surmise that all records for speed in zinc-smelting construction will be broken in the works that George E. Nicholson is now building in Oklahoma.

It is evident that we are already witnessing the provision of a very considerable increase of smelting capacity with the probability that more will follow. This will of course gradually ameliorate the tenseness in the zinc situation even if nothing else does so.

Zinc Ore and Spelter

The abnormal conditions existing in the zinc industry of late, and at present, have produced extraordinary variations with respect to the value of zinc ore, and a good deal of the controversy respecting the latter is due, no doubt, to misunderstanding of the terms of buying and selling raw material.

Zinc ores are sold in three principal ways—on sliding-scale contracts, on flat contracts, and by bids and offers in the open market.

Sliding-scale contracts are based upon the price for spelter. We have lately witnessed circumstances wherein ore coming in under sliding-scale contracts was paid for on the basis of 25c. for spelter, while the smelters were delivering spelter at 8 to 10c. per lb., which had been sold several months previous. The time will come of course when the opposite condition will prevail—that is, smelters may be taking in ore on the basis of 8 to 10c. for spelter and receiving upward of 20c. upon deliveries that were contracted for during May.

The selling of ore upon a flat price is a very simple matter. For example, a mine operator may in December agree to sell his output for the next six months at so much per ton, and be done with it. In this case fluctuations in the metal markets are of no concern to him, except that he is likely to feel good if it turns out that spelter averages less than what he figured—and inevitably he will feel sore if it turns out the other way.

The third way of selling zinc ore, the way that prevails especially in the Joplin market, is precisely analogous to the selling of any commodity, day by day or week by week, by offering it in a public market. Buyers bid what they think it worth to them, and sellers refuse to accept their bids if they think them too low.

Last spring the price for ore in the open market was excessively low. There were two chief reasons. The supply of ore offered under contracts was bountiful, and smelters, unable to sell spelter ahead with the freedom they desired, were reluctant to take chances on buying too much ore. Later the ability of the smelters to sell their spelter ahead changed radically, which made it

safe for them to buy ore against their contracts, and then the price for ore in the open market rose.

In considering the relations between zinc ore and spelter there are several things that it is needful to bear in mind. Some of these are the following:

A smelter must carry in stock a supply sufficient to run his works from one to three months. Consequently it is to be reckoned that such a time has to elapse before the zinc of incoming ore is rendered marketable as spelter.

The bulk of the blende of the Joplin district and Wisconsin is taken by the smelters who make sulphuric acid, especially the smelters of Illinois, who prefer those kinds and whose competition years ago practically drove the other smelters out of the Joplin market.

Nearly all the ore from the regions west of the Rocky Mountains is marketed according to sliding-scale contracts, and the old system, which still prevails in the Joplin market, is of far less importance than it used to be, the total ore tonnage of Missouri, Kansas and Oklahoma in 1914 being only about one-third of the total receipts of the smelters; but on account of its superior grade this ore probably accounted for nearly three-eighths of the production of spelter in that year.

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The Rise and Fall of Lead

The consensus of opinion is that the recent rise in lead, or the spectacular part of it at least, was engineered in Wall Street. The evidence on this point is considerable. The early stages of the rise from the level of 4.20c. were economically well founded. A shrewd, powerful and well-informed group of speculators then perceived and seized the opportunity to conduct a movement. The buying on the way up was not confined to them, however. Consumers and ammunition manufacturers were overcome by a panicky feeling, having the previous events in spelter fresh in mind, and entered into some very large contracts for deliveries far ahead at high prices. This business was done chiefly around 6c. Of course the bulk of the lead consumers were unaffected, their supplies being provided for by long-time contracts with settlements on quotations. Although they might have to pay more for their June lead, they were not in any doubt about getting it. A very large proportion of the lead business is done in this way. The quantity of free lead being correspondingly small, the recent speculative operations were the more easily conducted.

During the excitement the leading interest—the American Smelting & Refining Co.—preserved its poise admirably, maintaining its price of 7c. even while outside lead was realizing 8c. On the other hand it inflamed the situation by refusing to deviate from its policy of selling only for shipment within 30 days and moreover declining to do business with all comers, giving the preference to its regular customers. These procedures were unexceptionable; but they naturally excited crazy buyers, who tried and failed to obtain lead in the principal quarter, and forced them to sellers who had been standing aloof, waiting for just such an event.

The collapse came when speculators undertook to realize and found that they had been played with. Just as they had bid up the market against themselves, they depressed it. The A. S. & R. Co. completely lost control of the market on the way up and equally so on the way down. In the end the only course for it and other producers was to withdraw and wait for liquidation to exhaust itself, for no matter how low their price might be put the traders would go ½c. lower so long as they had any lead remaining to be sold.

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Wet Concentration, Flotation and Leaching Recoveries

The average copper recovery of the five large wet concentrating mills of the porphyry coppers now in operation in this country is 68.03%. The average recovery by use of the flotation process is generally higher than this. At the 50-ton experimental unit of the Cuba Copper Co. an extraction of 85% was made. At the National mill at Mullan, Ida., with a capacity of 500 tons per day, a total extraction of 85% was made, 30% being obtained by the tables and 55% by flotation units. The Butte & Superior mill using flotation is making 88.03% recovery. The Braden, which is now treating between 3000 and 4500 tons per day, makes a recovery of 75% by the flotation process, and it is officially stated that this figure may be considered a very conservative statement of results accomplished. At the Inspiration, in Arizona, the experimental mill which treated 76,000 tons of ore gave an average recovery of 86.7%, and at times as high as 90.3%. It was on the basis of results accomplished in this experimental mill that the Inspiration is now building its 15,000-ton per day flotation plant, one-half of which is nearly ready for operation; the other half it is expected will be in operation by the end of this year.

Based on a large amount of experimental work, a leaching plant said to be of 4000 tons capacity is being designed for the New Cornelia in Arizona. The elaborate tests conducted by Mr. Croasdale demonstrated that a recovery of between 80% and 85% was obtainable, depending upon the fineness of crushing and the length of time of leaching.

These figures are not given as a comparison to indicate that a superior process has at last arrived to totally displace "the honorable" wet concentration, but only to answer a question about relative results which frequently arises. The fields for application of these processes overlap to a certain extent but the processes are not interchangeable and none is universally applicable.

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Why Chemical Dealers Don't Answer Inquiries

We are constantly receiving complaints that letters of inquiry to various manufacturers of alloys and chemicals do not bring any replies. This is perhaps explained by the statement of a prominent official of one of these companies that at the outbreak of the war they were simply swamped with inquiries regarding rare chemicals and rare alloys. After spending a great deal of time replying to these letters, they looked up a few of the inquiries and became convinced that they were simply dictated by German agents who wished to find out what this company was going to do in the matter of supplying various materials which usually came in from Germany. Since that time, he said, they had answered only letters from persons who were known to them or who gave them unimpeachable references.

BY THE WAY

A U. S. Geological Survey Bulletin gives a list of well-known rivers and the amount of organic matter contained. The Nile has 10.36% ; the Hudson 11.12% ; the Delaware 16% ; the Uruguay 59.9% organic matter—we have eaten many vegetable soups that didn't come up to the latter.

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A shoveler in one of the Joplin zinc mines who had seen in the movies how the gold miners bought what they needed with gold nuggets, last week laid a small chunk of zinc ore on a bar counter and called for a beer. The bartender served the drink to him and laid down 20c. in change and, of course, the crowd laughed and cheered. Such, says the *Wall Street Journal*, is the spirit of the Joplin zinc boom, with crude zinc ore now worth 7c. a pound which is about 50% higher than the refined product spelter has averaged for many years.

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Louis H. R. von Ruecau, a mining engineer, who operates the Cuale mine in the State of Jalisco, Mexico, when not dodging or stopping bullets or visiting in the United States, tells of an amusing experience which threatened to put a permanent end to his activities. While visiting a Mexican friend in the city of Tlaxcala a local home-made 7-mm. revolution broke out. Louis heard that something had started; but although he has occasionally been a target for frivolous Mexicans, he did not attach very much importance to the rumor and enjoyed his customary strolls about the town. One evening while pausing to light a cigar he felt a cold circle of steel pressed against the back of his neck. Casually glancing over his shoulder, he gently inquired what might be the trouble. The sandaled patriot behind the gun gruffly hiccoughed: "I am going to kill you, because you are a —— —— foreigner." "That is foolish and unnecessary," replied the prospective victim. "But that is a beautiful rifle you have. Is it not a new one?" "Ah, si, Señor. I just received it today. Here, take it and examine it and tell me if you do not think it is a very fine rifle." Von Ruecau took the rifle, looked it over carefully and handed it back, offering a fine cigar with the other hand. The peon accepted his rifle and the gift; then he took off his hat and bowed politely, saying: "Many thanks, sir; I wish you good-night."

⁂

Because the question of a general amalgamation of Rand gold mines has been so frequently discussed in recent months, this subject was touched upon by Chairman Lionel Phillips at the recent annual meeting in London of the Central Mining & Investment Corporation, which has extensive interests in this field. He said: "A good deal of discussion has taken place in recent times upon the subject of a general amalgamation of the gold mines. Looked at purely as an economic proposition, I have no hesitation in saying that considerable economies could be effected if the control of the mines were vested in a single body of capable men, and the interests of all shareholders were rendered identical instead of continuing the present system of various and, in some cases, competing interests. I must not go fully into so complex a subject today, but I venture to say that, under existing conditions, general amalgamation is neither desirable nor practicable. In the first place, we know by our more limited experience of uniting mines that it takes a considerable time and expenditure of capital before full benefits can be manifested. In the second place we know that, although an amalgamation of mines might contribute to the ultimate welfare of the South African Government and people, it would involve considerable hardship to the Witwatersrand community in the first instance, and the political effect of such a step cannot be disregarded. I am therefore of opinion that we should at present, anyhow, dismiss from our minds so ambitious a scheme as that of general amalgamation."

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Ross-Burrage Hearing to be Sept. 13

The suit of Louis Ross against Albert C. Burrage, vice-president of the Chile Copper Co., to recover 10% of the profits secured by Burrage in the flotation of that company, has by consent of both sides been put down for final hearing on Sept. 13, according to the *Boston News Bureau*. Ross claims to have been the original discoverer and to have secured options for Burrage, working on salary and commission under written agreement. These options were transferred by Burrage to the Chile Exploration Co., all of the stock of which rests in the treasury of the Chile Copper Co.

⁂

Changes in British Prohibited Exports

An Order in Council has been issued making a number of amendments in and additions to the British list of prohibited exports. The following are the alterations in the section covering the iron, steel and allied industries, says the *Iron and Coal Trade Review:*

That the heading, "Zinc and iron ore (including zinc ashes, spelter, spelter dross, and zinc sheets)," in the list of goods the exportation of which is prohibited to all destinations abroad other than British possessions and protectorates, should be deleted, and there be substituted therefor the heading, "Zinc (including zinc ashes, spelter, spelter dross, and zinc sheets)," in the list of goods the exportation of which is prohibited to all destinations, and the heading, "Zinc ore," in the list of goods the exportation of which is prohibited to all destinations abroad other than British possessions and protectorates.

That the following articles should be added to the list of goods the exportation of which is prohibited to all destinations abroad other than British possessions and protectorates:

Chemicals, drugs, medicinal and pharmaceutical preparations: Hydrochloric acid; oxides and salts of nickel; oxides and salts of tungsten.

Metals and ores, the following, namely: Wolframite; minerals and vegetable wax; tungsten filaments for electric lamps.

That the following articles should be added to the list of goods the exportation of which is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Spain and Portugal:

Chemicals, drugs, etc.: arsenic and its compounds.

PERSONALS

H. A. Morrison is investigating a placer proposition near Weaverville, California.

H. J. Wolf, of Denver, examined mining property in Gilpin County, Colorado, recently.

Benj. H. Case has returned to Asheville, N. C., after several months' professional work at Mineral, Virginia.

Alexander Stanley Elmore, who has been visiting in this country for several months, returned to London on June 26.

George H. Garrey was in New York for a few days last week and has now gone to San Bernadino County, California.

R. D. Fetherstonhaugh, of Vancouver, B. C., and party have gone to investigate mining prospects on the Peace River and at Fond du Lac.

J. Norman Bulkley, of New York, has been appointed consulting mechanical and electrical engineer to the Canadian Mining & Finance Co., Ltd., of Montreal.

Arthur J. Hoskin, of Denver, has been for the past two weeks in the Tincup district, Colo., for the Tincup Gold Dredging Co., drilling and examining placer ground.

Thomas H. Kenvin recently with the Indiana Steel Co. at Gary, Ind., left last week for India to take a position as superintendent of the steel department of the Tata Iron & Steel Co. at Sakchi, Bengal.

Silvio DeVescovi lately engineer with the Societe Francaise des Mines de Cuivre Collahuasi-La Grande, in Collahuasi, Antofagasta, Chile, is now enrolled in the Italian army and has gone to the front.

L. D. Cooper of the engineering staff of the E. J. Longyear Co., Minneapolis, Minn., sailed last week with a crew of 60 miners for Norway, to sink a shaft for the Orkla Mining Co. at Lökken, near Trondhjem.

Robert L. Sackett, late of Purdue University, has been appointed Dean of the Engineering School of Pennsylvania State College. He succeeds John Price Jackson, who is now labor commissioner of Pennsylvania.

W. C. Tharp, recently with the Metallurgical Testing Laboratory of Pittsburgh, has been appointed manager in Pittsburgh for the Hoskins Manufacturing Co., of Detroit, makers of electric furnaces and pyrometers.

David A. Thomas, for many years a well known coal mine owner and operator in Wales, has been appointed purchasing agent for Great Britain in the United States and Canada and will have offices in Ottawa and New York.

The well known firm of D. R. Hanna & Co., Cleveland, Ohio, prominent shippers and miners of iron ore and coal has been reorganized. D. R. Hanna has retired, L. C. Hanna and H. M. Hanna, Sr., have associated themselves with the remaining partners, R. L. Ireland, M. Andrews and H. M. Hanna, Jr. L. C. Hanna was formerly head of the firm, retired some years ago and now returns.

Dr. Arthur A. Noyes, of the Massachusetts Institute of Technology, is to become a member of the faculty of the Throop College of Technology, Pasadena, Calif., for a portion of the coming academic year, and for one-half of the time in succeeding years, beginning with 1916-17, this arrangement having been made possible by a gift of $10,000 for the equipment of a physical chemistry laboratory, and the endowment of this laboratory in a sum yielding $10,000 annually for its support.

OBITUARY

Frank S. Castello, President of the Mary McKinney Mining Co., Colorado Springs, died June 18 at Los Angeles, Calif., where he had gone for his health. He was interested in several other companies in the Cripple Creek district.

Among those reported killed in the Mexican troubles are Stephen A. Parmenter, an engineer who is reported to have been killed at El Favor mine in Jalisco, June 22, and Robert Camp, formerly of Denver, who was reported by telegraph killed at Monterey.

A dispatch from Washington, June 19, says: "Gilbert Trambl, of Oklahoma City, superintendent of an iron mine, was killed while interfering in a private quarrel near Charcas, Mexico, on Wednesday. A dispatch to the State Department from Consul Bonney, at San Luis Potosi, today announced three arrests had been made.

John A. Finch, for many years a prominent mining man in the northwest and one of the pioneers of the Cœur d' Alene, died suddenly at Hayden Lake, Idaho, June 20. He was 61 years old and had been engaged in mining in Idaho, Montana and Washington for the greater part of his active life.

Henry C. Bolsinger died in Denver, June 21, after a long illness. He was 59 years old and for over 40 years had been engaged in mining in Colorado, having been at Leadville and Cripple Creek as well as at Central City, which was his home and headquarters for a number of years. He represented Gilpin County in the Colorado legislature for several years. He was also in Mexico for a time. He had a remarkable memory and a wide knowledge of mining property and was credited by his friends with knowing the history of practically every mine in Colorado for the past 40 years.

Scott Eldridge, mining engineer of Kerr Lake mine, Cobalt, Ont., and W. B. Foote, a capitalist of Geneva, N. Y., were instantly killed on June 25th by a blast at the mine. Mr. Foote who was about 45 years of age, had been in Cobalt for two or three days looking after his investments. He was being shown the Kerr Lake mine by the engineer, and they were in the stope at the 140-ft. level when the blast went off at the regular time at the 250-ft. level, and coming up the stopes killed both of them. Mr. Eldridge was about 25 years of age and leaves relatives in Philadelphia.

Thomas D. West died in Cleveland, Ohio, June 18 from injuries received by being struck by an automobile. He was 64 years old. He was born in England, but came to this country when a boy and when 12 years old, began work at the foundry of the Portland Locomotive Co., Portland, Maine. After mastering the foundry business, he organized a company at Sharpsville, Penn., which is now known as the Valley Mold and Ingot Co., makers of ingot molds. In 1907, he organized the West Steel Casting Co., at Cleveland, Ohio, of which he had since been head. Mr. West devoted much time and labor to the elevation of the foundry business and to the writing of text books on foundry practice and the metallurgy of cast iron. He was much interested in the American Foundrymens' Association, of which he was always an active member and of which he was president for several years. He established the use of standardized drillings for the checking of pig iron analyses as well as many other improvements. In the recent years, he was very much interested in the movement for the prevention of accidents and for greater safety in industrial employments. He was a member of the American Society of Mechanical Engineers, the American Society for Testing Materials and several other mechanical and scientific societies. He leaves a widow, a daughter and two sons.

Charles L. Gilpin, who for many years was one of the most widely known men in the sheet trade, died at a hospital near Philadelphia, June 7, aged 88 years. He was born at Wilmington, Del., and after receiving his education in that city moved to St. Louis in 1845, where he engaged in the iron and steel business. During the Civil War he was connected with the quartermaster's department of the army. After the war he was for many years associated with Alan Wood & Co., now the Alan Wood Iron & Steel Co., Philadelphia, and subsequently with W. D. Wood & Co., Ltd., Pittsburgh, and the successor, the W. Dewees Wood Co. He was a relative of W. Dewees Wood, who sent Mr. Gilpin to Russia to investigate the manufacture of Russia sheet iron, and to ascertain how to reproduce in this country the beautifully planished surface of the sheets which were then celebrated throughout the world for their rust-resisting quality. He was successful in his investigation, his genial personality contributing largely to this result, and the process thus brought to this country established the reputation of the firm whose plant was finally merged with other properties into the American Sheet Steel Co., afterward becoming part of the United States Steel Corporation. He was exceptionally well informed on the steel business, especially the sheet branch, and was an authority on tariff legislation. He leaves his widow, one son and two daughters.

INDUSTRIAL NEWS

K. E. Kersten has been appointed branch manager of the Boston Belting Co., 172 West Randolph St., Chicago, Ill.

The Terry Steam Turbine Co. announces the appointment of Joseph Battles as District Sales Manager for Denver, covering the states of New Mexico, Colorado, Wyoming and the western part of Nebraska. His address is 326 First National Bank Bldg., Denver, Colo.

Editorial Correspondence

SAN FRANCISCO—June 23

Corporation Tax in California for 1915 amounts to $15,036,798, as against $13,609,633 in 1914. The largest corporation tax payers are the railroads, which will pay an aggregate of $6,588,284; oil wells will pay $410,034; power companies $122,761, and mines $69,870.

Gold-Dredge Construction for the last year or so has not been so active as in recent former years and there has been a good deal of talk about the gold-dredging fields being exhausted. There have been a number of things combining to retard advancement of gold dredging for the last two years. The present aspect of the industry is much brighter and contracts are being let for dredge construction to be completed within the next two years that will total approximately $750,000. As to the exhaustion of dredging fields there is no solid basis for such reports. It has been the policy of all large mining investors who have their money placed profitably to play a waiting game with the owners of mining ground, whether placer or quartz. In various instances large areas have been examined by dredging companies and turned down for different reasons, that prospecting did not prove high values, or the price was too high, or the terms not satisfactory. So long as dredges can be operated in rich gravel deposits there is not much hope of low-grade properties being successfully exploited. But the rich placer grounds are being exhausted and dredge operators must content themselves with lower yield per cubic yard. The demand for gold is sufficient incentive to attract investors to ground that will pay a fair margin on the investment in dredge construction. The recent contracts for new dredges and contemplated construction include the Yuba Consolidated Gold Fields at Hammonton and the Marysville Gold Dredging Co. at Marigold, the Natomas Consolidated at Natoma, in California, and the Powder River Gold Dredging Co. near Baker City, Oregon. Yuba Consolidated contemplates the construction of an all-steel dredge to be known as Yuba No. 15. It will be of the same design as Yuba No. 14, which was put in commission in December, 1914. No. 14 is at present the largest all-steel gold dredge in the world and is equipped with 16-cu.ft. buckets. No. 15 will be a larger boat and will probably be an improvement in some respects upon the other dredge. This dredge will be built by the Yuba Construction Co. at Marysville. The Marigold dredge will be built by the Union Iron Works and will be similar to Yuba No. 14 and equipped with 16-cu.ft. buckets. Guggenheim interests on Yuba River, north of the Yuba Consolidated, also contemplate construction of one or more dredges; though their plans have not yet been made public. This land has formerly been turned down by other investors, but it is safe to say that there is a possible profit in sight or the Guggenheims would never have taken over the land. Natoma No. 4 dredge which operates in the Natomas field on American River will be rebuilt after a new design which will provide for the placing of the tailing so that the gravel will be evenly distributed for the soil on top. In other words the dredged land will be reclaimed for agricultural purposes. There is a large area of agricultural ground within the dredging field at Natoma and there has been in the past a great hue and cry about the destruction of valuable agricultural land by the gold dredges. While it might have been possible in the beginning to reclaim all these lands as the dredging was being done, the financial results might not have enabled the Natomas, or any other operators, to operate at a profit sufficient to guarantee large investment. The Powder River Gold Dredging Co. in Oregon has now in course of construction a 7½-cu.ft. bucket-elevator dredge of the California type, designed and built by the Yuba Construction Co. This dredge will dig 30 ft. below the water line, which is sufficient depth for its ground. This will not be an all-steel dredge, but will have a wooden hull which will be entirely fireproof. The experience of the Yuba Construction Co. in dredge construction will guarantee notable advancement in the construction of wooden hulls. It is reported that another dredge is contemplated in the Baker City region by the owners of the I. L. Borden bridge (formerly the Isabella) at Jenny Lind, Calif. Placer ground is being examined in Shasta and Trinity Counties with fair prospects of dredges being installed and it is not unlikely that before the end of the present year the installation of new dredges will be undertaken, not only in these counties but in other parts of California. It is not likely that there will be demand for more of the large all-steel dredges, but there is opportunity for installation of the smaller size dredges, and there is no good reason why such new construction should not be entirely of steel and patterned after the smaller boats recently completed for the Yuba Consolidated by the Yuba Construction Co. Gold dredging in California is by no means on its last legs.

BUTTE—June 24

Butte Now Has Three Miners' Unions, but they are not very formidable and are not likely to become so. When the old Butte Miners Union surrendered its Western Federation charter and seal it revived itself as the Butte Miners' Union, a corporation, and solicited members among the miners who are opposed to Moyer and his federation crowd. The union has been going it alone nearly two weeks and has succeeded in getting a membership of about 40. Moyer's federation agents have been working to get members back into the fold for six weeks or more and are now operating under the name and charter which the old union surrendered, but in six weeks they have obtained only about 200 members, and that seems to be about the limit of the federation sympathizers. Then there is the original rebel organization of I. W. W.'s, the Butte Mine Workers' union, which still maintains an organization through a few officers, but has no members. There are more than 12,000 miners working in the Butte district again, and the results of the efforts to organize unions indicate that the men who work with their hands are satisfied to stay on the outside and that they have no particular sympathy with the men who work with their jaws only. The miners are getting their $4 a day, and they have neither union nor contract to enforce the payment, but they find that the employing companies are a pretty decent lot of corporations and will do right if permitted to do it.

DENVER—June 25

Golden Cycle Mining & Reduction Co. will hereafter declare dividends of 2c. per share on the 10th of each month with strong probability of occasional special dividends to "take up the slack."

Midland Oil and Gas Company has been incorporated for $100,000, by Denver men to explore, by drilling, 160-acre tract a few miles northeast of the city. Another company, the Mid-Colorado, has drilled down 1800 ft. on another property in same locality and is still drilling. For years, geologists have believed that oil and gas exist in these measures although probably at considerable depth.

Purchase of Stratton's Independence Mine, Victor, by the Portland Gold Mining Co. has increased the latter's area by 250 acres. As viewed by a man on the outside, one strong feature in this consolidation is the opportunity afforded to now handle, by gravity, the tremendous dumps about the lower Portland shaft into the Independence mill for cyanidation. While the Portland has a magnificent mill, it is on top of Battle mountain convenient to the dumps at the upper shaft. Material from the lower dumps can be delivered to this mill only at considerable expense for transportation. The Portland mine proper is in splendid condition for ore production. Officials are reticent about plans.

SEATTLE—June 22

The Most Important Mining Deal completed in Fairbanks in the last several months was consumated by the payment of $20,000 for the Midway Association group of claims owned by E. A. Suter, P. C. Charles and L. B. Clough, by Jack Leach to be operated on a lease. Mr. Leach will start work July 1. The property has never been considered very highly and has been held by the present owners for more than 10 years, with little development work, but recently the Sjolseth brothers operating on the upper portion of the claim struck pay that will run approximately $2 to the foot. The gold is coarse and is pronounced by miners to be "paystreak" gold.

Operators Are Jubilant here over the bonding of the Hermann-Eaton property to the Alaska-Gastineau Mining Co., of Juneau, and feel that it marks the advent of other big operators into the district. The property was located three years ago about 1½ miles from tidewater at the head of Beetles Bay, Port Wells. It consists of four claims, lying

at an elevation of 700 ft. The vein is exposed for 300 ft. and is a high-grade contact vein carrying free gold, lead and iron sulphides, and silver. There is an incline shaft 112 ft. in the ore. The new owners will sink to the 200-ft. level at once. By running a tunnel 650 ft. long and building a dam 10 ft. high and 30 ft. long, sufficient power to operate a 150-hp. Pelton wheel will be developed.

Ruby is Better Than Expectations according to the latest cleanups from that creek which show that early work has netted considerably more so far this year than before, and it is expected that this creek will more than double its 1914 output. Selch, Deitz & Walker during the winter expected the cleanup of their dump would net about $80,000 and with only half the dump sluiced the returns are better than $90,000. Alex Larson has found dirt on Long Creek that runs $7 to the foot. This ground is now being worked extensively. Ruby Creek did not suffer, as most of the creeks this spring, on account of the thaws and was remarkably free from overabundance of water which retarded work on so many creeks. This trouble is now over and all the creeks of the district are working overtime to make up for what was lost. This is true of the Hot Springs district which showed so well last year. At Tofty, Cleveland & Howell have the largest plant that is now in operation and the output for the year will be greater than last. Bock has commenced operations on Woodchopper Creek. Joe Eglar is working a large plant with several others and expects to take out a large yield this summer. Good cleanups have been made on Cleary Creek. John Parquette, in making a cleanup of No. 4 Below Cleary, found that his dump, which was taken out with a windlass in a month, contained $1957. He was prevented from doing work most of the winter on account of water. The same trouble was encountered by other operators on this ground, most of them are taking in or will take in shortly, boilers and mining outfits to cope with the situation.

FAIRBANKS, ALASKA—May 29

Fairbanks Production—The First National Bank of this city has prepared an estimate of the output of this region for the coming season. It looks for a total placer production of $3,150,000 with Cleary and Sullivan creeks as the largest producers. In addition, it estimates an output of $600,000 from hard-rock mines.

Antimony—E. L. Scafford, of Chatham creek has 200 tons of antimony ore on the dock, ready for shipment on the first boat via St. Michael. This ore will go about 60% antimony. The continued rise in the price of this metal has revived interest in the hard-rock prospects of the Kantishna country. Outcrops of antimony seem to be widely distributed in that region, which is about 100 miles west of here. Transportation to and from that district is very difficult as yet.

HIBBING, MINN.—June 26

The Largest Shipper on the Mesabi Range as usual is the Oliver Co. Ore is going forward at a rapid rate from all of the company's mines on the range, as well as on the other ranges. The independents are working most of their pit mines, but few of the independent underground mines are mining ore. The M. A. Hanna Co. is not turning a wheel on the entire Mesabi range. Many of the smaller operators maintain that they cannot make money by operating their underground mines at present.

DULUTH—June 25

Refusal to Pay Taxes by the Mining Companies owning property in the Village of Hibbing, on the Mesabi range, will place their case before the courts. The assessed value of the village is $84,000,000, and as the companies possess 86 per cent. of the property, the community will derive little money from the remainder of the taxpayers with which to pay running expenses. The companies have decided that the school districts shall not suffer from a lack of funds and have agreed to finance them if necessary. The action was taken on the part of the mine owners because of the extravagant use of money by the village authorities during recent years, mentioned in these columns Apr. 3. By refusing to pay their taxes the companies are placing themselves subject to a charge of 10% additional, which they are willing to risk to bring about a readjustment of existing conditions. At the last session of the Minnesota state legislature an effort was made to pass a bill limiting the per capita tax of towns and villages of the state to $25, but the bill failed in the house after passing in the senate by a large majority. The companies that have refused to pay are the Oliver Iron Mining Co., Mahoning Ore Co., Shenango Furnace Co., Jones & Laughlin Co., Inter-State Iron Co., Pickands, Mather & Co., Republic Iron & Steel Co., Rogers-Brown Co., Great Northern Ore Co., Sargent Land Co., and Northwestern Improvement Co.

LORDSBURG, N. M.—June 24

Sodium-Nitrate Deposits in Grant County are coming into prominence and are attracting the attention of those interested in the products of the mineral. The deposits were first discovered in 1913 and little attention was paid to them until the fall of 1914 when active prospecting began and large areas of mineral bearing ground were located. The nitrates are found on the western slope of the Peloncillo Mountains on the eastern side of the San Simon Valley near the town of Rodeo, N. M. The outcroppings can be traced for a distance of nearly 50 miles north and south with a width of from one to four miles. At Rodeo the outcroppings form the yellow cliffs fringing the eastern side of the San Simon Valley. Until recently little work, aside from the necessary location requirements had been done. On one of the best claims the deposits lie at an angle of about 45 deg. with a footwall of porphyry and a hanging wall of quartzite. At one place the body shows a thickness of over 100 ft. The nitrates are disseminated through the rock and where cavities occur in the formation, collect into nodules of nearly pure sodium nitrate. The deposits are favorably situated as regards railroad transportation, being a short distance from the El Paso & Southwestern tracks. Water is plentiful and all conditions are indicative of economical operation. The U. S. Geological Survey has not yet examined the Rodeo deposits of sodium nitrates but has expressed its interest. Thus far no potash or nitrate withdrawals have been made either in New Mexico or Arizona. The deposits are coming into prominence and are being examined by engineers from various parts of the United States.

WILLCOX, ARIZ.—June 25

The Mascot & Western R.R., which connects the mines of the Mascot Copper Co. with the Southern Pacific at Willcox, Ariz., was completed June 15 and a celebration in honor of the occasion was attended by about 4000 people, many of whom were shareholders of the Mascot Copper Co. The construction of this road was commenced the latter part of January, this year. Shareholders from the East and West came in special trains and upon arrival at Willcox were met by the mayor of the town and a delegation of business men, who with the Willcox band gave the incoming visitors a royal welcome and sent them over the last lap of their journey on the Mascot & Western to Mascot. Upon arrival there they were met by T. N. McCauley, president of the Mascot Copper Co., and the Sixth Field Artillery Band. Following speeches by Mr. McCauley, H. A. Morgan the mayor of Willcox, James G. McNary, vice-president of the First National Bank of El Paso Mayor Frank K. Mott of Oakland, Calif., Hon. John A. Street chief counsel for the company and Judge John M. Raymond, of Aurora, Ill., the crowds were directed to the railroad tracks near the depot where President McCauley drove the last spike which officially completed the railroad. A large barbecue was then served, for which about a dozen fat beeves had been prepared.

The Building of This Railroad means much to the Dos Cabezas mining district where rich mineral ground has been known to exist for years. While the railroad has been built exclusively by the Mascot Copper Co. for the transportation of its ores to the smelters, it will have as a feeder the entire Dos Cabezas district. Already considerable activity has been apparent in the district other than that of the Mascot company since the new road was started. Transportation is all that has been lacking to make this district occupy a prominent place among the mining camps of northern Cochise County, Arizona. Several years ago the Mascot company commenced the development of its claims embracing about 800 acres of highly mineralized ground in the heart of the Dos Cabezas district. The main development has been carried on through a tunnel known as the Consolidated tunnel on the western portion of the property. By means of this tunnel the ore has been developed and blocked out for a depth of about 700 ft. below the surface croppings. The tonnage is estimated to be about 1,000,000 tons of merchantable ore. The railroad, just completed, cost $300,000. Its length is 15 miles and although the last four miles traverse a mountainous country, the steepest grade is not more than 3%. At the same time the construction of the railroad was commenced an aërial tramway, 10,000 ft. in length, with a capacity of 1000 tons per day, reaching from the mines to the unloading bins at the new town of Mascot, was also begun. This was rushed to completion simultaneously with the railroad and cost about $20,000 per mile. At the close of the ceremonies June 15, the first train of ore left the camp for the smeltery at Douglas.

NEW YORK CITY—June 30

Miami Copper Co. has increased its dividend to 75c. per share, payable Aug. 15. This increase was entirely unexpected.

The Mining News

ALASKA

GRANBY (Valdez)—Outside construction to be finished in about a month, when Midas mine will start operating.

ALASKA INDUSTRIAL (Ketchikan)—Aërial tram being repaired. Expect to start shipping copper at once. Charles E. Sulzer is manager.

ALASKA FREE GOLD (Willow Creek, Knik)—W. E. Martin plans installation of compressor and drills when power project on Little Susitna River goes through. If this project planned by Seattle people is abandoned, he will install his own power plant.

McKEEVER BROS. (Juneau)—On Nelson-Lott claims, Sheep Creek Basin, 2500-ft. tunnel to orebody has been started Arthur Riendeau, who drove Jualin tunnel last summer, has contract for tunnel. Water hammer drills are being used. $250,000 work planned to develop property.

ALASKA GOLD (Juneau)—Thomas Kneebone, who suffered a broken back in Perseverance mine some time ago, brought suit against Alaska Gastineau company for $75,000 damages. Suit thrown out of court by Judge Robert Jennings on June 18. Insufficient evidence as to company's liability.

GRANITE GOLD (Valdez)—Lower adit tunnel is in 600 ft. of 800 ft. planned. Will start raising from adit tunnel to workings in about month. New cross compound compressor, 10-stamp mill, and other new equipment installed. Good showing of ore continues. W. R. Millard, Superintendent.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Prospecting by winze below 3100 level. Mill running regularly with 30 stamps dropping.

BUNKER HILL (Amador City)—The 2400 level has been retimbered and development from this point will proceed. In May mill crushed 6700 tons of ore, and produced 200 tons of concentrates, which averaged $80 a ton.

Butte County

SOUTH BANNER (Oroville)—Extensive improvements on Amosky mine are being made. New machinery to cost about $3000 is being installed.

Calaveras County

EAGLE MARBLE QUARRY (Vallecito)—Reported that production will begin at an early date. There is large deposit of marble which it is said can be quarried and shipped at profit.

COLUMBIA (Angels Camp)—Property bonded to E. J. Carter and J. S. Rear. Electric hoist and compressors are being installed. Chile mill will be added to reduction plant Other improvements are contemplated and it is expected to increase milling capacity to 500 tons per day. Property situated between the Utica and Maloneys.

Eldorado County

RISING HOPE (Placerville)—George W. Englehardt is reopening this mine and installing necessary machinery.

UNION EXTENSION (Dixon)—J. Hillhouse and Roy D. Mayes have taken contract to develop mine and furnish machinery.

UNION MINE EXTENSION (Placerville)—Petition filed with State Corporation department asking permission to sell 127,500 shares of capital stock Mine is located at Mud Springs.

FROG POND (Garden Valley)—This property and Collins & Bacchi quartz mines will be reopened and extensively developed by Philadelphia men, owners of Collins & Bacchi, who have recently acquired Frog Pond. J. C. Levitt is superintendent. Properties are developed by shafts to depth of 130 ft. which will be deepened.

Inyo County

CERRO GORDO (Keeler)—Bucket tramway extending from mine to railroad station at Keeler, 29,110 ft., is expected to be ready for service early in July. Tramway will have a capacity of 1500 tons per hour and will effect saving of $2.50 per ton on all ore shipped. Large shipments of high-grade zinc ore are going to smeltery. There is large reserve of silver-lead ore.

Kern County

WERINGER (Woody)—Joseph Weringer, manager, contemplates installation of leaching plant.

ANTIMONY is reported discovered in ledge near Caliente in Old Horse Cañon Samples assayed by Ward M. Mills of High School laboratory showed 96% antimony sulphide and trace of silver.

NEW CREEDE is name of camp recently established in Lone Pine district, 14 miles northeast of Mojave. High-grade gold and silver ore has been disclosed in development work in progress by Williams and Gragoman on No. 5 claim. George Henry of Colorado and Fred and George Ramey and W. H. Bremendorfer of Caliente are engaged in active prospecting and development. Region is being prospected and claims located over area of six miles square.

Los Angeles County

JORDAN OIL (Vernon)—Series of explosions of gasoline wrecked one of four tanks of plant. Spark from a broken electric wire caused explosion and fire which destroyed 250,000 gal. of oil and gasoline. Driver on an autotruck and firemen were severely burned but no lives were lost. The loss is estimated at $100,000.

Madera County

ENTERPRISE (Madera)—More than 200 tons of ore have been extracted and the mill will start within short time. S. R. Johnson is manager.

Nevada County

EXCELSIOR CONSOLIDATED (Truckee)—Preparations being made to reopen mine, which was closed down at time of outbreak of war.

COLUMBIA (Nevada City)—Arrangements being made for reopening mine in July. Has been closed down since accidental death of W. C. Hunter, mining engineer, and two men recently. Mr. Klinkner is manager.

SHADY CREEK PLACERS (Nevada City)—Small dredge is being installed for working old hydraulic tailing. If found successful other installations will be made to work neighboring ravines which contain hydraulic tailing.

NORTH STAR (Grass Valley)—New 100-ft. steel headframe for Central shaft being constructed. Three large steel bins and sorting plant will be constructed within headframe. New 700-hp. electric hoist will have a capacity for handling 4-ton skips from depth of 6000 ft. incline. Expected to complete the installation by August. Reported that Apex contention between North Star and Empire will be taken into the courts. Expert mining engineers have been employed by both companies for several weeks. Settlement out of court is not now expected.

Plumas County

A GOLD NUGGET weighing 2½ lb. was taken from bedrock of a gravel claim on Squirrel Creek by Byron Turney. Nugget is worth about $540. Squirrel Creek gravel mines have produced probably more large nuggets than any other district in county.

San Bernardino County

ORO BELLE (Hart)—By terms of original contract with Tonopah Belmont, 50-ton mill will be built.

Trinity County

TRINITY ASBESTOS (Castella)—Eight miles of new wagon road from mine have been completed. Total length of road from mine to Castella is 25 miles. Seventy-four men are employed on road and 50 more to be added. Sixteen men are employed at mine. First shipment of asbestos will be made upon completion of road which will be about Oct. 1.

UNION HILL (Douglas City)—Two giants are at work on gravel banks of extreme height of 160 ft. Ditch which carries water from Grass Valley to mine has been repaired. Old Headlight mine at Trinity Center, also owned by this company, may remodel its 40-stamp mill and resume mining. Mine enjoyed long period of activity until oxidized ores were exhausted, and now large reserves of base ore justify installation of fine grinding equipment and filters, so that cyanide treatment may be employed. C. W. Shanks is manager.

COLORADO

Boulder County

WHITE RAVEN (Ward)—F. W. Davis pushing contract to sink main shaft 100 ft. and to start new level. Work will throw light on peculiar structure of this orebody which is unique in this district.

UNITED STATES GOLD CORPORATION (Boulder)—Recent litigation has been disposed of in Supreme Court and company now contemplates considerable additional development. Recent work on 400 level of Nyanza vein has opened high-grade ore.

BOULDER TUNGSTEN PRODUCTION CO. (Boulder)—This company is being financed by Chicago capital and anticipates funds allowing it to drive drainage tunnel through claims three miles from Nederland which will both drain and develop. At present there is no active work being done.

WOLF TONGUE MINING (Nederland)—This company is in market for purchase of tungsten in crude form or for tungsten concentrates of from 10% to 50%, for shipment from mines to either Nederland mill or the Primos Chemical Co. plant near Washington, D. C. Development has not been sufficient to provide enough crude ore for Nederland mill which has been running an average of one week in four, hence their wish to purchase outside ore and concentrates.

NEWHOUSE TUNNEL (Idaho Springs)—Engineer's Leasing Co. has opened an 18-in. vein of pay ore at a depth of 2300 ft. below surface. Selected streaks assay up to 8 oz. gold per ton. On 1300 level of Old Town mine leasers have opened streak of high-grade ore assaying 18 oz. gold per ton. Kuykendall & Co., of Denver, leasing on Bellman vein, have opened pocket of ore below tunnel level which assays as high as 7 oz. gold and 60 oz. silver. Argo mill is running full capacity and treating about 100 tons of ore per day.

Gunnison County

YUKON (Parlin)—New air compressor, boiler and hoist being installed at Yukon shaft, old machinery being transferred to Alaska shaft. Ore carries 36% zinc.

Lake County

WESTERN ZINC OXIDE CO. (Leadville)—Smeltery obliged to close down few days during removal of zinc oxide from large flue conducting fumes from furnaces to bag-house. Twelve tons of material was recovered. Crushing facilities have been found inadequate and much of ore is now crushed at Arkansas Valley smeltery before its delivery.

San Juan County

HAMLET (Howardsville)—Mill will start soon treating mine's complex zinc-copper ore carrying gold and silver.

SILVERTON BUSINESS MEN are organizing $50,000 stock company for local subscription, funds so raised to be used in erection and operation of custom cyanide plant.

Teller County

PORTLAND (Victor)—Was given possession, June 29, of Stratton's Independence property in accordance with terms of sale ratified by stockholders May 18.

ROOSEVELT TUNNEL (Cripple Creek)—Breast is even with Elkton mine shaft. New water conrses have been struck and total flow from portal exceeds 12,000 gal. per min. Face will soon be within crater.

MICHIGAN

Iron

MARY CHARLOTTE (Negaunee)—One hundred miners were added to working force here on June 28. There is plenty of ore in stock but large sales have been made recently. Total working force is now 175 hands.

OLIVER (Iron Mountain)—Chapin and Aragon mines were placed on full time June 21. Had been working only four days a week for 16 months. Considerable ore being shipped from both mines.

NEWPORT (Ironwood)—M. A. Hanna Co. has succeeded in disposing of 1,000,000 tons of ore for Newport Mining Co. Will be shipped from Newport at Ironwood and Palms-Anvil at Bessemer. Rapid progress being made at new Newport 14x24 shaft. Last month it was sunk 205 ft.

CLEVELAND-CLIFFS (Ishpeming)—Educational department graduated its first class this week. Graduates who received diplomas are miners and foremen in employ of company who have been taking prescribed work in school for over two years. New ruling of the company states that all shift bosses and foremen will be selected from among graduates. Educational work of company is in charge of Carl S. Stevenson, formerly of Bureau of Mines.

MINNESOTA

Duluth

UNIVERSAL PORTLAND CEMENT CO. (Duluth)—At present rate of construction, it is announced that company's new plant at Duluth will be in operation by Apr. 1, 1916. Plant will have output of 4000 bbl. of cement per day. It is most modern of Universal plants although not the largest. Eight hundred tons of Michigan limestone will be required daily, also 575 tons of slag from the Minnesota Steel Co.'s blast furnaces.

Cuyuna Range

WILCOX (Woodrow)—Now hoisting 500 tons daily. Initial cargo recently received at Point Edward, Ont., showed 13.5% moisture and 59% Fe, being lower in moisture than anticipated.

CUYUNA-SULTANA (Brainerd)—Company is installing some larger equipment at its No. 2 shaft, including 80-hp. locomotive-type boiler, Messinger (Duluth) hoist and Franklin air compressor. After installation shaft will be sunk 25 ft. deeper and cross cutting begun.

Mesabi Range

MEADOW (Aurora)—Shipments from stockpile started this week.

UNION (Virginia)—This mine is heaviest shipper in Virginia district at present time; 65 cars being sent out daily. Only one shift is being worked.

VIRGINIA DISTRICT. About 500 cars of ore being shipped daily from Virginia district, of which 300 come from Alpena operation of Oliver Iron Mining Co.

NORMAN (Virginia)—Oliver company is shipping 26 cars daily from this property. Two shovels are working at Minorca stockpile. Twenty-five cars are being loaded each shift. The Bessemer is sending out a like amount

MAHONING (Hibbing)—This mine is heaviest shipper on Mesabi Range at present; shipping 210 cars daily. Buffalo-Susquehanna, also at Hibbing, comes second with 80 cars. Duluth, Mesabi & Northern road is taking care of about 54,000 tons each day

MONTANA

Beaverhead County

NATIONAL OIL CO. (Dillon)—This company recently organized to drill for oil in Muddy Creek and Sheep Creek basin and in Small Horn Cañon near Dillon where company has located large tracts of oil land. Dr. A. C. Sandberg, of Butte, who heads company, has announced operations will begin at once

BEAVERHEAD-MONTANA COPPER (Argenta)—Ray Coban of Butte has lease and bond on Jackrabbit mine at Argenta and property is to be started up at once by new company which recently organized with capital stock of $100,000. Jackrabbit adjoins property of Butte-Argenta company and recent samples show ore to average 11.9% copper and 22 oz. silver. Company will ship to Salt Lake smelters but is contemplating erection of small concentrator.

Custer County

MONTANA PETROLEUM CO.—Articles of incorporation filed June 20 with clerk of Miles City. Company formed for development of gas and oil territory of Moorehead section in southeastern Montana. Upon finding oil company proposes to build plant and distill product on spot. Drilling operations will be commenced in new field as soon as necessary machinery can be brought there.

Fergus County

BARNES KING (Kendall)—Output of North Moccasin mine for May amounted to $41,044. This was secured from 4728 tons of ore, average yield per ton about $8.70.

Lewis and Clark County

EAST HELENA SMELTERY—Following visit of eastern officers of American Smelting & Refining Co. to East Helena plant, announcement was made by Manager F. M. Smith that another furnace would be blown in at once which will increase output of plant to three-fourths maximum capacity. High price of lead and zinc stimulating mining in these ores, necessitating an expansion at smeltery.

SCRATCH GRAVEL DISTRICT—New discovery has been made in this district on ground bonded by Thomas B. Miller and associates of Helena and located near celebrated Franklin property which is being worked by Cruse estate. It is in line with and about 2000 ft. distant southwesterly from present workings on Franklin lead. Shaft has been sunk on property to depth of 100 ft. and ore is to be stoped for shipment to smeltery as soon as work of running levels has been completed.

Missoula County

IRON MOUNTAIN (Missoula)—To be sold at sheriff's sale to satisfy claim of eastern capitalists. Of late was running behind causing bondholders to foreclose on mortgage.

AMADOR (Amador)—After idleness of several years has been acquired by Sydney L. Shonts and Oscar Nordquist, of Wallace, Idaho, who are preparing to erect 100-ton concentrator. Shaft is 700 ft. deep and is full of water below 400-ft. level.

Park County

MONTANA SCOTCH BONNET CO.—Property of this company, located about 60 miles from Cook City, to be opened up by eastern syndicate. About 4000 ft. of tunnels have been run and bodies of ore assaying $34 to $38 per ton have been opened up. New company intends to begin extensive development immediately.

Silver Bow County

ANACONDA (Butte)—Company has begun unwatering old Lexington mine and will work that property for its zinc ores.

BUTTE & ZENITH CITY (Butte)—Work will be resumed within short time. Mine which was closed down last fall on account of labor conditions, is located about two miles west of Rocker.

BUTTE & GREAT FALLS (Butte)—Development work at property of this company bringing promising results. Returns on samples taken from new orebody opened in crosscut that runs to Genevieve vein gave 11.5% copper, 24.4 oz. of silver and 0.08 oz. of gold. Plans to sink shaft to depth of 500 ft. or more. Hoisting engine will be installed capable to hoist ore from a depth of 1500 ft. and a large pump will be placed on 300 level.

RAINBOW DEVELOPMENT (Butte)—At annual meeting of company held in Duluth voted to issue general mortgage 6% convertible bonds to amount of $400,000 and to increase shares from 80,000 to 150,000. Par value to remain $10. Work is to be resumed at once in shaft where operations were discontinued last fall. Rainbow property adjoins Butte & Superior and has already encountered vein in which Butte & Superior's richest ores occur. Work is to be prosecuted vigorously.

BUTTE & SUPERIOR (Butte)—New flotation machines installed some weeks ago at mill of this company proved satisfactory. Grade of concentrates was raised materially and cost of production lowered. Tons of ore milled in May were 43,380. Tons of concentrates realized were 11,870. Zinc in the concentrates was 12,371,000 lb. Recovery was 88.03%. Concentrates assayed 52.11% zinc. On June 19 company filed regular monthly statement of operations in flotation plant with clerk of court showing 37,633 tons of ore treated in May in flotation plant. Amount of concentrates recovered was 7508 tons. Cost per ton of concentrates recovered, $4.28, and value per ton, $63.82. Total value of concentrates, $479,181. Assay returns of concentrates were: Zinc, 52.055%; lead, 2.767%; copper, 0.558%; silver, 24.149 oz.; gold, 0.0418 oz.

Yellowstone County

ROMAR OIL COMPANY—Will soon commence drilling for oil in Big Wall country, northeast of Roundup and is now negotiating with landowners for leases and oil grants. Same company prospected in Seventy-nine country last year. It is understood company intends to secure leases on 45,000 acres of land.

NEVADA

Clark County

SULTAN—This property, situated near Ripley, was recently purchased by Henry Robbins, who is shipping about 200 tons of zinc carbonate ore monthly.

BULLION (Goodsprings)—Young & Fayle announce that 50-ton dry concentrator will be erected on property at once. Plans for mill are now being made, and it is expected that Sutton, Steele & Steele tables will be used.

FREDERICKSON (Goodsprings)—New dry concentrator now operating at full capacity, and Sutton, Steele & Steele tables are proving successful in handling lead-zinc carbonates. Company is treating custom ore in additon to their own production.

YELLOW PINE (Goodsprings)—Mill producing full contractual allowance of 1500 tons of zinc concentrate per month, together with 200 tons of lead-silver concentrate. Sinking has been resumed in main two-compartment shaft to tap orebody at depth of 900 ft.

ANCHOR (Goodsprings)—Full tonnage of zinc carbonate ore allowed by contract being shipped. Company announces intention of erecting 50-ton dry concentrating mill for treat-

ment of mixed lead-zinc ores. Rolls and dry tables of Stebbins type will probably be used. Roy W. Moore is superintendent.

Esmeralda County

JUMBO EX (Goldfield)—Has increased shipments from 50 tons daily to 150 tons every two days.

FLORENCE (Goldfield)—Is again considering sinking shaft from 1200 to 2000-ft. level.

ORIZABA (Cloverdale)—Property situated six miles west of Cloverdale on Luning Road purchased by L. L. Patrick, of Goldfield, and others. Shaft is down 100 ft., exposing ledge of ore carrying high gold and silver values.

Humboldt County

MERRIFIELD LEASE (Haystack)—Five-stamp mill installed has started up successfully.

Lyon County

YERRINGTON BULLION (Ludwig)—Buildings and equipment will be sold at sheriff's sale to satisfy creditors.

Nye County

CASH BOY (Tonopah)—First shipment of ore made recently to Western Ore Purchasing Co., Millers.

SKAGGS (Round Mountain)—Lease and bond taken on this property by Elko men. Large tonnage medium-grade copper ore developed.

BIG PINE (Manhattan)—New machinery for mill operating on Muskett-Wittenberg lease now arriving and being installed. New 50-hp. hoist has already been set up.

BIG FOUR (Manhattan)—After more than year's idleness, lease granted to Kendall & Bragg, of Goldfield who will start work at once. There is 10-stamp mill on ground.

DEXTER-WHITECAPS (Manhattan)—At special meeting of stockholders held at Tonopah decided to dissolve old corporation and form new one with capitalization of $2,000,000.

Storey County

MEXICAN (Virginia)—On 2300 level work in understope in north drift continued and 30 tons of ore averaging $12.50 per ton extracted. Repairs to mill continued.

COMSTOCK PUMPING ASSOCIATION (Virginia)—Pumps ran successfully all week and water held below 2700 ft. point. East drift being timbered, cleaned out and drains enlarged.

CON. VIRGINIA AND OPHIR (Virginia)—On 1600 level and Ophir 2500 level jointly with Pumping Association have been cleaning out and repairing main north drift from incline station. Distance of 26 ft. made. Total now open, 48 ft with caved ground ahead.

OPHIR (Virginia)—At Central tunnel completed timbering intersection of two north drifts and west crosscut; and preparing to continue old slope in northerly direction. Crosscut near Andes line was timbered and crosscut in Andes ground advanced to 54-ft. point with face in porphyry and quartz. From development and stope above north drift 275 cars of ore saved and 245 tons milled.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Reported that 1083 tons of dump rock sent to mill; two bars of bullion shipped to smeltery. Pumping equipment formerly in Jacket incline installed at 1500 level and placed in operation. Incline being cleaned out and repaired. On Belcher 1300 level southeast drift yielded seven cars low-grade rock. Repairs being made on 1300 and 1400 levels.

UNION CON. (Virginia)—On 2650 level west crosscut advanced to 690 ft. point; face shows porphyry and quartz. Passed through 6-in. stringer that sampled $17.50 per ton. North drift from west crosscut on south boundary line cleaned out and repaired to the 165-ft. point. On 2500 level jointly with Sierra Nevada made good progress opening up west country for prospecting. West crosscut now in good condition to 164-ft. point.

NEW MEXICO

Grant County

BURRO MOUNTAIN (Tyrone)—Extensive grading is being done from company's railroad to new townsite. Contracts have been let for erection of dwelling houses, hospital and stores.

VIRGINIA DISTRICT (Lordsburg)—A 3½-mile spur, from Oil Siding to mines in Virginia Mining District is to be built by Arizona & New Mexico R.R. Contracts have been signed with producing companies and options for rights of way secured. Grading contract is being advertised and bids will be opened at the A. & N. M. offices in Clifton, Ariz. Railroad will be in operation by Sept. 1. Caterpillar tractors now on ore haul will be moved to other mines. Construction of Lordsburg spur will mean opening of now dormant mines and increase of production of mines now operating.

SOUTH DAKOTA

Lawrence County

WASP NO. 2 (Flatiron)—Property is again being operated at close to maximum capacity, which is 500 tons daily, after working day-shift only in mine during winter months.

HILL CITY DEVELOPMENT (Hill City)—Steam hoisting plant and compressor are being set up at main shaft. Shaft down 100 ft. and will be continued to 300 ft. followed by drifting on orebodies.

BISMARCK (Flatiron)—Resumption of milling is planned, property having reverted to original owner, John A. Sandholm, Des Moines Ia., through failure of company to complete purchase. First work to be undertaken will be construction of skipway from mill down hill to C. B. & Q. railway tracks below, over which supplies can be delivered.

ECHO (Maitland)—After suspension of mining since Apr. 29, unwatering of shaft was commenced on June 16. Water will be handled by Cameron No. 5 sinker, operated by compressed air, to furnish air for which 10x12 single-stage compressor, driven by 30-hp. motor, has been erected. Shaft is 135 ft. deep and will be continued with two shifts of miners.

UTAH

Beaver County

BEAVER GOLD (Beaver City)—Arrangements for sinking another 100 ft. have been made.

MAJESTIC (Milford)—Development is being done from 100 and 200 levels at this company's Hoosier Boy property, after shutdown of several months.

LEONORA (Milford)—East-west fissure opened on 400 level shows streak of ore widening as point of intersection with a north-south fissure approaches. This is 30 ft. distant.

MOONDAY (Milford)—Following recent strike at adjoining Cave mine, it is proposed to resume work here. Property opened to depth of 230 ft. and iron ore carrying copper has been found.

Juab County

TINTIC ORE SHIPMENTS for the week ended June 18 were 142 cars estimated at 7100 tons, valued at $177,000, compared to 124 cars week previous; about 900 tons increase.

TINTIC MILLING (Silver City)—Articles of incorporation have been filed, capitalization amounting to 1,000,000 shares, par value 3c. Jesse Knight is president and G. H. Dern, vice-president.

CHIEF CONSOLIDATED (Eureka)—Working forces have been increased, and output for week ended June 18 was 27 cars. Several blocks of ground on 1400 and 1600 levels have been given over to leasers, and more are to follow.

IRON BLOSSOM (Silver City)—Ore has not been found in commercial quantity in cave recently opened by winze from 600 level of No. 3 workings. Prospecting at depth is being continued in this section, productive at higher levels. Twenty-two cars of ore were shipped week ended June 18.

Grand County

GREEN MOUNTAIN MINING & MILLING CO. (Cisco)—Company organized under laws of Utah, 1,500,000 shares, Dr. R. S. Milhee, of Milwaukee, President. Company owns group of claims in La Sal district, 35 miles southeast of Cisco on Denver & Rio Grande R.R. Will install complete equipment of machinery, including 30-hp. gas engine, air compressor, fan, pumps, etc.

Salt Lake County

ALTA CONSOLIDATED (Alta)—A trial shipment of low-grade ore carrying copper, gold, and silver, with excess iron, is to be made as soon as teams can be obtained. Recently three cars of shipping ore were sent to market.

UTAH COPPER (Bingham)—Between 23,000 and 25,000 tons of ore daily are being treated by the Magna and Arthur mills. In May 14,053,000 lb. of copper were produced being 800,000 lb. greater than the previous record month.

CARDIFF (Salt Lake)—Shipments of 50 tons daily are being made. New oreshoot continues to open up satisfactorily; and ore has been followed downward from the main tunnel level for 75 ft. New roadway from mine is practically completed.

SOUTH HECLA (Alta)—The 500 level is producing a good tonnage of first-class ore, and 25 to 30 tons of ore daily are being shipped. As soon as surface water hampering work in the main stope has been got rid of, shipments will probably be increased. Sixteen men are working.

UTAH-APEX (Bingham)—The flotation process for the treatment of slimes will make possible an increase of nearly 10,000,000 lb. a year in output of lead, with cost of less than $20,000 for installation. At present the rate of production is 30,000,000 lb. annually. The bonded indebtedness has been reduced to $40,000; and par and interest are being offered for these but bonds are slow in coming in. Copper ore running 3 to 3½% is being shipped from 300 level, and is stated to be bringing about $10,000 monthly.

Summit County

PARK CITY ORE SHIPMENTS for week ended June 19 were 2479 tons valued at $100,000, compared to 1622 tons week previous.

SILVER KING CONSOLIDATED (Park City)—Shipments for the week ended June 18 were 1,086,640 lb.

SILVER KING COALITION (Park City)—Two shifts are being worked. The May output amounted to 4057 tons of crude ore and concentrates.

WASHINGTON

Stevens County

UNITED COPPER (Chewelah)—First unit of new stamp mill, 60 miles north of Spokane, started up. There are now 44 stamps in operation, treating 125 tons of ore. Station is being cut underground at 1000 level, and hoist equipment will be installed to sink shaft another 1000 ft.

CANADA

BRITISH COLUMBIA

CANADIAN GOLD FIELDS SYNDICATE—This company, which has not been operating since 1901, is being wound up and will make a liquidation of 4.43% to shareholders.

Ontario

ADANAC (Cobalt)—Unwatering of mine has been effected, and crosscutting begun from 200 level of No. 1 shaft. One promising vein has been encountered.

KIRKLAND LAKE (Kirkland Lake)—Rich ore has been encountered at depth of 60 ft. in shaft of McKane claim of this development. Shaft will be put down to 150-ft. level.

GLEN LAKE (Cobalt)—Lease of Foster property held by this company has been extended for another five years. Royalty has been reduced to 15% on all 200 oz. ore and under and 25% on ore of higher grade.

The Market Report

Metal Markets

NEW YORK—June 30

Copper and tin were very dull during the last week, prices remaining substantially unchanged. Lead and spelter were both stronger, particularly the latter, but the aggregate of business transacted in either metal was not large.

Copper, Tin, Lead and Zinc

Copper—The market was dull, the principal producers reporting no sales except for special brands, special shapes, for deliveries at non-competitive points. Being so well sold ahead they are quite unconcerned over the lull in buying and nominally maintain their old price of 20¼c., regular terms. Smaller producers and agencies offer copper at 19¾@20c., regular terms. Some of these sold for delivery in Western markets, which is unusual inasmuch as back freight has to be paid to them and ordinarily they are left to sellers who have refineries further West. However, the aggregate of domestic business during the last week was small, the sales effected being principally for export to England, France and Russia. In view of the declining tendency of Sterling Exchange it is difficult to figure what such sales are going to realize unless they be made on the basis of a net cash price in New York. Considerable sales were thus made upon the basis of 19.60c., which would correspond with about 19.80@19.85, regular terms for the ordinary domestic deliveries.

The Anaconda Copper Mining Co. has introduced a new brand of casting copper, viz., "ABS—Arizona Best Selected." This is refined at the Raritan works from copper produced at Miami, Ariz., which is low in gold and silver, but goes 99¼@99½% in copper.

The unusual disparity between the prices for electrolytic and casting copper—about 1c. per lb.—still prevails.

There are reports of improvement in domestic copper consumption, particularly on the part of the sheet rollers.

Copper Sheets are understood to have brought 25@26c. per lb. The principal manufacturer has withdrawn all quotations. Wire is quoted at 21½@22c. per lb. at mill.

Copper Exports for the week ended June 12 are given by the Department of Commerce at 11,064,237 lb. The larger items were 7,121,938 lb. to Great Britain and 2,921,375 lb. to France. Imports for the week were 2,518,379 lb. metal and 733,962 lb. in ore and matte; 3,252,341 lb. in all. The imports were from Peru, Canada, Cuba and Japan.

Tin—This market was quiet, only a small volume of business being reported. The deliveries in June were about 3900 tons—a large figure coming on top of the huge total of 5600 tons in May.

Tin production in Bolivia in 1914, according to official figures was 36,262 metric tons of concentrates averaging 60% tin. This is a decrease of 8332 tons from the previous year.

Tin production of the Federated Malay States, five months ended May 31, was 20,599 long tons in 1914 and 17,816 tons in 1915; a decrease of 2783 tons this year.

Lead—The outside speculative holdings appear to have been nearly all liquidated, as result of which the market gradually returned to the producers' prices, and some of the producers even made sales at their figures. At the close this market was distinctly firmer.

The exports of this metal continue heavy, as is shown in the table given on the following page.

Spelter—A moderate volume of business was done at advancing prices, particularly in the early half of the week. The bulk of this was in contracts for delivery late in the year at 18@19c. Spelter for early delivery sold up to 21c., but the market for this was spotty. This rally in the spelter market has not been characterized by any such crazy buying as there was early in June. When the price for prompt spelter rose to 21c. lots from second hands began to be offered at a little above that figure.

Exports from Baltimore for the week included 336,156 lb. spelter and 164,260 lb. zinc dross to Liverpool.

Zinc Sheets are lower; base price $27 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged.

Other Metals

NEW YORK—June 30

Aluminum is still quite active, but seems to be in rather better supply than it has been. More domestic metal is available. Quotations are a shade easier, at 30@32c. per lb. for No. 1 ingots, New York.

Antimony remains strong, though not especially active. Business is confined to necessary supplies. Ordinary brands, chiefly Chinese and Japanese, are held at 37½@40c. per lb. Cookson's is in short supply and 47@50c. per lb. is named.

Nickel is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
June	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
24	4 7665	48¾	19.45 @19 75	41	5.50 @5.75	5.37½ @5.67½	17.50 @18.50
25	4 7725	48½	19.45 @19 75	41½	5.50 @5.75	5.50 @5.67½	17.50 @19.50
26	4 7731	48½	19.45 @19.75	41	5 62½ @5 75	5.50 @5.67½	18.00 @20.00
28	4 7675	48½	19.45 @19.75	40½	5.62½ @5.75	5.50 @5.67½	18.50 @21.00
29	4 7613	48	19.45 @19.75	40	5.62½ @5.75	5.50 @5.67½	18.50 @21.00
30	4 7563	48	19 45 @19 75	39½	5.50 5.75	5.50 @5.67½	19.00 @21.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
June	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
24	23 3/16	80⅞	82	94½	20.33	168¾	166½	23¾	4.95	87½	18.63
25	23 1/16	82¼	83½	94½	20.33	171	168	24⅜	5.21	91	19.38
26	23 1/16	...	...	....	....				....	....	....
28	23	82¼	83½	94½	20.33	171	168	24⅜	5.29	92½	19.50
29	22⅞	82⅜	83⅞	95	20.43	171⅜	168½	25 3/16	5.44	100	21.29
30	22⅞	81¼	83¼	95	20.43	172	168¾	26¼	5.59	100	21.29

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Recent London quotations for ordinary forms of refined nickel are £216 per long ton, which is equal to 46.9c. per lb.

Quicksilver is in good demand and prices continue strong. New York quotation for wholesale lots is $90@95 per flask for large lots. Smaller orders bring $95@100 per flask. San Francisco reports by telegraph a somewhat variable market, prices ranging from $85 up to $95 per flask ,with demand in excess of stocks. London has had a sharp advance, the present price being £16 per flask, with £15 17s. 6d. quoted from second hands.

Minor Metals—Current sales of bismuth are at $2.75@3 per lb. New York. The London price is quoted at 10s., or $2.40 per lb. there—**Cadmium** is quoted at 6s., or $1.44 per lb. in London; $1.50 per lb., New York.—**Tellurium** is reported sold at 80s., or $19.20, per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50@5 for retail lots.

LEAD AND ZINC EXPORTS

Imports and exports of lead in April and the four months ended Apr. 30 are reported by the Department of Commerce as below, in short tons:

	April		Four Months	
	1914	1915	1914	1915
Imports	2,389	3,193	7,536	22,322
Exports	3,663	25,019	5,438	49,573

The exports included reëxports of foreign lead. The imports are nearly all in ore and base bullion, sent here to be refined.

Imports and exports of zinc or spelter for April and the four months ended Apr. 30 were as follows, in short tons:

	April		Four Months	
	1914	1915	1914	1915
Exports	60	8,842	481	50,523
Imports	208	23	459	264

Imports of zinc ore in April this year were 12,988 tons, estimated as containing 12,461,830 lb. zinc.; for the four months, 27,897 tons, with 23,081,296 lb. zinc contents. Imports of zinc dust for the four months were 1,792,414 lb. this year.

METAL EXPORTS AND IMPORTS

Spanish Metal and Mineral Exports three months ended Mar. 31, as reported by "Revista Minera," in metric tons:

	Metals		Ores etc.	
	1914	1915	1914	1915
Iron	1,871	37,515	1,979,396	962,157
Copper	4,481	3,934	35,380	11,198
Copper precipitate	2,579	2,044	..	..
Lead	41,999	32,936	708	183
Zinc	683	187	25,444	874
Quicksilver	619	372	..	..
Manganese	..	..	5,425	1,970
Pyrites	..	..	776,422	333,372
Salt	..	..	143,868	189,367

Imports of coal for the three months were 366,305 tons, a decrease of 328,988 tons from 1914; of coke, 37,251 tons, a decrease of 54,274 tons.

Gold, Silver and Platinum

NEW YORK—June 30

Gold continues to come from Ottawa on London account. More will doubtless come, as exports to Europe increase.

Gold output of the Kolar field in Mysore, India, five months ended May 31, was $5,051,562 in 1914, and $5,250,118 in 1915; an increase of $198,556 this year.

Sterling Exchange in New York reached the lowest point on record, having sold one day at a point below 4.76, which is 2% below par.

Platinum is still quiet, with business on a moderate scale. Prices show no material change. Dealers ask $37@39 per oz. for refined platinum and $41@44 per oz. for hard metal.

Our Russian correspondent writes that the improvement in the market continues. At Petrograd there is a demand for considerable quantities for shipment abroad, especially to Sweden. At Ekaterinburg there have been good transactions in small quantities. Quotations at Ekaterinburg are 8@8.50 rubles per zolotnik—average, $31.02 per oz.; at Petrograd, 33,500@33,800 rubles per pood—average, $32.78 per oz.—for crude metal, 83% platinum.

Silver—The market has continued dull and stagnant, and owing to lack of buying orders has been forced down to 22⅞d in London. The selling pressure has been light or prices would be lower still. India is only a small buyer and China is not in the market. Price closes steadier at 48c. in New York.

Silver shipments from London to the East from Jan. 1 to June 16 are reported as below by Pixley & Abell:

	1914	1915	Changes
India	£3,617,000	£2,562,000	D. £1,055,000
China	40,000	5,000	D. 35,000
Total	£3,657,000	£2,567,000	D. £1,090,000

Imports of silver in Great Britain five months ended May 31, were valued at £4,345,647; exports, £3,697,176; excess of imports, £648,471, which compares with an excess of exports of £1,272,671 last year.

Zinc and Lead Ore Markets

JOPLIN, MO.—June 26

Blende, high price $112.50 per ton of 60% zinc; premium ore, $110@100; medium grades, $100@90; lower grades down to $70; calmine, base 40% zinc, $75@50; average price, all grades of zinc, $96.36 per ton. Lead, high price, $75; base, $72@60 per ton 80% metal content; average price, all grades of lead, $64.35 per ton.

Producers are between opposing forces now. Prices are receding and a large number of miners went out on strike again tonight for a further raise in wages. Premium ore dropped $18 this week and $7 the previous week, and the decline is hurting. The strike among miners, it is believed, will be settled by the men returning to work Monday without advance, but if this is not done the output of the largest producing mines of Webb City will be severely curtailed.

SHIPMENTS, WEEK ENDED JUNE 26

	Blende	Calamine	Lead	Values
Totals this week	11,369,550	760,920	2,270,430	$656,490
Totals this year	299,601,790	25,187,400	43,029,300	11,774,710

Blende value, the week, $559,970; 6 months, $10,136,320.
Calamine value, the week, $23,480; 6 months, $522,660.
Lead value, the week, $73,040; 6 months, $1,115,400.

PLATTEVILLE, WIS.—June 26

The base price paid this week for 60% zinc ore was $95@110 per ton. The base price paid for 80% lead ore was $68 per ton.

SHIPMENTS, WEEK ENDED JUNE 26

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,449,750	80,000	747,860
Year	92,126,380	3,202,090	13,204,730

Shipped during week to separating plants, 4,516,400 lb. zinc ore.

Iron Trade Review

NEW YORK—June 30

The iron and steel markets are still gaining with large increases in orders in many lines, and with domestic as well as foreign business contributing to the improvement. Just what proportion the export business bears to the total it is not easy to say definitely, as orders for material are frequently so divided up that their ultimate destination cannot be determined. Undoubtedly it is large and includes a quantity of rail and of steel for railroad equipment as well as for the war munitions.

Naturally prices are firming up and advances are recorded in a number of lines. The upward movement is not rapid but is generally held.

The pig-iron market is not keeping pace with steel, but is generally lagging behind. Pig iron production is increasing, but the gain is all with the steel works furnaces, and the merchant stacks are making little progress, hardly holding their own.

The ferromanganese situation is not improving, and it looks as if the shortage might be a serious one before long. Some manganese ore is coming in, but receipts are much below last year. The English receipts also show a heavy decrease.

Exports from Baltimore for the week included 17,799,804 lb. billets and skelp steel, 3,420,700 lb. bars and wire rods, all to Great Britain.

Imports at Baltimore for the week included 8260 tons manganese ore from Brazil and 2017 tons ferromanganese from Liverpool.

Foreign Trade of the United States in iron and steel and in manufactures thereof four months ended Apr. 30 is valued by the Department of Commerce as follows:

	1914	1915	Changes
Exports	$74,414,334	$80,812,326	I. $6,397,992
Imports	10,306,027	5,948,722	D. 4,357,305
Excess, exports	$64,108,307	$74,863,604	I. $10,755,297

The incerase in exports this year, as compared witb 1914, was 8.6%; while there was a decrease of 42.3% in the imports

PITTSBURGH—June 29

The steel mills are now operating at slightly more than 80% of rated capacity, and operations are still increasing, pointing to a 90% operation or better by the beginning of August There will be no dull summer in the steel trade this year. Yesterday the Carnegie Steel Co. started the North Sharon works, for the first time in about two years, and now has only one idle steel plant, the small Columbus bessemer works. This plant will not be started in the near future, as recently reported, but if additional billets and sheet bars are required the Riverside plant at Wheeling or the National Tube Co. will be started for this purpose. The Carnegie Steel Co. is negotiating for billets and sheet bars to apply against some of its obligations in the East, particularly for the Pencoyd works of the American Bridge Co. It only buys steel when under unusual pressure.

Exports of steel that are reported by weight are expected to total between 250,000 and 300,000 gross tons for June, against 223,000 tons in April, for which month the government statistics have just been published. Exports of manufactures involving steel, not reported by weight, are unusually heavy, exports of passenger automobiles and trucks, machine tools, locomotives and freight cars being unusually heavy, while shrapnel, loaded and unloaded, not reported in the statistics by weight, involve a large quantity of steel. Altogether the exports of steel and manufactures involving steel now represent fully 20% of the current steel output, and may possibly amount to nearly 25%, the export rate exceeding the average rate in 1912, the banner export year.

Steel prices show only a slight advancing tendency, the strength of the market being shown chiefly by the heavy bookings for early deliveries and the indisposition of the mills to book for late deliveries. As a whole the actual shipping orders entered run from 15 to 30% above the current shipments. The Pittsburgh and western mills have nearly all withdrawn the 1.20c. price on bars, plates and shapes for prompt shipment, and are quoting 1.25c. for prompt or third quarter. Some mills east of Pittsburgh are still on the 1.20c. basis. Railroad spikes are up $1 a ton to 1.40c., and cold rolled strip steel is up $8, to 2.85c., base. Shafting is firming up, with 68% off list difficult to do and some producers quoting 66% off list.

The iron mill wage scale of the Amalgamated Association was arranged on Saturday at Atlantic City, on the basis of continuing the present scale for the twelvemonth. The men had asked advances, but the iron mills have not participated in the steel trade improvement sufficiently to be willing to grant any advances.

Pig Iron—The local pig iron market continues quiet, not showing any improvement, when the steel trade proper has improved so much. Recent sales to Westinghouse interests, instead of being at exceptionally low prices, now prove to be at prices that can be done again, and the market on Valley foundry iron is quotable 25c. lower than formerly, making the lowest level since 1904. Girard furnace in the Mahoning Valley will blow out this week, after being in blast only three or four months, finding prices obtainable unremunerative. We quote: Bessemer, $13.75; basic, $12.65@12.75; foundry and malleable, $12.50@12.75; forge, $12.25@12.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Small spot lots are commanding $105@115, regular contracts remaining at $100, Baltimore.

Steel—The Pittsburgh mills are practically out of the market and the Youngstown mills, with a little unsold capacity, are conserving this supply and quoting advanced prices, at about $29 for billets and $31 for sheet bars, prices delivered Pittsburgh being $1.05 higher. Rods are stronger, at $25.50@26, Pittsburgh.

FOREIGN IRON

Steel production in Germany in April was 1,012,344 metric tons, being 85,929 tons less than in March. For the four months ended Apr. 30 the total this year was 4,020,298 tons.

IRON ORE

Statistics compiled by the Lake Superior Iron Ore Association show that the shipments of ore from docks to furnaces during May amounted to 2,797,481 tons. The tonnage on dock June 1 was 5,970,115, compared with 5,772,462 tons on dock June 1 last year.

Imports at Baltimore for the week included 1600 tons manganese ore from Spain and 1731 tons from Liverpool, 3331 tons in all.

Exports of manganese ore from India in the fiscal year ended Mar. 31 were 718,040 tons in 1913-14 and 440,590 tons in 1914-15; a decrease of 277,450 tons.

Imports of manganese ore in Great Britain five months ended May 31 were 205,217 tons in 1914, and 107,297 tons in 1915; decrease, 97,920 tons.

Imports of Iron Ore into the United States in April were 91,561 tons, which is 3159 tons more than in March, but 20,251 tons less than in April, 1914. The chief items were 73,811 tons from Cuba, 18,725 from Sweden, 7800 from Newfoundland and 6256 from Spain. For the four months ended Apr. 30 the imports were 394,739 tons in 1914, and 334,022 in 1915; a decrease of 60,727 tons this year.

Imports of Iron Ore in Great Britain five months ended May 31 were 2,070,224 long tons in 1914, and 1,939,719 in 1915; decrease 130,505 tons.

OTHER ORES

Recent quotations for rare ores in Great Britain are: Molybdenite, 90% MoS_2, $28.80 per unit. Tungsten ore, wolfram, over 65% WO_3, $9.60 per unit; scheelite, 70%, $9.36@9.60 per unit.

Tungsten, Ore.—The schedule of prices now paid for tungsten ore delivered at the Primos Mill, is as follows: $2 a unit for 1% ore, with an increase of 50c. a unit for each additional unit up to 5%, which is worth $4 a unit; an increase of 10c. a unit up to 40% ore, which is worth $7.50 a unit; then an increase of 5c. a unit up to 50% ore, which is worth $8 a unit; then an increase of 10c. a unit up to 60% ore, which is worth $9 a unit. The sampling charge on lots assaying less than 2% is $2 a ton. On small lots worth less than $50 a charge of $5 is made for sampling and assaying. The Primos mill is at Lakeville, Colo., in the district where most of the ore is mined.

FERRO-ALLOYS

Recent quotations for ferro-alloys in Great Britain are as follows: Ferrochrome, from $121.67 per ton for 10% carbon up to $155.75 for 4% carbon. Ferrosilicon, 25%, $51 per ton; 45%, $70.50 per ton. Ferromolybdenum, 70-80%, $4.32 per lb. Ferrotungsten, $1.34 per lb. for 75-85% tungsten and under 1% carbon; tungsten metal, powder, $1.46 per lb. for 96-98% pure.

COKE

Connellsville—The wage cuts made in the fore part of 1914 by the majority of independent coke producers are being eliminated by a return to the Frick scale, announcements to this effect having already been made by the Connellsville Central Coke Co., the Struthers Coal & Coke Co., the Republic Iron & Steel Co., the Bessemer Coke Co. and the Washington Coal & Coke Co. The last named had a strike last week which was settled by restoring the old rates and others have been posting announcements to hold their men, as a labor shortage is regarded as certain in the near future. The merchant coke market, however, remains dull. The wage advance will doubtless stiffen operators' views and may correspondingly delay further buying. We quote: prompt furnace, $1.50@1.55; contract to Jan. 1, $1.75; prompt foundry, $2@2.50; contract, $2.20@2.50, per net ton at ovens.

Chemicals

NEW YORK—June 30

The general market is gradually steadying and shows a better tone on moderate business in most lines.

Arsenic—Demand is only fair, but prices show no change. Quotations are about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady, with no material change in prices. Quotations are $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller orders.

Nitrate of Soda—The market continues strong and steady, although transactions are rather variable in quantity. Quotations are 2.20c. per lb. for spot and all positions this year.

Potash Salts—The Department of Commerce reports that the imports of potash salts into the United States for the five months ended May 31 were, in pounds:

	1914	1915
Carbonate of potash	9,867,075	8,396,034
Hydrate of potash	3,462,638	2,016,942
Nitrate of potash	1,079,045	6,855
Cyanide of potash	275,977	828,527
Other potash sales	2,704,391	2,064,260

The imports of potash salts used as fertilizers were as follows for the five months, in long tons:

	1914	1915
Kainit	239,362	3,786
Manure salts	81,669	12,456
Sulphate of potash	21,313	8,806
Muriate of potash	105,759	56,135

The large decreases this year are, of course, due to the stoppage of imports from Germany.

Assessments

Company	Delinq.	Sale	Amt.
Belcher, Nev., (post.)		July 8	$0.15
Best & Belcher, Nev., (post.)		July 8	0.05
Blue Bell, Ida	July 5	Aug. 4	0.003
Blue Star, Ida	June 19	July 10	0.01
Carbonate, Ida	June 23	July 23	0.001
Challenge Con., Nev.	July 12	Aug. 4	0.05
Con. Virginia, Nev	July 19	Aug. 10	0.05
*Contact Copper, Mich.		July 14	0.50
Contact Copper, Mich	May 15		0.50
Crown Point, Nev., (post.)	June 16	July 8	0.15
Duluth, Ida	June 5	July 8	0.001
Glen Metal, Ida	May 31	July 1	0.002
Hancock Cons., Mich.	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1.00
Houghton, Mich.	May 25		1.00
Idaho-Nevada, Ida	July 14	Aug. 6	0.001
Idora, Ida	June 3	July 2	0.005
Iron Mask, Ida	July 1	Aug. 10	0.002
Majestic-Idol, Nev.	Dec. 15	July 20	0.005
Mayflower, Ida	June 15	July 17	0.005
Mineral Range, Utah	Mar. 24		0.003
Monarch Pitts., Nev.	June 14	July 14	0.01
Moonlight, Ida	June 5	July 8	0.005
Nahob, Ida	July 5	Aug. 2	0.005
New Arcadian, Mich.	June 1		0.50
New Arcadian, Mich.	Dec. 1		0.50
New Baltic, Mich	July 15		0.50
New Baltic, Mich	Jan. 15		0.50
New Yerrington Cop., Nev	July 9	July 27	0.01
North Bunker Hill, Ida	June 12	July 17	0.002
Old Veteran, Ida	July 5	July 3	0.002
Rainbow, Ida	July 7	Aug. 7	0.002
Revelator, Utah		July 16	0.00½
Revelator, Utah	Aug. 17	Sept. 3	0.00½
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Rhode Island, Ida	June 24	July 24	0.001
Royal, Ida	June 1	July 6	0.0015
Silver Mountain, Ida., (post.)		July 15	0.002
Silver Pick, Nev.	June 5	July 12	0.01
Sunrise, Ida	July 17	Aug. 17	0.002
Sunset Dev., Ida	June 30	July 24	0.0025
Umatilla Tonopah, Nev.	July 12	Aug. 16	0.01
Union, Nev	June 18	July 9	0.05
West Tonopah Con., Nev.	July 10	Aug. 10	0.01
Yellow Jacket, Nev., (post.)	June 14	July 8	0.15

*This assessment was levied and payable Apr. 27, '14.

Stock Quotations

Sales at auction during the last week included: 1500 West Coast Smelting & Refining, $10 par, 35c. per share; $500 Consol. Nevada-Utah convertible 6's, 1918-1922, $100 lot. The New York Stock Exchange has listed $15,000,000 collateral trust 7% bonds of the Chile Copper Co.

COLO. SPRINGS June 29 Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con.	.01
C. K. & N.	.03
Doctor Jack Pot	.10¾
Elkton Con.	.39¾
El Paso	94
Findlay	.04½
Gold Dollar	.02
Gold Sovereign	.04½
Golden Cycle	1.80
Isabella	.18
Jack Pot	.06½
Jennie Sample	‡ 02
Jerry Johnson	.04
Lexington	.005
Mary McKinney	.36
Pharmacist	.01
Portland	1.45
Raven B. H.	.02
Vindicator	1.71½

SALT LAKE June 29 Name of Comp.	Bid.
Beck Tunnel	04
Black Jack	.09½
Colorado Mining	.11½
Crown Point	01½
Daly-Judge	7 25
Gold Chain	15
Grand Central	60
Iron Blossom	83
Little Bell	10
Lower Mammoth	03
Mason Valley	‡2 50
May Day	16
Opohongo	00¾
Prince Con	63
Seven Troughs	01½
Silver King Coal'n	3 42½
Silver King Con	2 00
Sioux Con.	03
Uncle Sam	05½
Yankee	04

TORONTO June 29

Name		Name	
Bailey	01½	Dome Exten.	13
Coniagas	05	Foley O'Brien.	30
Peterson Lake.	.22	Hollinger.	25 50
Right of Way	04	Imperial	05½
Seneca Superior.	.00¾	Jupiter	09
Silver Queen	01	McIntyre	47
T. & Hudson Bay.	‡18 50	Pearl Lake	01
Timiskaming	.32	Porcu. Crown	.75
Wettlaufer-Lor.	03	Preston E. D.	02
Big Dome	17 12½	Rea	10

SAN FRANCISCO June 29

Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡ 04	Belmont	4 05
Andes	05	Jim Butler	90
Belcher	32	Lone Star	05
Best & Belcher	06	MacNamara	02
Caledonia	22	Midway	16
Challenge Con.	‡ 06	Mont.-Tonopah.	25
Confidence	06	North Star	.15
Con. Virginia	06	Rescue Eula	08
Gould & Curry	02	West End Con.	83
Hale & Norcross	04	Atlanta	30
Julia	‡ 02	Booth	49
Mexican	.37	C. O. D. Con	03
Occidental	.79	Comb. Frac.	08
Ophir	11	Jumbo Extension	1 60
Overman	06	Pitts.-Silver Peak	‡ 12
Potosi	‡ 03	Round Mountain.	51
Savage	04	Sandstorm Kendall.	09
Sierra Nevada	04	Silver Pick	11
Union Con	.16	Central Eureka	‡.16
Yellow Jacket	.36	So. Eureka	‡1 50

N. Y. EXCH. June 29 Name of Comp.	Clg.
Amalgamated	74¼
Am.Sm.&Ref.,com.	79
Am. Sm. & Ref., pf	107
Am. Sm. Sec., pf. B.	79
Anaconda	36
Batopilas Min	1½
Bethlehem Steel	168
Bethlehem Steel, pf.	116
Chino	45½
Colo. Fuel & Iron.	30¼
Federal M. & S., pf.	45
Great Nor., ore., ctf.	36
Guggen. Exp.	63½
Homestake	118
Inspiration Con.	31
Mex. Petroleum	74
Miami Copper.	26
Nat'l Lead, com.	63⅝
National Lead, pf.	109¾
Nev. Consol.	14¾
Ontario Min	3½
Quicksilver, pf.	3
Ray Con.	23¾
Republic I&S, com.	29¼
Republic I&S, pf.	87
SlossShefi'd, com.	34
Tennessee Copper.	37
Utah Copper	67⅜
U. S. Steel, com	60⅜
U. S. Steel, pf.	109¼

N. Y. CURB June 29	
Alaska Juneau.	13¼
Alta Con	.72
Beaver Con	‡ 32
Big Four.	‡ 05
Blue Bell.	‡ 03
Braden Copper.	7½
Buffalo Mines.	‡.50
Can. Cop. Corpn.	$1\frac{1}{16}$
Can. G. & S.	‡.03
Caribou.	‡.50
Cashboy	.07
Chambers Ferland.	‡.16
Chile Cop.	20½
Con. Ariz. Sm.	1
Con. Coppermines.	‡2½
Con. Nev.-Utah.	$\frac{7}{16}$
Davis-Daly	‡1⅛
Diam'field-Daisy.	‡7
Dia. Black B.	04
Florence	.52
Goldfield Con.	$1\frac{9}{16}$
Goldfield Merger.	22
Greene Cananea.	39½
Kennicott Cop.	33⅛
Kerr Lake.	4½
La Rose.	.50
McKinley-Dar-Sa	22
Majestic	.99
Mines of Am	‡2½
Nevada Hills.	21
New Utah Bingham	4
Nipissing Mines.	5⅜
Ohio Copper.	‡.22
Oro	10
South Utah	‡¼
Stand'd Oil of N.J.	394
Standard S. L.	$1\frac{9}{16}$
Stewart	$2\frac{7}{16}$
Tonopah	‡7½
Tonopah Ex.	3
Tonopah Merger	.42
Tribullion	$\frac{11}{32}$
Tularosa	$\frac{3}{16}$
Yukon Gold	2½

LONDON June 17	
Alaska Tre'dwell	£7 5s 0d
Cam & Motor.	0 14 9
Camp Bird	0 5 0
El Oro.	0 7 3
Esperanza.	0 7 0
Mexico Mines.	3 12 6
Oroville.	0 14 0
Santa Gert'dis	0 7 6
Tomboy.	1 1 3
Tough Oakes.	0 8 6

BOSTON EXCH. June 29 Name of Comp.	Clg.
Adventure	‡2½
Ahmeek	399
Alaska Gold M.	38
Algomah	‡3
Allouez	56
Am. Zinc	54½
Ariz. Com., ctfs.	7½
Bonanza	‡35
Butte-Ballaklava	3
Butte & Superior	70½
Calumet & Ariz.	64
Calumet & Hecla	585
Centennial	19
Cliff	‡1
Copper Range	54
Daly West	3½
East Butte	12½
Franklin	10
Granby	88
Hancock	17½
Hedley	‡28
Helvetia	60
Indiana	6¼
Island Cr'k, com.	48
Island Cr'k, pfd.	88½
Isle Royale	‡28
Keweenaw	3½
Lake.	13¼
La Salle.	‡6¼
Mass.	‡13¼
Mayflower	4½
Michigan.	1½
Mohawk.	79
New Arcadian	11¼
North Butte	32¼
North Lake.	2¼
Ojibway.	‡2
Old Colony.	4
Old Dominion	55
Osceola	90¼
Quincy.	‡87
Santa Fe	‡3
Shannon	9
Shattuck-Ariz.	28
Superior.	‡29½
Superior & Bost.	3½
Tamarack.	‡37
Trinity.	5
Tuolumne	49
U. S. Smelting	41
U. S. Smelt'g, pf.	47½
Utah Apex	$4\frac{5}{16}$
Utah Con	‡14¼
Victoria.	3
Winona.	4
Wolverine.	62
Wyandot.	‡1

BOSTON CURB June 29 Name of Comp.	Bid.
Alvarado.	.50
Bingham Mines.	.09¾
Boston Ely.	25
Butte & Lon'n Dev.	22
Calaveras	1¼
Calumet-Corbin.	.05
Chief Con	1.12½
Corbin.	.50
Cortez	.30
Crown Reserve	.75
Eagle & Blue Bell	1.75
First Nat. Cop.	2¾
Houghton Copper	4
Iron Cap Cop., pf	06
Majestic	99
Mexican Metals.	25
Nevada-Douglas	45
New Baltic	3½
Oneco	1¾
Raven Copper	.10
Smokey Dev.	.15
So. Lake	6½
Tonopah Victor.	.32
Trethewey	09
United Verde Ext.	$4\frac{7}{16}$

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

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

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.990	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223		60.540		64.955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53.227		*	
December	12.801		56.841		*	
Year						

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301			

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891		3.738		19.051	
August	3.875		3.715		‡	
September	3.828		3.658		‡	
October	3.528		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.737			

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.61
July	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.15	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.59	13.96	13.77
July	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	

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The Engineering and Mining Journal

VOLUME 100 JULY 10, 1915 NUMBER 2

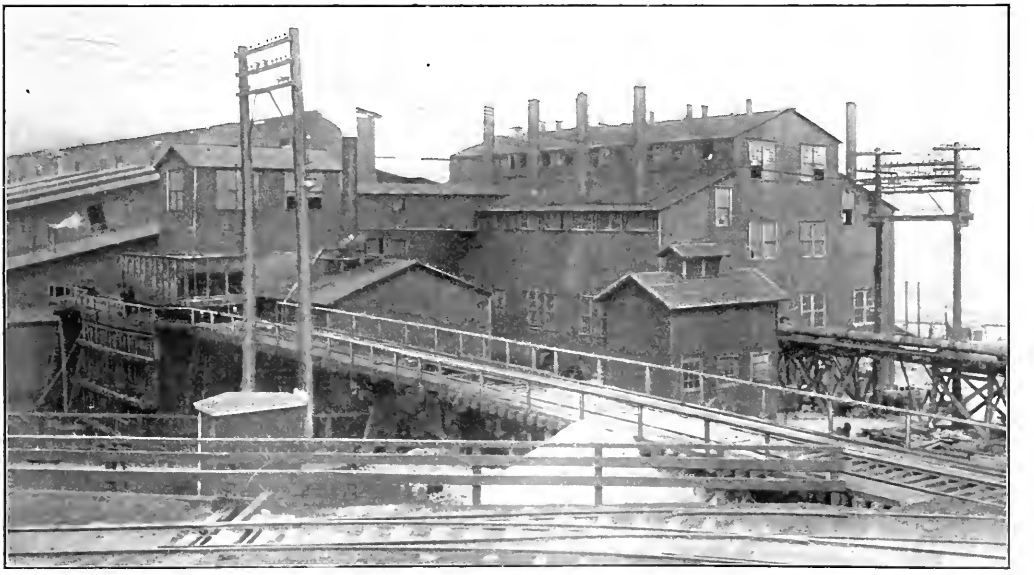
Anaconda Coal-Pulverizing Plant

By E. P. Mathewson*

SYNOPSIS—A description of the new plant now being built at Anaconda, Mont., to supply coal-dust fuel for the reverberatory furnaces at the Washoe Reduction Works.

The Anaconda Copper Mining Co. is installing at its Washoe Reduction Works, Anaconda, Mont., one of the largest and most modern plants for pulverizing coal to be used as fuel in firing reverberatory furnaces: half the plant is now in operation and the rest will be ready in a short time. The building is completed and all the machinery is on the ground.

The main building is of steel and adjoins the reverberatory building on the east. The accompanying picture is a general view of the structure. At the left is shown the temporary coal bin; and next the temporary shed in which is operated one of the Ruggles-Coles driers. The pulverizing machinery is in the large building at the right. The layout of the pulverizing plant is shown in the general plan presented on the succeeding page.



Coal-Pulverizing Plant at Washoe Reduction Works, Anaconda

The coal is received in cars of 50 tons' capacity; these dump into a bin from which the coal passes to two 30x30-in. Jeffrey single-roll coal crushers having a capacity of from 80 to 130 tons per hour. The maximum size of the coal leaving these crushers is 2 in. From the crushers the coal discharges into two manganese-steel-chain bucket elevators which deliver the coal upon a 30-in. conveyor belt equipped with an automatic tripper so arranged that it will distribute the coal evenly in a steel bin having a capacity of 1000 tons. From this storage the coal is drawn upon a 24-in. belt conveyor through automatic-feed chutes which feed the coal upon the belt only when it is in motion. This conveyor belt passes over a Dings magnetic pulley, which removes all scrap iron, nails, spikes, etc., from the coal, and discharges the coal into the boot of an elevator which feeds into three Ruggles-Coles indirect-heat driers. These driers in the completed plant will be fired with pulverized coal.

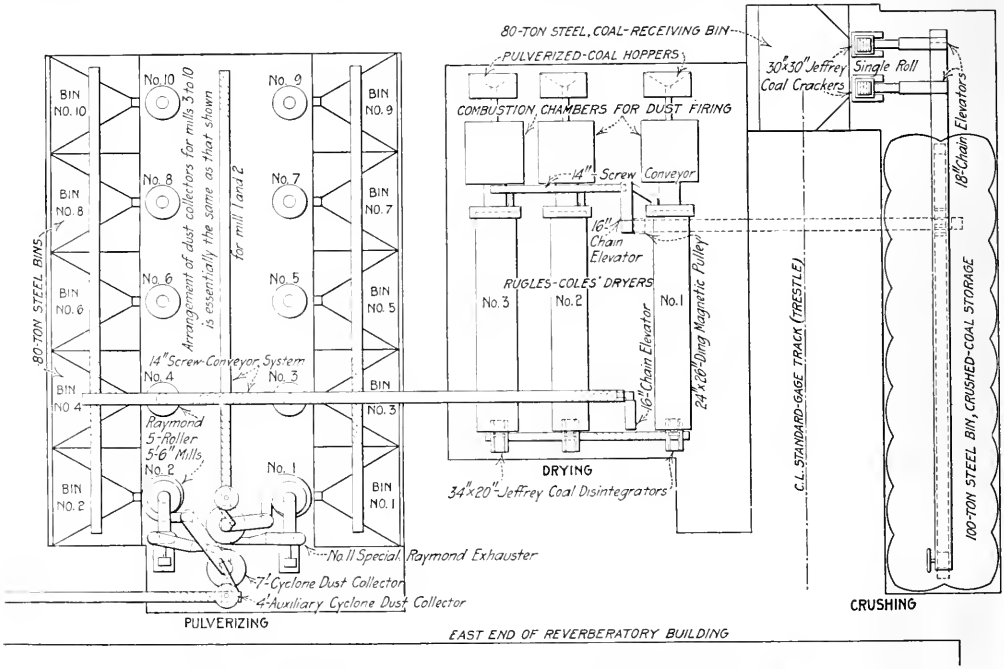
From the drier the coal is discharged on three Jeffreys 20x34-in. coal disintegrators which reduce the coal to $\frac{1}{4}$-in. size. From the disintegrators the coal is conveyed by a 14-in. screw conveyor to the boot of a manganese-steel-chain bucket elevator which discharges into a series of 14-

*Manager, Washoe Reduction Works, Anaconda Copper Mining Co., Anaconda, Mont.

in. screw conveyors delivering the coal into 10 steel hoppers, each one of which is placed above and in front of a Raymond Bros. five-roller pulverizer. These pulverizers are electrically driven and so pulverize the coal that 96% of it will pass through a 100-mesh screen. The pulverizers are operated on the vacuum system, a blower being placed above each mill which draws the coal from the mill as fast as it is reduced to the required fineness and discharges it into a Cyclone collector, where the coal is separated from the air. The air returns in a closed circuit to the Raymond mill. From the collectors the pulverized coal is delivered by a system of 14-in. screw conveyors, in airtight housings, to a 50-ton storage hopper at the firing end of each reverberatory furnace. From this hopper the coal is fed into the furnaces by five Warford coal burners.

as it drops from the conveyor housing is drawn through the four pipes into the mixing chamber, and all of the coal dust entering the mixing chamber is drawn to the end of the blast-air nozzle and thence into the furnace through 5-in. pipes, which in turn discharge into 8-in. pipes. The space between the 5- and the 8-in. pipes allows for secondary air to be drawn in as required to obtain complete combustion of the coal.

The burner and feeder are so arranged that the coal, the primary and the secondary air are under absolute con-

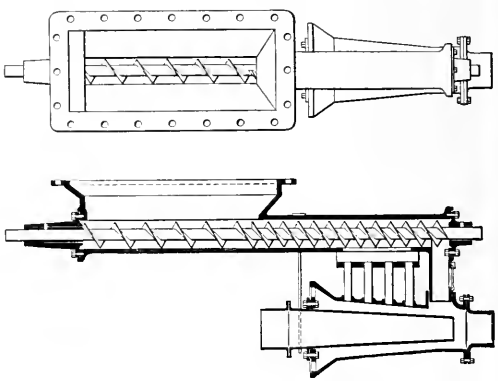


General Arrangement of Coal-Pulverizing Plant at Anaconda, Mont.

The Warford Coal Burner

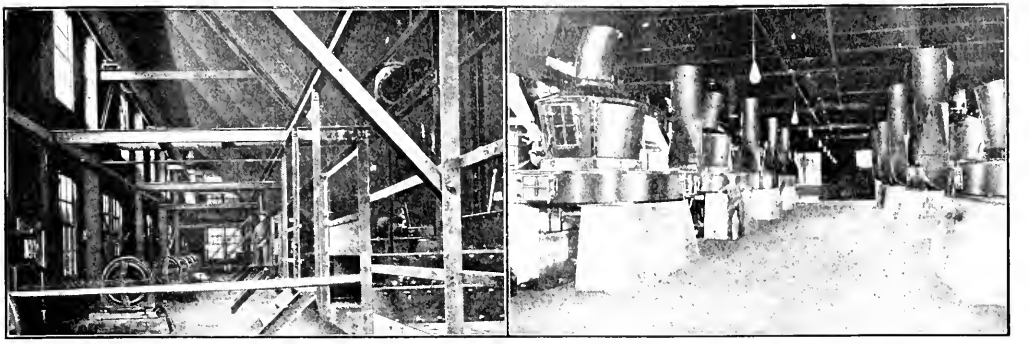
The Warford burners are illustrated in an accompanying drawing and may be described as follows: The feeding device, or control, consists of a screw conveyor inclosed in a cast-iron dust-tight housing which is bolted to the bottom opening of the hopper through which the coal dust is fed by gravity. The screw carries the coal dust forward to the discharge end of the conveyor housing, where it is discharged into four receiving pipes through a long slot; and what does not pass through the slot passes over and drops, through a larger opening at the extreme end of the conveyor housing, on the nozzle in the mixing chamber.

The mixing chamber consists of an outer housing, through which the blast-air nozzle extends. The coal dust



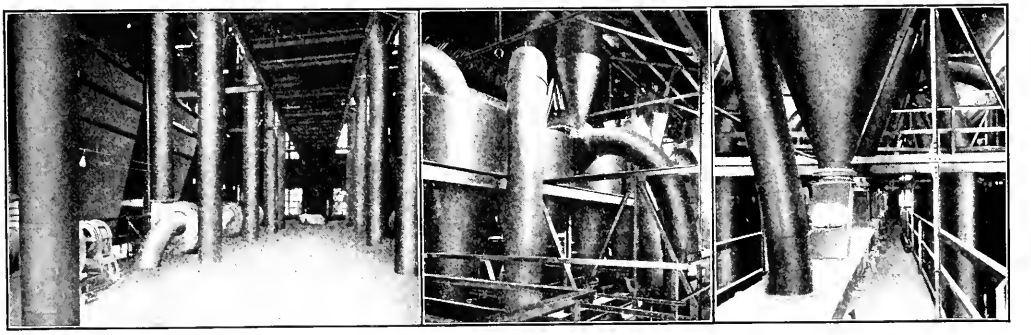
Warford Pulverized-Coal Burner

trol by the operator. These burners are susceptible to close regulation so as to burn any quantity from 5 to 26 tons of pulverized coal in 24 hr.



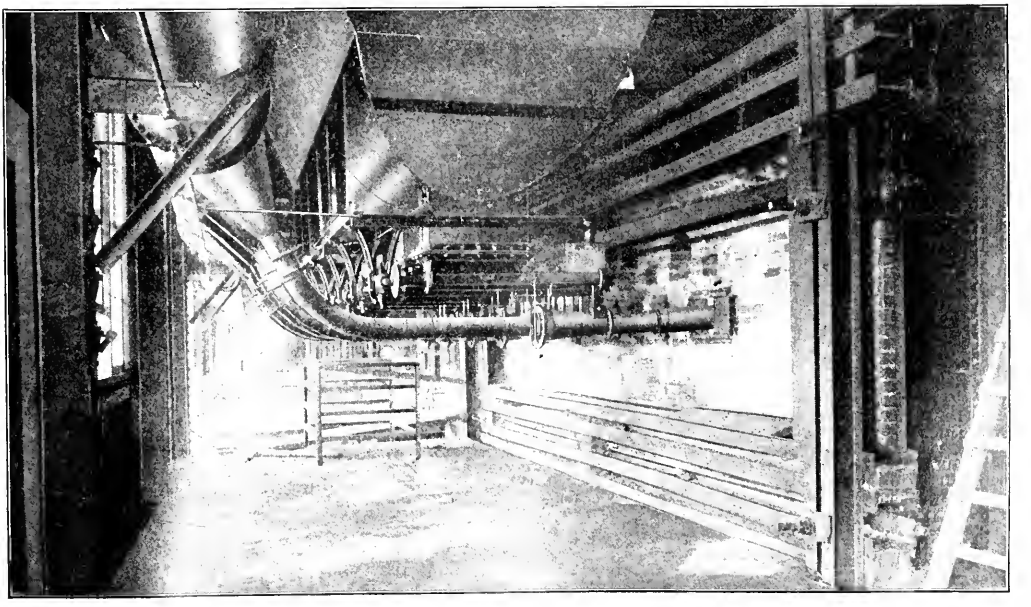
RAYMOND-MILL SECTION OF ANACONDA COAL-PULVERIZING PLANT

There are 10 Raymond mills, each 7 ft. 6 in. in diameter. The discharge from the pulverizing mills is controlled by fans which draw away the coal particles as they become fine enough to be acted upon by the suction



THE COAL-DUST COLLECTING SYSTEM

At the right are the fans that control the discharge from the Raymond mills. The other views show the Cyclone dust collectors and their discharge into screw conveyors delivering to the furnace bins



FIRING END OF REVERBERATORY, SHOWING WARFORD COAL BURNERS

The blowers used to supply air to the burners are two of the Sirocco type, made by the American Blower Co., each having a capacity of 10,000 cu.ft. of free air per minute, and six single-stage centrifugal compressors, manufactured by the General Electric Co., each of these also having a capacity of 10,000 cu.ft. of free air per minute. All of the blowers work on a pressure of 16 oz. and each is driven by a 75-hp. induction motor, direct connected.

The capacity of the pulverizing plant is 1200 tons in 24 hr. The crushers have a capacity of 1200 tons in 8 hr., the intention being to do all the crushing on day shift. The entire plant is designed to be as nearly automatic as possible, and all machinery through which the coal passes is made dustproof, so that but little dust is seen in the pulverized-coal department.

Possibility of Iron Smelting in Norway

SPECIAL CORRESPONDENCE

The Norwegian *Teknisk Ukeblad* in an article on iron-ore smelting in Norway says that England, Belgium, France and Germany will, after the war, require a colossal quantity of every sort of metal and that the demand for iron will increase enormously. The iron works of these countries using foreign ores will, in addition to the cost of the ore, have sea or canal freights and railway rates to meet, expenses which would be avoided by home treatment of a country's products. As regards coal for a Norwegian smelting enterprise, transport from Spitzbergen or England only would be necessary, and in the latter case the transport cost would be small, as the coal would be brought as return cargo by ore boats. The object to be attained is the reduction of Norwegian ores in Norway to as wide an extent as possible. Exporting its crude ores, as Norway is at present doing, is from an economic point of view unsatisfactory, as the labor employed in reduction is lost to the country and it is dangerous to be too dependent on other nations.

Norway possesses much of the world's best iron ore, including the Sydvaranger briquettes, which have a 65% Fe content. Excellent Swedish ore can also be purchased at reasonable prices. These ores are, however, too rich to be employed without the addition of lower grades, and the latter kind Norway possesses. The necessary limestone for slag purposes is available, together with magnesia- and lime-containing materials for furnace construction, and at a low cost. There are, moreover, plans under way for a large output of coal from Spitzbergen and a coke works in northern Norway. Hence the *Teknisk Ukeblad* asks:

> Why not take up our blast-furnace industry again? We have no time to wait upon electric smelting. The electric coke smelters, despite all reports as to favorable results, are as yet an unsolved problem in Norway. On the other hand, the ordinary blast furnaces, developed and proved throughout centuries and now in operation in most places with coke as a reduction material, are, of their kind, almost technically perfect. There has always been an established rule that the ore shall be brought to the fuel, and this has up till now practically held good. Lately, however, it appears that in large, new, mineralized districts it has been the custom to convey the fuel to the ore, and here iron works have been developed relatively more quickly than in the fuel districts.
>
> Broadly speaking, it is calculated that one ton of pig iron requires one ton of coke. Ore ought to be comparatively cheap wherever a blast furnace be operated in northern Norway. For instance, a site near Narvik would be particularly favorable, though there is no reason why it may not be selected even farther north. One should not be too anxious as to the amount of the output. It is apparent that the demand for iron has considerably increased even in our times. From 1870, with a requirement of 18 kg. iron per inhabitant, the consumption in Norway was in 1900 about 53 kg. per inhabitant. In Germany in 1900 it was already over 100 kg. per head. One should not commence with a lesser operation than 100,000 tons of pig iron yearly. Of that quantity about 50,000 tons might be marketed as foundry iron and the remainder refined on the spot by steel works. As regards a market, one must first reckon on Norway, and afterward on Sweden, Russia, Finland and Denmark. For a blast-furnace production of 100,000 tons of pig iron per annum, one-half of which is to be converted into steel, there would be required possibly a capital of 6,000,000 to 7,000,000 kroner ($1,600,000 to $1,875,000). It will be a big undertaking, but one for the benefit of the country and its independence. It will bring money into the country; it will provide a livelihood for Norwegian workmen and officials; and Norway will be self-supplying as far as iron is concerned.

The bulk of the capital employed in mining, as in most other undertakings in Norway, is foreign, and in special iron-ore propositions as at Sydvaranger and Dunderland, it is international, or British. If, after the war, it should prove to the interests of these concerns to continue their policy of exporting to British, German and French smelters, the only alternative, says the *Teknisk Ukeblad* (apart from the purchase of Swedish ores and state-aided mining propositions), would be a prohibitive export duty.

Do Nickel Minerals Underlie Cuban Iron Ore?

Several years ago C. K. Leith and William J. Mead contributed to the *Transactions* of the American Institute of Mining Engineers an account of the lateritic alterations of serpentine in eastern Cuba that produced the Mayari and Moa iron deposits. These authors at the San Francisco meeting will submit some additional data on the mineralogical changes from the serpentine rock below to the lateritic iron ore above. Twenty-nine analyses, supplied by chemists of the Spanish-American Iron Mines Co., representing a graded series from unaltered serpentine to the ore at the surface, were compared by means of the "straight-line diagram" with the analysis of the unaltered serpentine.

Starting with the unaltered rock, it was apparent that magnesia and silica were rapidly lost, magnesia practically disappearing at a distance of 5 ft. above the serpentine rock and silica being reduced to its minimum at about 10 ft. Alumina, iron and chromium rapidly increase with loss of the silica and magnesia. At about 10 ft. from the surface, the alumina shows an increased concentration. Nickel and cobalt are lost relative to iron and alumina, the loss being sharply accelerated at about the same depth at which a sharp acceleration in the relative increase of alumina occurs.

The marked loss of nickel and cobalt during the formation of the ore suggests the possibility of secondary downward concentration of these metals. Descriptions of the nickel ores of New Caledonia indicate that they are the result of alteration of peridotic and pyroxenic rocks and of serpentine rocks derived from them, from which the nickel is leached during weathering and carried down and deposited as hydrated silicates in veins in the underlying unaltered or slightly altered rock. This suggests the possibility of similar occurrence of secondary nickel-bearing minerals in the serpentine rock beneath the Cuban iron-ore deposits.

The Cost of an Ounce of Gold

By Percy E. Barbour

The cost of producing a pound of copper is commonly known and is nowadays almost never omitted from the annual report of any prominent copper-mining company. The cost of producing an ounce of gold is not only not commonly known, but is not included in the report of any gold-mining company which has ever come to the notice of the writer. The reason for this is obvious. Gold is generally, although erroneously, considered as money, and the mental attitude of the casual observer is that the gold-mining company is producing money, and no thought is given to the unit cost; and what is worse, to the unthoughtful observer, producing gold is all profit.

An investigation of the costs of operation per unit of gold recovered, in a large number of operations in various parts of the world, reveals some interesting figures which certainly furnish food for thought.* In classifying these gold-mining operations, we do not find that the type of deposit, or the locality, or the scale of operation has any specific or predominating effect on the cost of producing an ounce of gold.

Referring to the accompanying table, it will be noted that in the dredging operations in the Yukon, California, and Colorado, the cost of producing an ounce of gold is lower on the whole than is shown for other operations by the rest of the table. However, not only are the data of dredging operations enumerated in less number, but there are an equal number of low-cost producers in the other types of deposits mentioned.

PRODUCTION COSTS PER OUNCE AT SOME OF THE WORLD'S LEADING GOLD MINES

Location	Name of Mine	Year	Grade of Ore per Ton[1]	Production[2]	Cost of Gold per Ounce
Alaska	Alaska Treadwell	1912	$2.45	$2,183,150	$11.85
Arizona	Yuma	1 mo.	15.10	37,125	9.67
California	North Star	1912	10.26	1,042,024	11.08
	Melones	1912	1.75	273,307	18.30
	Oroville[4]	1913 1914	8.68[5]	251,599	9.62
	Yuba[4]	1912	16.86[5]	2,665,106	6.26
Colorado	Vindicator	1911	.....	647,710	9.89
	Portland	1912	22.16[5]	1,413,765	15.94
	El Paso	1913	15.26[5]	617,766	16.78
	Camp Bird	1912	26.18	1,742,040	7.65
	Butterfly Terrible	1912	2.99[5]	40,122	19.33
	Tomboy	1913	8.02	1,049,166	11.31
	Colorado[4]	1913	17.41[5]	221,116	6.82
Nevada	Round Mountain	1912	6.24	342,996	16.15
	Goldfield Cons.	1912	18.40	7,652,045	7.21
	Goldfield Cons.	1914	12.57[5]	4,182,888	11.93
So. Dak.	Homestake		4.02	6,319,368	13.72
Bri. Col.	Hedley	1912	10.63	748,133	10.05
Costa Rica	Abanagarez	1912	12.14	606,782	25.01
	Abanagarez	1910	25.71	805,233	13.61
Nicaragua	Lone Star	1910	3.26	92,240	18.91
Rhodesia	Gaika	1912	16.01[5]	£61,996	14.53
Transvaal	Witwatersrand	1911	6.78	£33,324,400	13.58
	East Rand Proprietary	1912	7.81	2,967,443	13.41
India	Mysore	1912	14.63	852,802	8.39
	Ooregum	1912	9.81[5]	327,702	11.22
Australia	Sons of Gwalia	1912	.....	266,774	14.84
New Zea.	Waihi	1912	10.41[5]	293,790	12.20
Yukon	Yukon Gold[4]				
	Dawson Dredging	1912	64.88[5]	$3,346,026	9.76
	Dawson Hydraulicking	....	21.19[5]	629,043	9.13
	Iditarod Dredging	1912-4	1.47[5]	1,971,091	7.69

[1]Yield per ton unless otherwise stated. [2]Includes miscellaneous small incomes. [3]Value in dollars per yard. [4]Dredging operations. [5]Value in cents per yard. [6]Gross value per ton.

If we look first at the large low-grade deposits of gold ore, taking the Treadwell in Alaska and the Homestake in South Dakota, we find their costs per ounce of gold produced are $11.85 and $13.72 respectively. These are close enough together so that we might assume that they are typical of unit costs in this type of deposit. However, many of the figures for other producers in more difficult orebodies, with less local advantage, and with operations on a smaller scale, show lower producing costs than do these two companies. Therefore, although these two companies produce upward of two and six million dollars respectively per annum, and work ore that averages $2.45 and $1.02 respectively, we see that operations on this scale do not necessarily make for low-cost productions per ounce of gold.

Furthermore, the Treadwell mines a lower grade of ore and is less favorably situated than the Homestake, yet has the lower production cost.

If we consider only those mines treating ore under $5 in value, we find the cost varies between $11.85 and $19.33. Looking at these figures again we see that three of the five producers in this class are small ones. It is, of course, perfectly reasonable that small productions should result in relatively higher production costs, but it is not an opinion which would be given offhand by the average man who considers that gold is gold and it matters not whether it is produced in large quantities or small.

Looking now at those companies treating ore of value between $5 and $10, we have five with production costs varying from $11.22 to $16.15. The $16.15 producer is the Round Mountain Mining Co. and mines an ore valued at $6.24 per ton. The production cost evidently reflects both the low-grade of the ore and adverse desert conditions at Round Mountain. Eliminating this one, we have four producers with costs between $11.22 and $13.58, three of these being foreign mines and only one a United States mine. All are large operations, under widely different conditions, and no especial significance attaches to the closeness of the cost.

Comparing these two groups it will be seen that the range of the costs is about the same for both groups, although the limit of value of one is double that of the other.

If we now examine those mines whose ore runs between $10 and $20 per ton, we find eight in the table whose production costs range from $7.21 to $16.78. One mine in this class, the Abanagarez, produced its gold at a loss, its production cost being $25.01 per ounce. This case being an exceptional one, under the circumstances, we are omitting it from consideration in the figures and conclusions, but call attention to it to show that all gold mines are not paying propositions, even if their production is extremely large, as in this case where the annual production was over half a million dollars and the ore above $12 per ton.

Referring again to the table, we find no uniformity to support the too general conclusion. The Goldfield Consolidated has the lowest cost in this group, $7.21 per ounce, the next lowest being the Mysore of India, which has a cost of $8.39. The highest cost is the Abanagarez which we noted above, and the next one is $16.78 at the El Paso mine in Cripple Creek. If we take those mines whose ores run above $20, we have an even greater discrepancy in the producing cost, finding that one producer is as low as $7.65, while the other extreme is $15.94.

If we analyze these figures on the basis of total annual production, we find that for those whose production is less than $500,000 per year, the cost varies from $9.67 to $19.33. For those whose production is between one-half and one million, the cost varies from $8.39 to $25.01. For those whose production is between one and two million, the cost varies from $7.65 to $15.94. Considering those

*The U. S. Mint pays a fixed price of $20.67 per oz. for gold.

whose production is in excess of two million per year, we find that the cost varies from $7.21 to $13.72 per ounce.

The largest producer given in the list is the Witwatersrand, whose production is more than $165,000,000 annually, and its cost of production is $13.58. This is not nearly as low as would be expected, considering the size of the operation and the grade of the ore.

Nor does the company with the lowest grade of ore have the highest production cost, although as we have shown above, the figures indicate the natural expectation that with low-grade ore on small propositions and limited operations, the production cost tends to the higher limit.

The lowest cost in the list is from the Yuba dredging operations in California, and is $6.26 per ounce. Outside of the dredging operations, the lowest cost given in the table is the Goldfield Consolidated for the year 1912, when it produced gold at a cost of $7.21 per ounce. During 1914 the corresponding cost was $11.93, and the average values of the ores for the two years were $19.97 and $12.57 respectively. During 1912, the Camp Bird produced gold at a cost of $7.65. There is a balancing of advantageous and disadvantageous circumstances in these cases which bring the ultimate producing costs so close together, but under widely divergent conditions the Mysore produced for $8.39, a not greatly different cost.

These figures dispel many illusions. Cheap Kafir labor in the Transvaal, coupled with operations on an enormous scale in ore of fair average grade, and under conditions otherwise reasonably favorable, does not by any means give the lowest production cost. Neither does the lowest-grade ore under disadvantageous circumstances give the highest cost of production.

Therefore it is evident that neither the grade of the ore, the locality of the mine nor the size and extent of the operation have a predominating effect upon the producing cost of an ounce of gold.

These figures should show also that producing gold is not all "velvet." None of these figures quoted takes into consideration any of the enormous investments in plant and equipment which are required for this production. Not only do these figures not contain any amortization, but they do not include any interest on the principal. So few companies follow any broad-gage method in this respect that these two factors cannot be taken into consideration in the figures, and in any event, those companies which do write off annual amounts for the sinking fund, have no uniformity of method, and for that reason also it is impossible to include that factor in these comparative figures.

It is, therefore, also evident that the old expression, "a regular gold mine," which is supposed to indicate an ultra-profitable venture, is a misnomer, and that producing gold, even under the best conditions, is often a pretty tough proposition.

Tungsten in the British Empire

One of the industries, formerly carried on chiefly in Germany, which have been established in Great Britain since the outbreak of war is the refining of tungsten, says the *Chemical Trade Review*, quoting from the *Chamber of Commerce Journal*. From the moment of the outbreak of war, the establishment of this industry was of the most importance, in view of the requirements of the factories engaged in the production of armaments. The British Government was not unwilling to assist in founding a tungsten refinery, but steel manufacturers realized that the control which the Government would have properly desired to exercise if public money had been provided, and the fact that the output of the refinery would necessarily have to be sold under certain restrictions, rendered it desirable to dispense, if possible, with such assistance in order that the entire control of the new industry might be in their hands. The steel manufacturers found themselves strong enough to do this, and the refinery is now in operation.

Burma is now the world's largest producer of tungsten ores, the other chief sources being the United States (1390 tons in 1913), Portugal (1380 tons in 1913), South America (Peru, 300 tons in 1913; Argentina, 638 tons in 1912; Bolivia, 497 tons in 1912), and Australia. There is also a small output in Spain, Japan, and the United Kingdom.

The production of tungsten ore in Burma dates only from 1910, when 395 tons were mined, rising to 1671 tons in 1912. The production in 1913 is recorded, unofficially, as 2700 tons. Most of the ore is mined in the Tavoy district, Mergui produces a smaller quantity, and the remainder comes from the Southern Shan States.

The following are some details of the production of tungsten ores, the chief of which are wolfram and scheelite, in other parts of the British Empire:

The production of wolfram in Queensland in 1913 was 359 tons, value £35,359, as compared with 626½ tons, value £57,821, in the preceding year. In addition, 182 tons of "bismuth and wolfram," value £17,867, were mined in 1913, as compared with 191½ tons, value £16,426, in 1912.

The quantity of scheelite exported from New South Wales during the year 1913 amounted to 44 tons, valued at £4457, as against 56 tons valued at £4963, in 1912. The mineral is obtained in the vicinity of the town of Hillgrove. The mineral is found chiefly in patches or pockets. The quantity of wolfram exported from New South Wales during 1913 amounted to 126 tons, valued at £13,037, as compared with 172 tons, valued at £16,584, in the previous year.

The quantity of scheelite concentrates exported from New Zealand during 1912 amounted to 135 tons, valued at £13,347, being a slight increase (as regards value only) over the output during the previous year. This mineral is usually obtained in conjunction with auriferous-quartz mining in Otago and Southland, but during 1912 a quartz-scheelite mine of some magnitude was opened at Wakamarina Valley, Marlborough. The output of wolfram ore in Tasmania in 1913 was 68 tons, value £7040 chiefly from Avoca and from Shepherd and Murphy Mine at Middlesex. The production of wolfram in Victoria, Australia, in 1913, was only 12 cwt., worth £49.

The occurrence of tungsten ores in economic quantity in Canada is confined to a few small areas, the most important of which is situated in Halifax County, Nova Scotia. Operations have been under way on these deposits for two or three years, and one firm is now turning out satisfactory high-grade concentrates. New finds are constantly being made in this district, which promises to become an important producer. In Lunenburg County, Nova Scotia, scheelite, cassiterite, and molybdenite have been found together at a point some three miles east of New Ross, and some high-grade hübnerite, another ore of

tungsten, is to be seen near N.E. Margaree, Inverness County, Cape Breton.

Several tungsten minerals have been obtained in British Columbia, more especially near Salmo. The gold ores of the Kootenay Belle and Queen mines, on or near Sheep Creek, carry an appreciable amount of tungsten, some of which is recovered with the concentrates from the gold mills. At the Meteor mine, in the Slocan district, scheelite has been found. The best of the Western prospects seems to be one situated on Willow Creek, 10 mi. northwest of Barkerville, in the Cariboo district.

Recent statistics of the output of tungsten in Canada are not available. In 1912, 14 tons of concentrated scheelite ore (72% tungstic acid) were shipped, and the shipments for 1913 are stated to have been considerably larger.

As regards the United Kingdom, wolfram ore is mined at Illogan and Carn Brea in Cornwall, the production in 1912 amounting to 193 tons, valued at £16,873.

Russian Mining Laws Protect the Worker

By Leonard C. David*

The rights of employer and employee in the Russian Empire are clearly defined by laws which are strictly enforced. The government's interests in each mining district are looked after by an engineer of experience. He has at each industrial plant or mine one or more "steigers" who have passed examinations for such work and who in reality are government superintendents, responsible to a district engineer for the safety and sanitation of the works.

In case of an accident, the first on the scene are generally the police; and the "priestoff," who is the local chief of police, makes out a protocol or statement based on first-hand evidence and if possible blames the steiger or some other individual for neglect. The steiger makes a protocol also, and these two protocols go to the district engineer, who goes to the scene of the accident, makes out a protocol of his own, and on the basis of his conclusions the government starts suit for the injured person. It has often happened that the steiger or some other person has had to serve a sentence in jail for neglect of duty, as specified by the Russian mining law.

In hiring men, the law requires that all applicants shall pass a rigid physical examination by the doctor or his "feldsher." The feldsher is a man trained in first-aid work as well as in pharmacy, and such men are valuable around industrial plants. For the first six days, a new man is on trial and can be discharged without notice. After six days he becomes a regular employee and cannot be discharged without 14 days' notice, or he can be immediately discharged and paid for 14 days of work. The Duma recently passed a workingmen's compensation or insurance law which provides for a fund contributed mostly by the companies. In case of illness or injury an employee receives half of his wages from this fund. The employee contributes each month 2% of his wages toward this insurance.

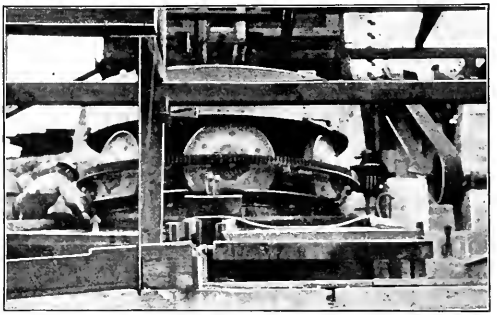
The interest in these stipulations is due to the usual assumption that the welfare of the Russian wage-earner is a matter little considered by his government and its lawmakers.

*Mining engineer, Box 485, Chisholm, Minn.

Milling Below Sea Level

By Lewis H. Eddy*

The milling plant of the McCausland mine in the extreme southern end of Death Valley, California, stands at a point 150 ft. below sea level. The mine is on the rim of the valley at an elevation of 2250 ft. above sea level and four miles from the mill. The ore is hauled from mine to mill on motor trucks. This is probably the lowest point at which milling or other metallurgical operation is carried on in California or in the Pacific Coast region. There are ranches below sea level and there is a large amount of travel across and through Death Valley at minus elevations. But usually the mines in this region



Lane Mill at McCausland Mine, California

are so situated that the treatment of ores may be carried on at points above sea level, and generally within the area of the mining ground. The McCausland mine stands at a comparatively low point, although there are mines in neighboring regions as low or lower, but the topography here is so precipitous that the floor of Death Valley offers the only point within reasonable distance for the installation of the mill.

So much has been written and told of the terrors of Death Valley and the hardships of desert mining that probably few people, unacquainted with the topographic and climatic conditions of the desert regions, believe it possible to labor below sea level. There are places where it is not possible to labor or to live without suffering great discomfort, and they are not confined to Death Valley nor to even sea level. The chances are better at the mill camp of the McCausland mine than in the center of Panamint Valley at an elevation of 1000 ft. It is not so much the proximity to sea level that one need fear as the distance and elevation of the surrounding mountains and the absence of water. At the McCausland camp, as at Furnace Creek ranch, one is in the shadow of the mountains. In the broader expanses of Death Valley and of Panamint Valley there are no shadows.

The McCausland mine and milling plant are situated about 30 miles west of Zabriskie, in Inyo County, a shipping station on the Tonopah & Tidewater R.R., three miles north of Tecopa. Machinery for mine and mill was shipped from Los Angeles via the Santa Fé Ry. to Ludlow, thence via the Tonopah & Tidewater to Zabriskie, and hauled in on motor trucks over fairly good roads. The metallurgical equipment consists of a 10-ft. Lane mill,

*Associate editor, "Engineering and Mining Journal," San Francisco, Calif.

8x16-in. Samson crusher, Hammil elevator ore feeder, grizzly, amalgamating plates and Wilfley concentrating tables. It is driven by a 32-hp. Fairbanks-Morse distillate engine. The Wilfleys were taken out of commission after trial runs showing that concentration was not essential.

Prior to installation of the plant, laboratory amalgamation tests showed possible recovery of 57% of assay values by amalgamation. On this account the concentrators were installed. Practical operation of the mill, treating 40 tons per 24 hr., gave 93 to 96% of assay value by inside amalgamation alone after an improvement, fashioned by the mill superintendent, had been installed. This device consists of raised beads forming riffles placed diagonally across the mill plates, which assist in building up amalgam on the plates by protecting it from the action of the current, the amalgam forming mainly behind the raised beads. This improvement while aiding amalgamation is not claimed to be wholly responsible for increasing recovery, but it took the place of the concentrators. The discharge product is fine, 72.51% passing a 100-mesh screen and 53.42% passing a 200-mesh screen. The ore is at present of more than average hardness. The property is owned chiefly by B. W. McCausland and is not incorporated. R. D. McCausland is mine superintendent and Alexander McLaren mill superintendent. The milling plant was built and installed by the Lane Mill & Machinery Co., 236 Douglas Building, Los Angeles.

Absorption of Gases by Refined Copper

The gas-absorbing power of molten copper increases in general with the temperature up to a certain point, also with increasing purity of the metal, and with the partial pressure of the gas; the presence of Pt or Ni, however, has a favorable influence on the absorption, according to W. Stahl in *Metall und Erz* (abstr. *Journal* Soc. Chem. Ind., Dec. 15, 1914).

The disintegration of copper which takes place during solidification has been traced to occluded SO_2, which is formed by oxidation of the sulphur present, and given up during solidification with a "spitting" action. Up to 1500°, the absorption increases almost linearly with the temperature and approximately as the square root of the pressure. The fact that the gas causes the metal to "spit" and become spongy during solidification, and that a considerable quantity of gas is still retained in the cold metal, shows that absorption and not adsorption effects are concerned. SO_2 does not diffuse through solid copper below 1000° C. The interaction of cuprous oxide and sulphide, giving copper and sulphur dioxide, is exothermic; the reverse reaction can be expressed as $Cu_2S + 2\ Cu_2O = 6\ Cu + SO_2 - 38{,}000$ cals. It follows from this that an equilibrium relation will be obtained. Estimations of the lowering of freezing point produced by the oxide and sulphide show that the compounds occur as Cu_2S and Cu_2O, and that their solubilities are more than sufficient to account for the absorption of SO_2 by decomposition and chemical reaction. The fact that the addition of either Cu_2S or Cu_2O to the system diminishes the solubility of the gas is also in accord with this view. That a state of equilibrium between the four participating bodies occurs at all temperatures has been verified in a number of investigations.

Evidence of the solubility of hydrogen is given by the surface disintegration and blister-like structure assumed by the metal during solidification after exposure to this gas. An absorption of H_2 in, and diffusion through, copper has been detected at 650° C. Up to 1500° C. the absorption increases almost linearly with the temperature, except at the melting point of the metal when a sudden increase occurs. At 650° the solubility is 0.1 and at 1500° C., 1.4 mg. H_2 per 100 grams of copper. With both the molten and solid metal, the solubility increases as the square root of the pressure. The conductivity of copper is not affected by dissolved hydrogen. On heating copper containing oxide in a hydrogen atmosphere, the gas penetrates the metal and reduces the oxide with formation of water, which escapes by disintegrating the metal and rendering it unsuitable for further mechanical working. A reaction of this nature takes place in molten copper during the "poling" treatment.

Hydrocarbons are decomposed by molten copper into carbon and hydrogen, of which the former is oxidized and the latter absorbed. No occlusion of any undecomposed hydrocarbon has been observed.

The dissociation pressure of cuprous oxide equals the partial pressure of atmospheric oxygen, or 0.21 atmospheres, at 1662° C. When in solution in the copper, the dissociation pressure is lowered so that at 1600° C. it is certain that no thermal decomposition of the dissolved oxide occurs, and the absorption of O_2 at this temperature is not a physical solution but a chemical combination.

With water, carbon-dioxide, nitrogen, argon or helium gases no absorption by either solid or liquid copper can be detected. A slight solubility of carbon monoxide has been shown by changes in the density produced in the metal by its presence, by the blister-like structure it imparts to the metal, by spectrum analysis, and by direct measurement. At 1120°, 61 grams of Cu absorb 0.15 c.c. CO. This small quantity of gas appears to have a marked influence on the physical properties of the refined metal.

The above data indicate that during the refining of molten copper, the absorption of CO predominates during the end of the "hard poling" period and at the beginning of the "green poling," while the absorption of H_2 predominates during the latter period when the oxygen has been removed.

Duty to Warn Mine Employees

In exonerating a Missouri mining company from liability for fatal injury to a shoveler in a mine, received while attempting to explode a stick of dynamite in breaking up boulders the second day of his employment, the Springfield Court of Appeals holds that an operator of a mine is under no legal duty to warn an employee against an ordinary danger of his work, unless the operator has actual or constructive knowledge that the employee is inexperienced in that line or work; than an employer is entitled to assume that an adult applicant for a given position is competent to perform the work of that position; and that an inexperienced employee is guilty of contributory negligence in attempting to use dynamite in breaking boulders, merely because others in the same employment are permitted to do so. (Batesel vs. American Zinc, Lead & Smelting Co., 176 *Southwestern Reporter*, 446.)

Shaft-Rockhouse Practice in the Copper Country—IV

By L. Hall Goodwin*

SYNOPSIS—Quincy rockhouse system complicated because of necessity of handling much mass copper. Copper Range system extremely simple. Quincy employs elaborate methods to handle mass. Copper rock fed to crusher by use of chute with gate at each end. Quincy crushers use broad corrugations. Two methods of loading stamp rock. Copper Range uses no grizzly, passing all rock through crusher. Comparisons of methods are vain.

The rockhouse methods taken up in this installment are those used by the two largest companies in the district not controlled by the Calumet & Hecla interests.

The Quincy System

The flowsheet of Quincy No. 2 rockhouse which T. C. DeSollar presents in his paper describing that building, read before the 1912 meeting of the Lake Superior Mining Institute,[1] shows, I believe, a more complicated arrangement of working parts than would a similar diagram of a rockhouse of any other mine in the district, and this is largely true because this company's rockhouse problems are increased by the large proportion of mass copper in the Pewabic lode.

The term mass copper is used rather loosely to cover all sizes of the native metal as it occurs in the rock, from small nuggets up to huge masses weighing many tons. A distinction is sometimes made by referring to those sizes ranging from, say, 50 lb. down to fist size as "barrel-work," a term derived from the old custom of sending masses of this size to the smelting plant in barrels. At the different mines in the district the occurrence of mass copper differs in the proportion it bears to the stamp copper in the vein. At some mines it is of rather slight importance; at others it forms a considerable percentage of the total output. Among the bedded veins, which at present are the only ones worked, it appears that the mines near Portage Lake, Quincy, Isle Royale and Hancock, have a larger proportion of mass than the others.

Handling Mass Copper

Thus Quincy practice in handling mass copper is more highly developed than that of any other mine, and while a description of its methods will not be exactly typical of those of the district, it will cover the subject more fully than a like description of any other method. Fig. 16 shows diagrammatically the sequence of the principal processes involved in the segregation of the mass copper from the copper rock and the disposition of those two products. The fine rock which will pass the grizzly and all rock which has been crushed are here referred to as "stamp rock."

Masses so large that they will not go into the skip—and there are many such—are cut underground by means of a pneumatic chisel into pieces small enough to hoist. These pieces, as well as those single masses weighing from a few hundred pounds up, which do not need to be cleaned of the rock adhering to them, are hoisted in the regular rock skip, but are not mixed with copper rock and are not taken to the rockhouse proper, but are dumped automatically into the shafthouse just above the collar of the shaft upon a concrete chute. This is faced with old rails to protect the concrete from rapid wear by the jagged edges of the heavy mass copper. This chute delivers the masses to a platform at a convenient height for loading on railroad flat cars, on which they are shipped directly to the smelting works. Masses weighing up to eight tons are loaded on the cars by means of chain blocks hung from trolleys carried on heavy I-beams which extend over the track.

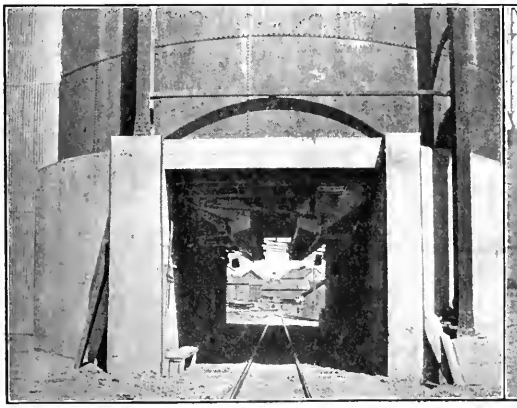


Fig. 12. Quincy Method of Loading Stamp Rock

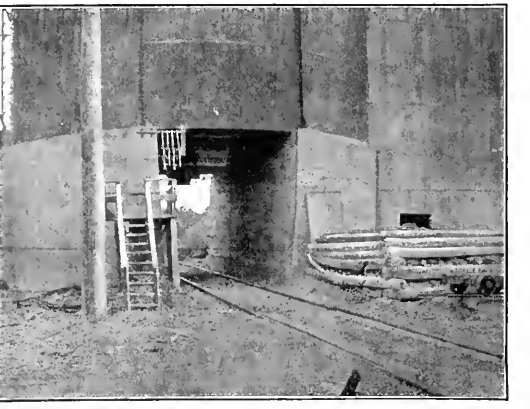


Fig. 13. Usual Method of Rock Loading

*Assistant with Allen H. Rogers, 201 Devonshire St., Boston, Mass.

[1]"Proceedings" of the Lake Superior Mining Institute, p. 217, 1912.

Smaller masses, and larger ones up to a ton or more, which need to be cleaned under a drop hammer before they can be shipped, are dumped into the skip underground along with the copper rock. At other mines no attempt is made to separate these masses from the copper rock mechanically. They are simply picked out before the rock is fed to the crusher; at the Quincy, however, a set of 6-in. round grizzly bars, 16 ft. long, sloping at 16° and having 20-in. spaces, is placed over the copper rock grizzly so as to take off the larger masses, as well as large pieces of copper rock which have to be broken by the drop hammer before being fed to the crusher. These wide-spaced grizzly bars deliver the masses to a chute, which conducts them over a working part of the crushing floor to a bin at the extreme side of the building. This bin is rectangular, one side of it being entirely open and facing a 3000-lb. drop hammer. An air lift is used to handle the masses, which are placed under the hammer and pounded, a few blows usually being sufficient to render them fairly free from adhering rock. They are then placed on a heavy iron pan which swings from a crane to clear the sides of the building, and are lowered to a platform outside, from which they are readily removed to railroad cars.

Those masses which are too small to be removed by the 20-in. grizzly go into the hopper bin along with the copper rock and are later separated from it by the crushermen, who pick it out by hand or with the aid of the air lift as it goes through the chute from the hopper bin. It is important that all of the mass be picked out, as it does not require a large piece to cause great trouble between the jaws of the crusher. These masses are piled up on the "copper pan," a semi-circular steel chute set at a slight inclination, at the lower end of which is a small steam hammer. The copper pan is situated between the two crushers so that it may be easily reached from either of them. The barrel-work copper is left piled up on it until the man whose duty it is gets around to clean it; it is then thrown into a chute leading to the mass-copper bin. This small steam hammer does the work of cleaning the barrel-work quickly and effectively and is an important adjunct to all Quincy rockhouses. So far as I know it is not used elsewhere in the district.

Handling Copper Rock

Under the widespaced grizzly is a smaller one with 3-in. spaces. Undersize from this grizzly goes directly to the stamp-rock bin, oversize to the hopper bin, a cylindrical steel bin having a capacity of about 10 skip-loads. Two openings set radially in the sides of the hopper bin at its bottom lead to chutes which feed two 24x36-in. crushers. The chutes are about 5 ft. long and are set at 30°. Feed to them is controlled by a heavy iron gate sliding vertically to close the opening in the hopper bin; feed from them is controlled by a sort of flap apron, hinged along the bottom edge of the chute, which swings upward in an arc to close the chute and is operated by an air cylinder.

The operation of feeding rock to the crusher is as follows: The chute being empty, the apron at its end is raised to prevent the rock from going to the crusher, the bin gate is lifted and the rock allowed to run out until the chute is full; then the bin gate is allowed to close by gravity and the mass copper and waste are picked out; the chute apron is lowered and the rock is allowed to feed to the crusher; when the chute is empty the operation is repeated. Of course in practice the method works faster than this description would indicate, both gate and apron often being open at the same time.

Power is furnished by a corliss engine on the crusher floor, and a motor of corresponding capacity is always held in readiness to assume the load should anything happen to the engine.

Fig. 15 will serve to illustrate the general features of the design of the Quincy No. 2 shaft-rockhouse and to make clear the preceding description of its rock-handling methods. As stated in Part I, this building may be viewed as typical of a broad class of modern shaft rockhouses in the Lake Superior district.

Advantages and Disadvantages of Method

As has been stated, this process is complicated and the rockhouse work is increased, compared with most other mines of the district, by the large amount of mass copper handled. The crushing floor occupies a space only 44 ft. square, and the effective arrangement of the machinery in this limited space enables a large output to be handled by only three men per shift, one of whom attends to the machinery and cleans most of the mass copper. The hopper bin furnishes a small storage capacity, which enables hoisting operations to be continued for a while after any accident has happened, and it also enables all three of the rockhouse men to work for short periods at operating the drop hammer, etc. A disadvantage of the method would appear to be that the grizzlies, located as they are at the top of the hopper bin, are out of sight of the men on the crusher floor and are not easily reached to be cleaned. At the North Kearsarge No. 4 rockhouse of the Osceola Consolidated, which uses the Quincy system, this difficulty is eliminated by having the lander stationed near the grizzly, and it is one of his duties to clean down the grizzly each time after a skip has dumped. This method would not be applicable at the Quincy, however, as the lander is an important man in the shafthouse end of the building.

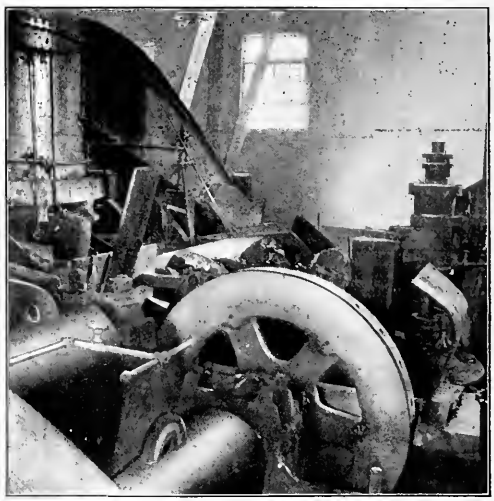


Fig. 14. Crushing Floor at the Quincy

Details of Quincy Crushing

Quincy crushers, Fig. 14, are operated at the low speed of 140 r.p.m. presumably because of the comparatively soft amygdaloid rock handled. It appears to be a rule that the hardness of the rock governs the speed of the crusher. The Calumet & Hecla, where it handles the hard conglomerate, uses about 175 r.p.m., and the Copper Range mines, on their dense amygdaloid, use as high as 185 r.p.m.

Crusher jaws at the Quincy have wide corrugations, 1 ft. between the tops of adjoining ridges. Some mines use narrow corrugations ranging down to 2 in., and it has already been noted that the Calumet & Hecla uses smooth jaws. Various ideas are held as to the virtues of corrugations, but later practice seems to tend toward avoiding them entirely, since they retard the discharge of rock and make it more difficult to extract masses from between the jaws. The broad corrugations at Quincy, however, appear to have distinct advantages, and they are so wide that the disadvantages of the usual corrugations are largely avoided. A large boulder, which would bear fairly evenly over a considerable area of a flat jaw or on many of the small corrugations of the usual type, will bear at, say, four points only, corresponding to its contact with two ridges on either jaw. This has the effect of confining the breaking at first to a few points, and the strain on the crusher is much less.

Quincy jaws are made of manganese steel, which is the usual practice throughout the district. The Calumet & Hecla uses this material at the conglomerate rockhouses, but uses chilled cast iron for the amygdaloid, presumably because it has facilities for casting the iron jaws, which, however, would not be suitable for crushing the hard conglomerate. For the softer rocks the chilled iron is quite as good as manganese steel, its only disadvantage being that the chilled surface is likely not to be uniformly hard and the jaws wear unevenly.

Loading Stamp Rock

The Quincy method of loading stamp rock from the main storage bin into cars for transportation to the mill is unique in the use of air cylinders for operating the chutes and also in the arrangement of the chutes. These are placed in pairs opposite each other on each side of the railroad track, and each pair is operated as one by a 3x15-in. air cylinder (Fig. 12). This arrangement of the chutes is good because there are more than twice as many of them as when there is a single row placed over the center of the track, which permits more rapid loading and draws the rock from a greater bin area; in fact, nearly the same result is accomplished in this way as is obtained by putting two tracks under the bin. The form of chute used is simple. It is closed by two aprons, of which the more important is hinged along the lower edge of the chute and swings upward in an arc to stop the flow of rock, while the other is hinged above the mouth of the chute and acts by gravity only.

That this method is not used elsewhere is probably due to the fact that at other properties the supply of air for rockhouse use is wholly dependent upon the underground

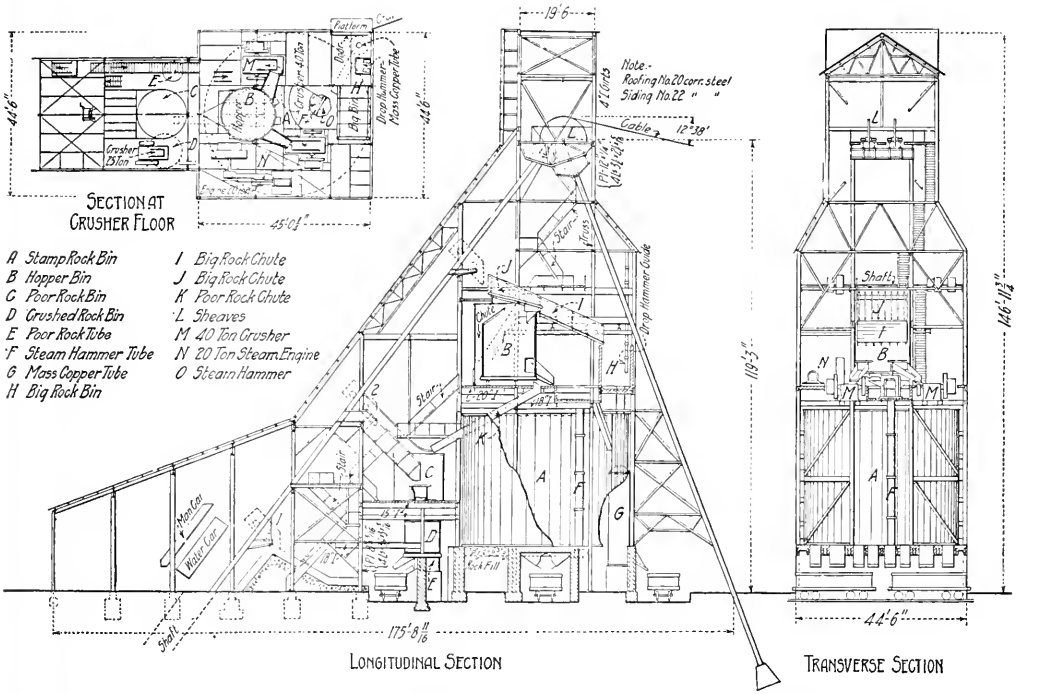


Fig. 15. Plan and Elevations of Quincy No. 2 Shaft-Rockhouse

air system, and when the main air compressor is stopped between shifts no air is available for rockhouse operations. The Quincy overcame this difficulty by installing at each rockhouse a small Westinghouse air pump, which is so regulated that it starts and stops automatically, depending on whether the pressure in the mains falls below a certain point or exceeds it.

The other important method of loading stamp rock is used almost exclusively throughout the district, except for the Quincy. The form of chute used is essentially the same as that just described, but the chutes are placed directly over the center of the track, and the levers operating them are worked by hand (Fig. 13). The important factor in comparing present practice with old is that the levers are controlled from a central point. At the Quincy there is a recess in the bin foundations large enough for a man to stand in and operate the air cocks; while at other mines the levers are operated from a platform at the side of the track, or between the tracks if

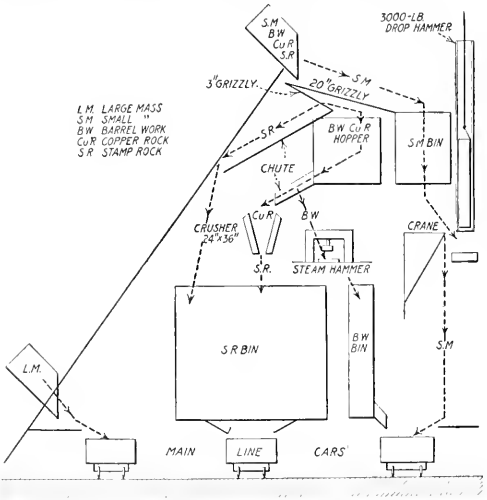


FIG. 16. DIAGRAM OF QUINCY ROCKHOUSE OPERATIONS

there are two of them. At many of the older rockhouses —such as those on the Calumet conglomerate and the Osceola amygdaloid in Calumet—there are two tracks under the bin, because the old rectangular bins were so large in horizontal section. Two tracks are still used, but for a different reason, where the bins are unusually large as at the new Ahmeek Nos. 3 and 4 shaft rockhouse.

Statements as to the speed with which a car can be loaded are often overdrawn. For instance, the claim has been made that at a certain plant using the usual method a 40-ton car can be loaded in 10 sec., which is perhaps true. However, after reading that statement, I found an item in my notebook regarding this shaft which stated that it required 13 min. for two men and a locomotive with its operators to load nine cars, which is probably nearer the actual working speed.

COPPER RANGE CONSOLIDATED SYSTEM

The method of handling copper rock used by the Copper Range Consolidated is unique among those of this district in that no attempt is made to remove the fine rock by a grizzly, all of it passing through the crusher. In other respects the method is much like that of the Quincy insofar as copper rock is concerned, although the smaller proportion of mass in the Copper Range rock makes its rockhouse problem much simpler than that of the Quincy.

The skip dumps directly into a large hopper bin with a capacity of about 25 to 30 skip loads. From there the rock is drawn off through two openings opposite each skip dump. The mode of feeding the crusher is exactly the same in principle as that at the Quincy, but the methods differ in details. The hopper bin instead of being of cylindrical steel construction is of wood, and of rectangular pattern. Steel is used sparingly about the bin. It is used in places where the wear on wood would be excessive and in a small space back of the bin door to provide a chute which aids in starting the rock through the door, the rest of the bin bottom being of the usual rock type. The bin doors are closed by vertically sliding wooden gates 5 ft. square, lined with 2-in. cast-iron plates. The lower end of the chute rests directly on the jaw of the crusher, and the chute is closed by an apron pivoted on a shaft on the top of the crusher and fitting into the lower end of the chute. This chute apron and the bin gate are operated by air lifts.

Mass copper is cleaned under a drop hammer and is then pushed through a door and allowed to drop to a platform, built of log cribbing filled with waste rock, alongside a railroad track.

The Copper Range method is minutely described in a paper[2] read before the 1912 meeting of the Lake Superior Mining Institute, and an interesting discussion of the development of the rockhouse practice of this company is given.

ADVANTAGES AND DISADVANTAGES

The great advantages of the system are its extreme simplicity and the small maintenance charges necessary to keep the rockhouse in first-class working condition. The regular crew consists of two men only, who handle a large output. The great capacity of the hopper bin enables hoisting operations to be continued while any ordinary breakdown in the rockhouse equipment is being repaired. The hopper-bin opening is made so large that the usual trouble experienced in getting the larger pieces of rock through that opening is largely avoided.

The natural criticism is that power is wasted in doing unnecessary crushing on the fine rock. This disadvantage is partly offset by the better crushing secured, and it has been found an advantage to have the stamp rock in the bin evenly mixed, as is the case where all the rock goes through the crusher.

I would not like to create the impression that the small space accorded to this system is a measure of its worth. The method is so simple that it does not require much description, and many details of its practice have been considered in other parts of this paper.

COMPARISONS OF THE SEVERAL METHODS

To those only superficially acquainted with Lake Superior mining it will perhaps seem that so wide a variance in rockhouse methods as is indicated by our preceding descriptions is not justified, and that it must necessarily follow that some of these four broad methods must be

[2] "Rockhouse Practice of the Copper Range Consolidated Company," by H. T. Mercer, chief engineer, "Proceedings" of the Lake Superior Mining Institute, 1912, p. 283

notably weaker than others. As a matter of fact, although the producing Lake Superior copper mines are located on the same type of bedded vein, of either amygdaloid or conglomerate formation, the rock from different mines needs different treatment in all departments—mining, milling and smelting. Another factor is that two different managements confronted by the same problems will work along entirely different lines and by close attention to the weak points of their respective systems so perfect them that a comparison of the two as regards their ultimate efficiencies must be made reservedly.

In comparing different rockhouses of the same mine, which serve shafts having about the same capacity and handle the same kind of rock, the ultimate analysis of rockhouse efficiency is found in the cost sheet. In this case figures do not lie. It would be not only useless but misleading, however, to compare figures of costs of the different companies' rockhouse operations, because that cost depends upon many factors which are widely variable at the different mines.

As a general proposition, the statement may be made that some of the most efficient rockhouses, serving shafts of large capacity and operating under favorable conditions, have shown over considerable periods an average rockhouse labor cost of 2½ or even 2c. per ton of material handled. This figure is probably much lower than the average cost in the district as a whole. The important facts in this connection are that costs have shown a steady decline for many years, and that according to figures recently published covering one of the important mines the unit cost of material handled was shown to have decreased approximately 50% during the last 10 years. Another important mine reduced its unit rockhouse costs nearly 70% in 12 years; and these economies, it must be remembered, were effected in the face of material advances in the price of labor.

In closing this series of articles I wish to extend my thanks to the general managers of the several properties, who were without exception liberal in extending courtesies, and also to those rockhouse superintendents, engineers and others who aided me, many of whom put themselves to a great deal of trouble to give accurate information.

Qualifications of Montana Hoisting Engineers

By A. L. H. Street*

Under the provisions of a law enacted at the last session of the Montana legislature, operators of electric- or air-hoisting engines of more than 25 hp., used in lowering or hoisting men in mines or other underground works, must obtain licenses renewable annually. Two classes of licenses are provided for, first- and second-class. Holders of the former may operate any hoisting engine covered by the law, as may first-class licensed engineers. Licenses of the second class do not authorize the operation of hoisting engines of more than 100 hp. The power to issue and revoke licenses is vested in the State Boiler Inspector. The act declares it to be a misdemeanor for an unlicensed person to operate hoisting engines covered by the law, or for an owner or manager to knowingly employ such person.

*Attorney, St. Paul, Minn.

United States Bauxite and Aluminum Production

The production of bauxite and the consumption of aluminum in the United States in 1914 were the largest ever recorded. The report prepared by the Geological Survey shows an output of 219,318 long tons of bauxite in 1914, against 240,241 long tons in 1913. The states which produced bauxite in 1914 were Alabama, Arkansas, Georgia and Tennessee. Arkansas produced more than 80% of the output, owing to the extensive operations of the American Bauxite Co. in Saline County. The production of Georgia, which held second place in both years, and of Alabama and Tennessee was considerably less in 1914 than it was in 1913. The imports of bauxite amounted to 24,844 long tons, or 3388 tons more than in 1913.

Bauxite is used in the production of metallic aluminum (its most important use) and in the manufacture of aluminum salts, of bauxite bricks and of alundum. The commercial mineral carries 50 to 60% of Al_2O_3, corresponding to 26.5 to 31.8% of Al.

Alundum, which is used extensively as an abrasive, is made at Niagara Falls, N. Y., by fusing calcined bauxite in an electric furnace. Only the best grades of bauxite are used in the manufacture of such chemicals as alum, aluminum sulphate and aluminum salts, as freedom from oxide of iron is desirable for such purposes.

Another use to which bauxite is adapted is in the manufacture of calcium aluminate, which gives a quick set to plaster compositions.

The quantity of aluminum consumed in the United States in 1914 was 79,129,000 lb., against 72,379,000 lb. in 1913 and 65,607,000 lb. in 1912.

The value of the exports of aluminum and of manufactures of aluminum amounted to $1,546,510 in 1914, as compared with $966,094 in 1913.

Aluminum is the most abundant of metals and ranks third among the elements which compose the crust of the earth, being exceeded only by oxygen and silicon.

Tennessee Mines' Output, 1914

The mineral and metal output of Tennessee for 1914 was as follows, the items standing in decreasing order of value: Coal, 5,753,476 tons; pig iron, 2,905,672 tons; copper, 18,249,839 lb.; phosphate rock, 379,826 long tons; zinc, mill ore, 329,943 tons; coke, 234,129 tons; iron ore, 304,675 long tons; limestone, 72,693 tons; silver, 97,302 fine oz.; bauxite, 23,400 long tons; mineral paints, 1600 tons; barytes, 1255 tons; gold, 300 fine oz. There was a considerable production of ceramic and building material which is not covered in the figures given here.

Potash Deposits in India May Be Developed, according to a recent report of the Indian Geological Survey, at Khewra and Nurpur in the Punjab salt range. The Prussian deposits differ markedly from those found in India. They are of course greater in extent, but mineralogically there is also a wide difference. Although both were probably similar at the time of their deposition, the Punjab deposits have been affected to a much greater degree by thermal metamorphism, so that carnallite, for instance, one of the chief products mined at Stassfurt, is unknown in India. Since the outbreak of war the subject has assumed an added importance, for the main sources of the world's supply—the deposits in Germany and Austria—have been cut off. The possibility of the economical exploitation of the Indian deposits has been enhanced, and the subject is now engaging the attention of the government of India.

Details of Practical Mining

Sample Bags and Sample Filing

By Frederick W. Foote*

The accompanying description is of the sample bags I made and used and the method of filing them for reference. The bags are of light-weight canvas. A piece 16x14 in. is split for a couple of inches as in Fig. 1. The flap *A* is then sewed down, leaving a hem sufficiently deep to hold a small stick. The sticks used in the bottom of window shades have been found to be satisfactory. The flap *B* is then sewed down with a piece about 5 in. deep inserted. This piece, *C*, is used as a cover when the bag is finished. The bag then appears as in Fig. 2. It is then folded along the dotted line and sewed together firmly along the line *X*, the bag is turned inside out, and appears as in Fig. 3.

Sticks 12 in. long are then cut and inserted in the hems and fastened with string through holes *D* in the

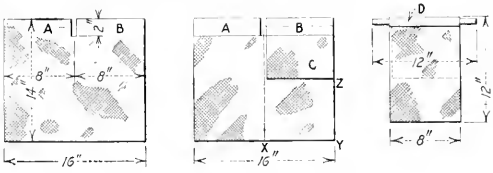


Fig. 1 Fig. 2 Fig. 3

Convenient Sample Sack

sticks. The material for these bags costs 5c. each and one can be made, even by an amateur, in an hour. After the sample has been put in the bag the flap *C* is put outside and rolled under the stick on the opposite side. The ends of the stick are then tied firmly together. The bags when fastened in this manner are good to detect salters. The tops have the appearance of an opening, but the flap underneath will catch any dust that might be inserted. A card stuck in this opening may show the location of the sample and the assay value.

Wishing to keep the samples of several properties separate and easily accessible I devised a rack similar to a filing cabinet, having one tier for each property. These racks were built with 9 in. between the sides, 14 in. in height and were made to slide in and out of the framework. Each sample bag is placed in the rack and held in suspension by the ends of the sticks resting on the framework. In a large property separate racks could be used for each level or any other arrangement most suitable to the individual requirements.

*University, Va.

Compressed-Air Leaks

Too little attention is paid to having compressed-air pipes underground tight and free from leaks. With the advent of the several excellent compressed-air meters now on the market, it is hoped that more attention will be paid to testing compressed-air lines for leaks, and when the amount and cost of these leaks are determined, the present careless inattention to this detail of mining will very quickly be done away with. J. H. Rider, in a paper read before the Institution of Electrical Engineers, states that at a barometer pressure of 24.5 in. an orifice of only ¼-in. diameter will pass 450 lb. of air per hour at 100-lb. pressure. This runs into money very fast, and the common sizzling at joints of air hose around machine drills accounts for a large item of the operating cost.

Cementation Process for Sinking Shafts*

The cementation process is employed where the quantity of water running into the shaft is difficult to keep down with a pump. It is a question also whether, when a shaft is to be sunk in ground that is known to be faulty, and in which water may therefore be expected to rush in through fissures at any moment, it may not be wise to protect the sinking at the commencement by the adoption of the cementation process.

The plan involved in the cementation process is to fill all the fissures through which water can run into the excavations; practically to dam back the water. According to the experience in the United Kingdom, the process is successful, except in certain cases, and it appears that in those cases the freezing process would be even more difficult to carry out.

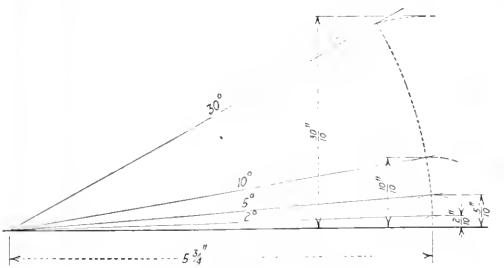
In carrying out the cementation process, a ring of bore holes is put down in the strata through which the shaft is being sunk, and 3-in. pipes are driven into them. In one shaft, which was 25 ft. in diameter, eight bore holes were put down on the inside, the diameter of the ring of bore holes being about 20 ft. The bore holes are first put down to a depth of 9 ft., then 15 ft. of 3-in. casing is forced into each hole, so that the pipe stands above the ground to a height of 6 ft. The diamond drill is then set to work inside of the casing pipes. The diamond drill had a crown 1½ in. in diameter, which gave a core of ⅞ in. The boring is continued until a fissure containing water is met, and it is known when this occurs by the water issuing from the top of the 3-in. pipe. The water is usually under pressure, sometimes being forced up by the pressure of gas, as well as by the pressure of the water in the water-bearing strata. As soon as water appears the boring is discontinued, the drill removed, and a pressure pump connected to the 3-in. pipe. Liquid cement is forced by the pump down the pipe, down the bore hole, and into the fissure under a pressure of from 800 lb. to 1200 lb. per square inch, the idea being to force it into the fissure and to fill it completely. When no more cement can be forced in, the top of the 3-in. pipe is plugged and allowed

*Abstract of paper by Sydney F. Walker, Bloomfield Crescent, Bath, England, in the "Colliery Engineer."

to remain undisturbed for about 30 hours. At the end of that time the plug is removed from the pipe and the cement is drilled down to the fissure; then if no water appears the drilling is continued until another fissure is struck, when the process is repeated. If water appears on drilling out the bore hole, the process is repeated until the fissure is completely closed by cement. The same process is going on at each of the bore holes, and when a depth of 150 to 250 ft. has been reached by this method, rock sinking is commenced and carried to the same depth. After the shaft is sunk and the walling* is put in, the stopping back of the water is further insured by drilling holes at the depths at which fissures were met with, horizontally into the strata behind the walling, and forcing cement in under pressure in the same manner as was done from the surface. Cement is also forced in behind the walling at various points where it is thought desirable or where there is any appearance of water. The horizontal bore holes that are drilled for supplementary cementing are carefully plugged up when everything appears right. After the walling is completed for the 150 ft. or 200 ft. that has then been protected and after the supplementary cementation has been finished, bore holes are drilled down from the bottom of the shaft and the process repeated in the same manner as from the surface. In this way, any reasonable depth of sinking can be carried out.

Laying Out Small Angles

The illustration indicates a simple but accurate method—described by Francis W. Shaw in the *American Machinist* of June 10—of laying out small angles in the absence of a good protractor or drafting machine. The accuracy obtainable this way is said probably to exceed that resulting from the use of a protractor. The error



Laying Out Small Angles

in 1 deg. is but 4 sec.; in 10 deg. it is less than 1 min., and even in 30 deg. but 13 min.

From the base line draw an arc of 5⅜-in. radius and lay out the desired angle along this arc, setting the compasses or dividers to $\frac{1}{10}$ in. for every degree. Join the center of the large arc with the point of intersection of the large and small arcs.

For angles approaching 30 deg., lay out an angle of 30 deg. with the triangle and add or deduct the small angle of difference. For angles near 15 deg., bisect an angle of 30 deg., adding or deducting the difference angle.

*In Great Britain shafts are made of circular cross-section and lined with masonry.

Steel-Tape Repairs

Many engineers and surveyors repair their own steel tapes, the repair outfit consisting of a combined punch and rivet set and copper rivets or eyelets. Few know how to repair a broken tape properly, even when furnished with all the necessary facilities, says *Engineering News*.

The point which needs the most emphasis is that no matter how it is broken, some of the original tape must be cut away and a new piece spliced in. This applies both to graduated ribbon tapes and to most of the heavier flat-wire tapes. Any kind of a mend which stiffens the tape at the splice weakens it and makes it more likely to break

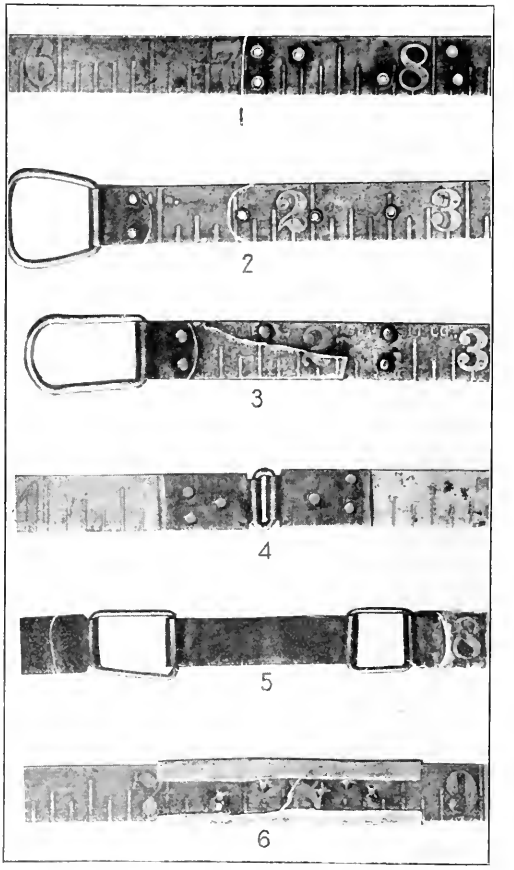


Fig. 1. "Horrible Examples" of Tape Repairs

near there a second time, especially in the case of thin ribbon tapes. The only exception is in the case of heavy wire tapes, ¼-in. wide or less, which are usually so stiff that they can be mended with a soldered sleeve.

In Fig. 1, tapes Nos. 1, 2 and 3 illustrate defective splices. No. 1 is made by lapping the tape by 0.12 ft. and securing the lap with six eyelets. A little consideration would have shown that two eyelets and a 0.02-ft. lap would have done just as well. This is one end of a 0.3-ft. splice, and the tape broke a second time at the left-hand

end of the splice. No. 2 is another lap joint, 0.1 ft. long. In No. 3 the whole of the old tape has been retained and the repair made by riveting a piece 0.15 ft. long on the back; solid rivets are used where eyelets should have been. Nos. 2 and 3 also illustrate defective methods of fastening on the end rings—the laps are too long. The best result is attained if the lap is little more than 0.1 ft.

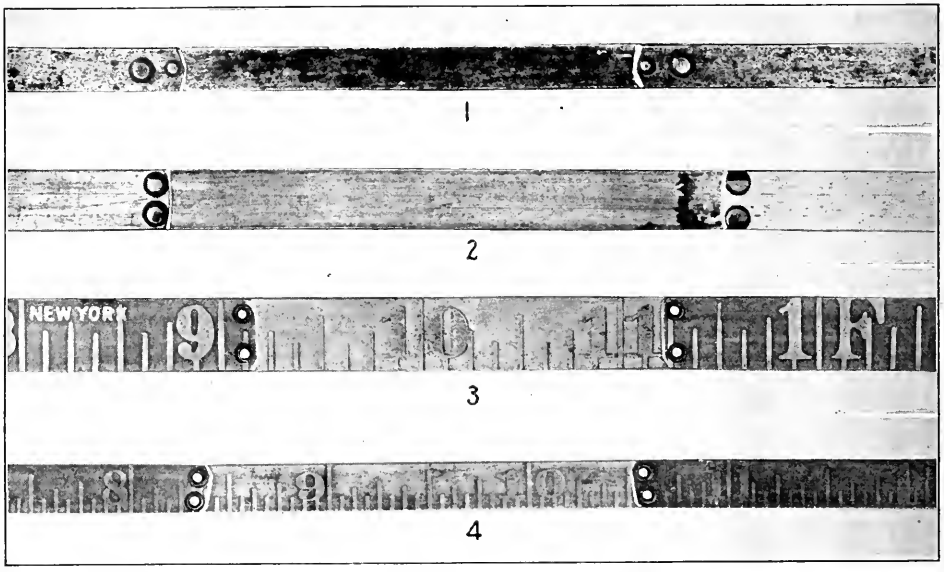


Fig. 2. Examples of Tapes Repaired to Preserve Maximum Flexibility

fastened with two eyelets. Nos. 4 and 5 show conscientious and ingenious attempts to keep flexibility, but by means not to be recommended. No. 6 is a crude but effective repair, no doubt made in camp. The sleeve was probably cut from a tin can, and an axe and nail were used for a punch. There are no rivets and the sleeve holds by depressions punched partly through the tape.

In Fig. 2 is illustrated the proper way to make tape repairs according to directions: First punch two holes in each of the broken ends about 1 in. or more back from the break. Take a piece of tape about 2 in. longer than the completed splice is to be, lay one of the broken ends on the splice, tying it tightly to insure proper alignment, and punch holes in the splice through the holes already

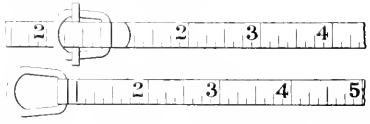


Fig. 3. How to Put the Ring End on a Tape

punched in the tape, placing and setting a rivet as soon as a hole is punched. Solid rivets are used for flat-wire or band tapes, and when the tape is ¼ in. or less wide, the rivets are placed in tandem, as shown in No. 1, Fig. 2. After the splice has been riveted to one end of the broken tape, lay the other broken end on it and butting the two ends of the break together, tie it in place and rivet as before. When all rivets are driven, notch the ends of the tape close to the rivets with an edged file and break the tape on the file marks. In the same manner notch and break off the ends of the splice close to the rivets. The result is a lap of not over 0.03 ft. for a tandem splice and a little over 0.01 ft. (or ⅛ in.) for rivets side by side, which means a tape practically as flexible as new. For thin ribbon tapes eyelets should always be used instead of solid rivets, as shown in Nos. 3 and 4, Fig. 2.

To replace a broken ring or repair a tape broken at the ring, take a piece of similar tape showing any foot mark. Lay the ring with its clip or sleeve in place on this splice-tape, and hold it there by slipping a narrow piece of tape (or a wire) under the splice-tape and over the ring (see Fig. 3). Punch one hole through the ring clip and tape, separate, and cut the tape close to the hole; insert the clip, and rivet, using a long eyelet. Then punch the second hole and rivet as before. Notch the clip with a file close to the eyelets and break it off on both sides of the tape. Rivet the new section to the broken end, not less than 2½ in., or 0.2 ft., from the end, being careful to lay the new piece on top of the old tape.

Don't Blow in a Cap

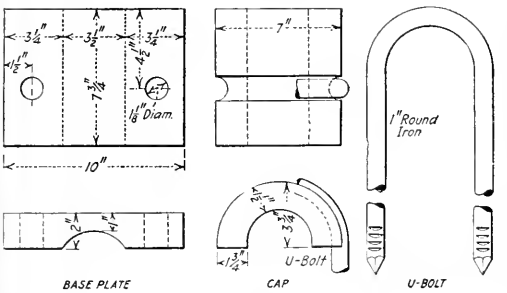
It is very common for miners to blow into fulminate caps when making up primers, in order to blow out any dust, dirt or sawdust which may be therein. This is a very undesirable thing to do, as the moisture from the breath or small globules of saliva may dampen the end of the powder train in the fuse when it is inserted and cause a cut-off or even a misfire. Neither should the cap be rapped on anything hard to loosen and shake out any dirt. If the caps are properly taken care of they will not get full of dirt.

Details of Milling and Smelting

Sectional Stamp-Stem Guide

The sectional cast-iron stamp-stem guide, designed and recently installed at one of the larger Nevada stamp mills, is shown in the accompanying drawing. Before this guide was adopted, a nonsectional, two-bolt, cast-iron guide was in use, but as a great many of these were either broken or badly worn, it was decided to gradually equip the mill with new guides.

A few sets of the cylindrical shell-type guides were tried, and while on the whole satisfactory, great difficulty was experienced at times in removing a shell from the frame. The guide shown was finally decided upon and has proved excellent in every particular. Its initial cost is moderate; it may easily be attached to any wooden battery-frame; it is unbreakable, adjustable and very easily manipulated when turning or putting in a stem. It will be noticed that the ends of the U-bolt are well tapered. It is necessary, at times, to drive the U-bolt through the guide timbers with a few light blows of a hammer, and



DETAILS OF SECTIONAL GUIDE

having the bolt-ends tapered prevents any stripping of the threads. The guides weigh 73 lb. per set and cost, laid down at the plant, $8.43 per pair (one stem), the freight charge being $1.50 per pair.

Moving Water-Tube Boilers

At Garfield, Utah, two 350-hp. Stirling water-tube boilers were recently moved from the boiler house to the reverberatory building, a distance of about 1000 ft., without having the tubes dismantled. The boilers were formerly used as direct-fired boilers, but will hereafter be employed as waste-heat boilers. The engineer in charge was agreeably surprised to find, when the boilers were moved and tested with a water pressure of over 100 lb., that they did not show any signs of leakage. It was expected that many of the tubes might have to be rerolled. The boilers were placed on a car, and after they were once in this position, they might be moved several hundred miles as easily as the shorter distance, provided the overall dimensions were not too great for railroad clearances.

Van Arsdale's Method of Copper-Ore Treatment

A new method of treating copper ores is proposed by George D. Van Arsdale, of East Orange, N. J., for which he has been granted U. S. pats. 1,119,477 and 1,119,478. This is a leaching process, the solution having a base of sulphuric acid containing copper.

Heretofore sulphur dioxide has been added to such leaching solutions before electrolyzing for the purpose of reducing polarization, and similar methods using chloride solutions have been proposed. None of these has been commercially successful, since in the conditions present while employing them, a part or all of the copper is precipitated as sulphide compounds and not as metallic copper. This disadvantageous feature is caused by the electrolytic hydrogen evolved at the cathode reacting with the sulphur dioxide present and forming hydrogen sulphide, which then precipitates copper as sulphide. This side reaction is undesirable, since copper sulphide is not marketable as such and requires further treatment before it can be sold. Van Arsdale claims to have discovered that such deposition of copper-sulphide compounds can be prevented.

He prefers to use a solution of copper sulphate, which may be made by dissolving copper sulphate in water or by making a solution of copper sulphate from copper ores which have been roasted. Such solutions contain ferrous sulphate, which, in former practice, has been undesirable, but which, according to the new method, is made a desirable factor. The next step is to add, in any of the well-known ways, sulphur dioxide, and the resulting solution is treated electrolytically. A function of the sulphur dioxide is not only to act as a depolarizer, but also to reduce any ferric sulphate present in the solution to the ferrous state, which also tends to prevent polarization at the anodes, the ferrous sulphate combining with nascent oxygen at the anode to form ferric sulphate. He prefers to work without a separating diaphragm and to regulate the voltage and speed of deposition so that copper only is separated, and not hydrogen or hydrogen sulphide. With a 10% solution of copper sulphate containing sulphur dioxide sufficient to prevent polarization and to reduce all salts of iron to the ferrous state, it is found that with about 10 amp. per sq.ft. and between 0.7 and 1.2 volts, it is possible to precipitate about 80% of the copper before the formation of sulphide commences. Precipitation is stopped at that point, and the solution will then contain free sulphuric acid and copper sulphate. This solution is used again for further ore treatment, approximately the original solution being regenerated each time. The voltage and amperage as above given are not fixed for all cases, but represent only a particular case, and may be varied at will to suit the different ores which are being worked upon.

The second patent of the numbers mentioned relates to a process for changing the copper in ores into soluble

copper compounds, dissolving them and then precipitating the copper from the resultant solutions, and its object is to provide a simple and inexpensive method for accomplishing these purposes. After being ground, the ore is roasted with a suitable material to form copper compounds which are soluble in water. If copper sulphates are desired, the ore may be roasted with pyrite (if there is not enough sulphur present) or with salt, a soluble chloride product being obtained. Then excess of sulphur does no particular harm. During the roasting, particular attention should be paid to the temperature and other factors to obtain the maximum amount of copper compounds which are soluble in water. After roasting, these compounds may be leached out with water, which may be acidulated by the addition of a desired amount of liquid from a preceding operation to dissolve the copper present in the form of sulphates and oxides.

In beginning the leaching operation, it will be necessary to use dilute sulphuric acid to acidulate the wash water, but after the first step the acid will be generated through the process. The solution is withdrawn from the ore as completely as possible, water or weak solution added to the residue, agitation and leaching repeated, and the wash liquid withdrawn. A part or all of this first wash water is added to the first solution to maintain a desired standard strength and volume of solution for succeeding steps of the process. The ore which contains the copper separated by these operations is again subjected to washing with water or weak solution, and the resulting second-wash liquid passed over iron to recover such copper as may be in it and then, with its impurities, allowed to run to waste. By properly choosing the amount of solution rejected in this way, the main solutions in the cycle of operations may be kept as free from accumulated impurities as necessary. The first liquor from the ore, with the wash solutions added to it, is now subjected to electrolysis in the presence of sulphur dioxide. The amount of sulphur dioxide added may be sufficient to satisfy the equation

$$CuSO_4 + SO_2 = Cu + 2\,H_2SO_4$$

but in many cases it is sufficient to supply only enough sulphur dioxide to keep the iron salts, which are always present, reduced to the ferrous state.

In ordinary electrolysis, with an insoluble anode, a high voltage is required, but by operating in this manner the voltage may be greatly reduced and the amount of copper precipitated per unit of power is such as to render this method essentially economical.

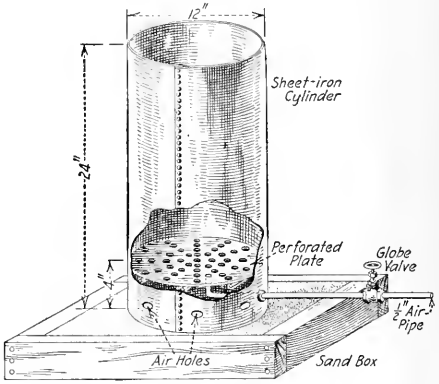
Recovering Zinc from Leaching Solutions

A process for the recovery of zinc from the waste solutions obtained in copper leaching has been patented by Wilhelm Buddeus, of Charlottenburg, Germany (U. S. pat. 1,120,683). These solutions contain a considerable amount of iron in addition to the zinc, and Dr. Buddeus states that the present method of oxidizing the iron to the ferric state and then precipitating it before recovering the zinc is not commercially feasible because of the high price of the various oxidizing agents. Accordingly, he suggests precipitating the zinc and ferrous iron by means of burnt lime, magnesia or ground limestone, filtering the slimy mass thus obtained and then drying so as to oxidize the ferrous iron completely to the ferric state. The dried mass is then treated with sufficient acid to remove the zinc; the iron will then be left undissolved.

If lime be used for the complete precipitation of the zinc and ferrous iron, the precipitate will carry down a considerable amount of calcium sulphate. However, he states that from the resulting product the zinc can be removed if the acid corresponds exactly to the amount of zinc contained in the product under treatment. In this case he says the calcium sulphate will remain behind along with the ferric oxide.

Coke Heater for Milling Plants

Small mills are sometimes built without heating facilities, or with the intention of heating by stoves, while sometimes in larger plants where heating systems have been installed, the installations have been found to be inadequate and some auxiliary form must be resorted to. A heater which will take the place of a stove either as the main source of heat in a small mill or as an auxiliary in



Stove for Heating Small Mill

a larger plant, and which is simple and inexpensive to make and operate, is shown in the accompanying illustration.

It consists of a sheet-iron cylinder 2 ft. high by 1 ft. in diameter, open at the top and bottom. About 4 in. from the bottom three or four pieces of ¼- or ⅜-in. round iron are run through the cylinder, and upon these is placed an iron plate perforated with a number of ½-in. holes. Just under the plate six or eight 1-in. holes are cut in the cylinder to admit air. Compressed air is conducted in through a ½-in. pipe fitted with a globe valve, the end of the air pipe being bent up under one of the holes in the plate. In operating, a little oily waste, some wood and a mild blast will ignite the coke. The temperature is regulated by the blast and considerable heat is developed with small fuel consumption. In cleaning, the heater is first allowed to cool. It is then shipped away from the air pipe and the contents dumped, the coke then being easily sorted from the ash. This heater, if placed upon a sand box, may be operated upon a wood floor with perfect safety, as almost no heat goes down. A perforated plate over the top of the cylinder will make the heater as serviceable as a stove in warming oil cans, lunch buckets and the other uses customary in such cases.

Company Reports

Alaska Gold Mines Co. in 1914

The 1914 report of the Alaska Gold Mines Co., Juneau, Alaska, shows that the company owned $3,268,000 par value of Alaska-Gastineau Mining Co. bonds out of a total issue of $3,500,000 and $11,438,670 par value of its stock out of a total issue of $12,000,000. During the year a policy of construction and equipment was carried out with the view of ultimately treating 20,000 tons per day. Owing to this policy the company borrowed $750,000 during the year and has provided for a bond issue of $1,500,000. The mine is fully developed for an output of 6000 tons a day, the capacity originally planned.

There were 28,523 ft. of drifts, raises and crosscuts driven during the year and 6203 ft. of diamond drilling was done. This includes the completion of the Sheep Creek tunnel, which is nearly two miles in length. Development work to date by the present company totals 63,248 ft., including 7545 ft. of diamond drilling. It is stated that very little work was done during 1914 to prove directly additional ore because the tonnage already developed is sufficiently great. The work was directed almost wholly to blocking out more thoroughly ore from which active production would first begin. This makes it possible to give some statement of the tonnage blocked out. A block of ore lying west of No. 2 incline shaft and above level No. 10 is estimated to contain 21,000,000 tons of fully developed ore averaging slightly less than $2 per ton. From all data at hand, and considering the known continuous and uniform nature of these ore deposits, a minimum estimate of fully developed, partly developed and probable ore could not, the report says, reasonably be stated at less than from 75,000,000 to 100,000,000 tons having a recoverable value of $1.50 per ton. These figures contemplate no consideration of orebodies extending below sea level.

To increase the tonnage capacity beyond 6000 tons a day some further equipment in compressor plant, mine-haulage system and living accommodations for employees will be necessary. An additional electric locomotive and a few additional cars will be required for the Sheep Creek railroad from the new mill to the bottom of the main shaft. Some additions to power plants will also be necessary.

At the Salmon Creek power plant the dam is 165 ft. high and has had a maximum of 135 ft. of water behind it, without showing any signs of material leakage or any undue deflection. With the completion of a small amount of unfinished construction this project will be developed to a point where the cost of power will probably not exceed $1000 per month for 6000 hp. Another source of power has been selected that may finally develop a year-round capacity of 11,000 hp. This may be developed gradually, beginning with about 4000 hp. and working up to maximum capacity.

At the time of writing the report one section of the mill had been in continuous operation for practically one month and was being worked up to a capacity of about 2000 tons a day, which would give a capacity of 8000 tons a day for the entire plant. It is believed that when everything is working smoothly the plant will have a capacity of 10,000 tons a day, and with some additions to the crushing plant it can be made to treat 12,000 tons. From the treatment of about 40,000 tons, recoveries have been in excess of $1.50 per ton from ore containing $1.85 per ton in gold and silver. Tailings are expected to average from 20 to 25c. per ton on ore containing approximately $2 when operations have become systematized. The main mill produces nothing but concentrates, at the ratio of about 1 ton of concentrates for each 50 or 60 tons of ore. In the retreatment plant the coarse gold containing some silver is separated from these concentrates and reduced to bullion. This separation is also accompanied by the production of a small tonnage of lead concentrates containing gold and silver, the concentrate for the present being shipped to smelters on the Pacific Coast. The residual portions of the original concentrates consisting principally of iron and zinc sulphides, are ground and amalgamated and the resultant iron-zinc tailings discarded. The report contains a map and several photographs of the property.

Anaconda in 1914

The Anaconda Copper Co., Butte, Mont., in its report for 1914 shows a total production of 223,720,292 lb. of refined copper, 8,314,115 oz. of silver and 99,650 oz. of gold, of which 205,298,531 lb. of fine copper, 7,221,815 oz. of silver and 99,650 oz. of gold came from ores produced from the company's mines. The profit and loss statement given in the report shows a profit of $8,789,587; dividend payments amounting to $9,077,500 were made. The mines of the company produced 3,898,100 tons of ore and 6782 tons of precipitates. The reduction works at Anaconda treated 3,748,726 tons of ore and other cupriferous material and 488,243 tons were treated at the Great Falls plant. Of this aggregate 3,768,640 tons came from the company's mines, 457,903 were from outside mines and 426 tons of precipitates came from cleanings and old works. Some of the expenses as charged in the profit and loss statement follow: Mining expense, including development, $15,298,517; ore purchases, including transportation, $1,695,809; transportation of ore from mines to reduction works, $1,023,171; reduction expense at Anaconda and Great Falls, $6,862,306; transportation of metals from West to East, refining and selling charges, $2,998,097; administration expense and Federal corporation tax, $272,411; depreciation of plants, etc., written off, $845,628; and interest, $408,831. Of the profit reported before allowing for depreciation and interest charges, $7,200,556 came directly from operations and $2,843,491 from investments and subsidiary companies.

During 1914, 330,000 shares of Anaconda stock were exchanged for the 100,000 shares outstanding of the International Smelting & Refining Co., and this company was dissolved and the International Smelting Co. was in-

corporated for $15,000,000, consisting of 150,000 shares of $100 each, of which 95,000 shares were issued, all of which were delivered to the Anaconda company in payment for the properties turned over by the Anaconda. It is estimated that improvements contemplated in the reduction works department will cost about $6,000,000.

In the Anaconda mines 33.15 miles of development work was performed, and it is estimated that a tonnage of ore slightly in excess of the amount extracted was added to the ore reserves. The coal department produced 619,208 tons of coal, of which 420,362 tons were shipped to other departments of the company, 140,830 tons were sold commercially and 58,016 tons were used at the coal mines.

The lumber department cut 84,411,461 ft. of lumber, and purchased 23,373,493 ft. It shipped 50,701,581 ft. to the mines of the company, sold 46,118,118 ft. commercially, used 60,083 ft. at the mills for repairs and construction and supplied 3,284,217 ft. to the factory.

The railroad transported 5,380,045 tons of ore and freight and 306,065 passengers. The net income from this business amounted to $267,822, including rentals for tracks, etc. A dividend of ½% was paid by this department.

Tonopah Mining Co.

The report of the Tonopah Mining Co., Tonopah, Nev., for year ending Feb. 28, 1915, shows a total production of 143,602 tons of ore, consisting of 113,616 tons of mine ore and 29,986 tons of dump ore. This ore was treated in the mill and averaged by assay 0.246 oz. of gold and 21.22 oz. of silver per ton. Total net earnings and income for the year were $1,050,124, of which $225,803 represents dividends from investments, etc. Dividends aggregated $1,000,000. A statement of receipts and disbursements shows that there was an excess of disbursements over receipts of $205,733, including dividend payments. A statement of costs shows that the average gross value of the ore milled was $16.25 per ton, of which $1.23 was lost in milling and refining, $8.51 paid out in costs and $6.51 represented by profits. The details of costs per ton were: Mining and handling dump ore, $4.40; milling, $2.96; freight on ore milled, 74c.; and marketing products, 41c. The total dividend record shows that $12,600,000 has been paid to date, not including $380,557 paid out in retiring an issue of preferred stock.

The company owns 83.33% of the stock of the Tonopah Placers Co., Breckenridge, Colo., and has also purchased a property in Nicaragua and contemplates the erection of a 100-ton mill on this property.

New York & Honduras Rosario

The New York & Honduras Rosario Mining Co., San Juancito, Honduras, reports for 1914 a production of 109,170 tons of ore containing by mine assay 1,834,361 oz. of silver and 14,298 oz. of gold. The extraction was 88.662%. The income from the production of gold and silver amounted to $1,239,877. After deducting expenditures and crediting miscellaneous earnings there was a profit of $329,814, of which $240,000 was paid out in dividends. The total bullion production of this company from 1882 to 1914 inclusive amounts to $19,981,206, and dividends amounting to $3,550,000 have been paid from this production. The costs as reported for operating were: Mining, 9.96 pesos; milling, 5.05 pesos; administration, 2.28 pesos; total, 17.29 pesos. In 1914 the average value of a peso was 41c. Ore reserves are estimated to contain 418,978 tons of ore, averaging $10.45 per ton. The mill has treated 299 tons per day, which is nearly 50% more than its original rated capacity. The actual consumption of power for crushing was 8 hp.; stamping, 92.4 hp.; grinding, 242.1 hp. These figures show a consumption of 1.7 hp. per ton of ore treated. The two power plants produced an average of 947.6 hp. per day at a cost of $19.90 per hp. per year, or $0.227 per hp.-hr.

Copper Range in 1914

The Copper Range Consolidated Co., Painesdale, Mich., for 1914, shows a net income of $494,600 from 27,857,457 lb. of copper produced by its subsidiaries. This copper was sold for 13.38c. a lb., making receipts from product $3,726,389. The operating expenses were $2,855,340, leaving a mining profit of $871,049. Receipts from the Copper Range railroad amounted to $25,274, and $10,673 was received from the Atlantic mine, making the total income $906,996. Other expenses amounted to $83,308; and $329,088 was paid to St. Mary's Mineral Land Co. for its share of the profits of the Champion mine, leaving a net income as stated. No dividends were paid in 1914, but dividends to date aggregate $13,986,746. The following comparison of 1914 operations is made, including only one-half the output and profits of the Champion:

	1914	1905 to 1914, Inclusive—Average
Tons of rock stamped	909,110	1,349,739
Refined copper produced, lb.	19,953,854	29,284,999
Refined copper per ton ore, lb.	21.95	21.70
Total cost per lb. copper	10.66c.	9.97c.
Price received per lb. copper	13.38c.	14.85c.
Profit per lb. copper	2.72c.	4.48c.
Net earnings, Copper Range Cons.	$494,600	$1,648,170

The Baltic mine produced 7,001,945 lb. of copper and made a profit of $154,233, making a total surplus of $490,550 on hand at the end of the year. The total production of the Baltic to date is 176,129,415 lb. of copper. No dividends were paid in 1914, but dividends to date amount to $7,950,000. The following table gives a comparison of 1914 operations with the average for the last 10 years:

	1914	1905 to 1914, Inclusive—Average
Tons of rock stamped	324,433	638,267
Refined copper produced, lb.	7,001,945	14,206,204
Refined copper per ton ore, lb.	21.58	22.25
Total cost per lb. copper	11.17c.	9.29c.
Price received per lb. copper	13.38c.	14.76c.
Profit per lb. copper	2.21c.	5.47c.
Net earnings	$154,233	$776,488

The Champion Copper Co. produced 15,807,206 lb. of copper and made a profit of $658,175, which was added to surplus, making $1,206,819 at the end of the year. Dividends to date aggregate $8,400,000 from a production of 191,864,475 lb. of copper. The following table compares the operations of 1914 with the average for the last 10 years:

	1914	1905 to 1914, Inclusive—Average
Tons of rock stamped	614,854	679,202
Refined copper produced, lb.	15,807,206	16,492,059
Refined copper per ton ore, lb.	25.71	24.28
Total cost per lb. copper	9.21c.	9.34c.
Price received per lb. copper	13.38c.	14.77c.
Profit per lb. copper	4.17c.	5.43c.
Net earnings	$658,175	$894,306

The Trimountain Copper Co. produced 5,048,306 lb. of copper at a profit of $58,639, which was added to surplus. There was a surplus balance of $503,397 on hand

at the end of the year, and dividends to date aggregate $1,450,000. Copper production to date amounts to 93,506,574 lb. The following table gives a comparison of 1914 operations with former years:

	1914	1905 to 1914, Inclusive—Average
Tons of rock stamped	227,251	371,871
Refined copper produced, lb.	5,048,306	6,832,766
Refined copper per ton of ore, lb.	18.21	18.37
Total cost per lb. copper	12.21c.	12.15c.
Price received per lb. copper	13.38c.	15.16c.
Profit per lb. copper	1.17c.	3.01c.
Net earnings	$58,639	$205,861

Inspiration in 1914

The Inspiration Copper Co., Miami, Ariz., in its report for 1914 summarizes its stock issue as follows:

	Shares
Total shares issued and outstanding, including 39,797 shares issued for New Keystone property	762,755
Reserved for redemption of first mortgage bonds	240,000
Reserved for redemption of debenture bonds	180,000
Total authorized, including stock reserved for conversion of bonds	$1,182,755
Balance unissued	317,245
Total capital stock	$1,500,000

During the year the New Keystone property was purchased by the Inspiration for $795,940, payable in 39,797 shares of the company's stock. The property holdings of the company now total 3528 acres, of which 1881 acres are mining lands, 615 acres mill site and tailing lands, and 1032 acres ranches, water lands, etc.

It is stated that copper production would begin during June, 1915, and the mill when in full operation will have a daily capacity of from 14,000 to 15,000 tons. The scheme of treatment in general terms follows: At the mine the ore will be subject to two crushing operations—first to 4-in. maximum size in gyratory crushers, next to 1.5-in. maximum size by Symons disk crushers. In the mill the product will be ground in Marcy ball mills to pass a 48-mesh screen, then treated in flotation machines, followed by a separation of flotation tailings into sands and slimes. The sands will be treated on concentrating tables, and the slimes will be retreated in flotation machines. The concentrates will be dewatered in a filter plant. The ore from the mine will be delivered to one set of double concrete bins underground holding 3700 tons and hoisted through twin concrete-lined shafts to a bin of 2000 tons capacity located between the shafts. The total hoisting depth will be 630 ft., and the hoisting and coarse-crushing equipment will have a capacity of 1000 tons per hr. The ore crushed at the mine will be stored in a 25,000-ton bin. From this bin it will be hauled 1.6 miles in 60-ton railroad cars to the mill storage bin of 12,000 tons capacity. During the year 102,066 ft. of development work was done, consisting of 6114 ft. of large haulageways, 31,048 ft. of ordinary-sized drifts and 64,904 ft. of raises. Development work to the end of the year totals 42.9 miles and includes 1.2 miles of shafts, 7.4 miles of large haulageways, 18 miles of ordinary-sized drifts and 16.3 miles of raises. There has also been 29.33 miles of holes churn drilled on the property.

The ore will be undercut and caved in blocks of probably 70 ft. vertical dimensions and delivered to haulage drifts below through vertical raises. Ore reserves are estimated to contain 97,143,000 tons of 1.63% ore. This consists of 46,252,000 tons of 2.01% sulphide ore, 28,698,000 tons of 1.26% ore, 17,460,300 tons of 1.31% oxidized material and 4,732,700 tons of 1.31% mixed carbonate and sulphide material. Tests have demonstrated that the milling process will save from 86.7 to 90.3% of the copper in the sulphide ores and from 20 to 30% of the copper in the oxidized ores. During 1914, 172,722 tons averaging 1.52% copper were treated. The average quantity of copper oxide in the ore milled was 0.16% of the total. It is estimated that the concentrates will average from 28 to 32% copper.

Mason Valley in 1914

The Mason Valley Mines Co., Thompson, Nev., reports a deficit of $40,274 for 1914. The smeltery treated 75,038 tons of company ore and 67,159 tons of custom ore, or a total of 142,197 tons. The metal production consisted of 9,127,974 lb. of copper, 11,553 oz. of gold and 221,151 oz. of silver. Development work consisted of 419 ft. of drifts, 385 ft. of crosscuts and 1191 ft. of raises. It is stated that future smelting operations are dependent upon the stability of the copper market, the available tonnage of custom ore and the development of the Mason Valley property. The report also states that a prominent geologist was employed for the purpose of making a special study and investigation of the geological conditions and to recommend the most consistent line for further prospecting on the property.

Iron Silver

The Iron Silver Mining Co., Leadville, Colo., for 1914 reports a total income of $421,661; gross expenses, $247,032, and a net operating realization of $174,629. Dividends amounting to $100,000 were paid. The surplus at the end of the year was $428,167. The following table shows details of ore production from the various properties:

	Moyer Mine	Tucson Mine	Blind Tom Mine	Leases
Tons of ore	23,651	13,932	395	14,512
Value of ore	$236,789	$159,710	$1,549	$61,519
Metal contents:				
Gold, oz.	736.49	68.86	.....	117.75
Silver, oz.	207,344	66,271	2,334	52,027
Lead, lb.	6,830,904	2,509,519	.....	1,268,311
Zinc, lb.	5,937,154	7,625,255	36,925	3,797,028
Iron, lb.	3,849,409	126,053	208,835	1,063,118
Copper, lb.	.....	12,751	.....	.....

Algomah Mining Co., Houghton, Mich., reports for 1914 that no mining work was done. A selected ore shipment was made from shaft-sinking operations amounting to 12,467 lb. of copper, for which it received $1695. Total expenses were $17,119, and assets amounted to $14,597 at Dec. 31.

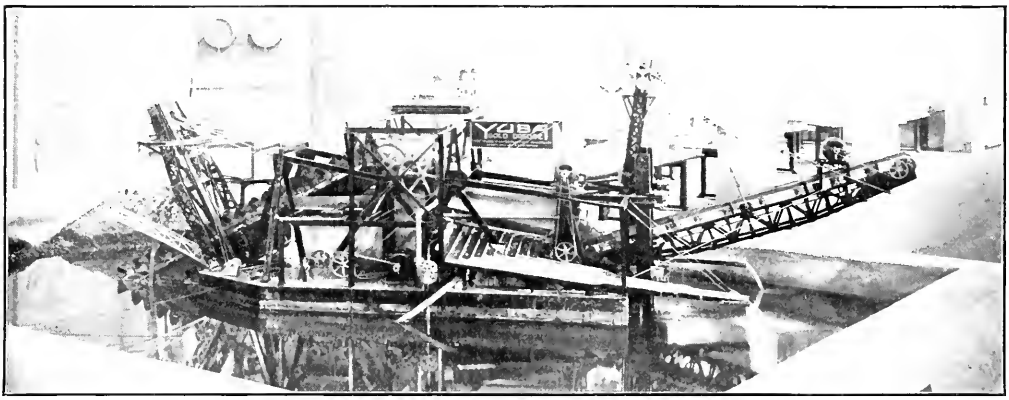
North Lake Mining Co., Houghton, Mich., for 1914 reports a balance of assets amounting to $18,946, after payment of $30,749 for expenses. Work was resumed in May, and 788 ft. of crosscutting was done at a cost of $16.18 per ft. In addition to work now going on it is recommended that the shaft be sunk to 800 ft. and a crosscut run to the east to cut the lodes indicated by diamond drilling.

The La Salle Copper Co., Houghton, Mich., for 1914 reports that 45,509 tons of rock was treated, which produced 540,731 lb. of refined copper, or an average of 11.88 lb. per ton of rock. The expenses amounted to $48,668 more than the receipts from the sale of the product. The balance of the assets at the end of the year was $110,158. A total of 1123 ft. of development work and 94 ft. of shaft sinking was done.

Indiana Mining Co., Houghton, Mich., for 1914 reports that 1152 ft. of crosscutting was done at a cost of $11.13 per ft. Total mine expenses were $28,542, other expenses in Boston made the total expenses $26,286. Accounts show a deficit of $29,523 at the end of the year. Work at present is confined to finding No. 2 drill hole at the 600-ft. level with the object of surveying from this point positively to locate the rich felsite found by the drill at 1450 ft. depth.

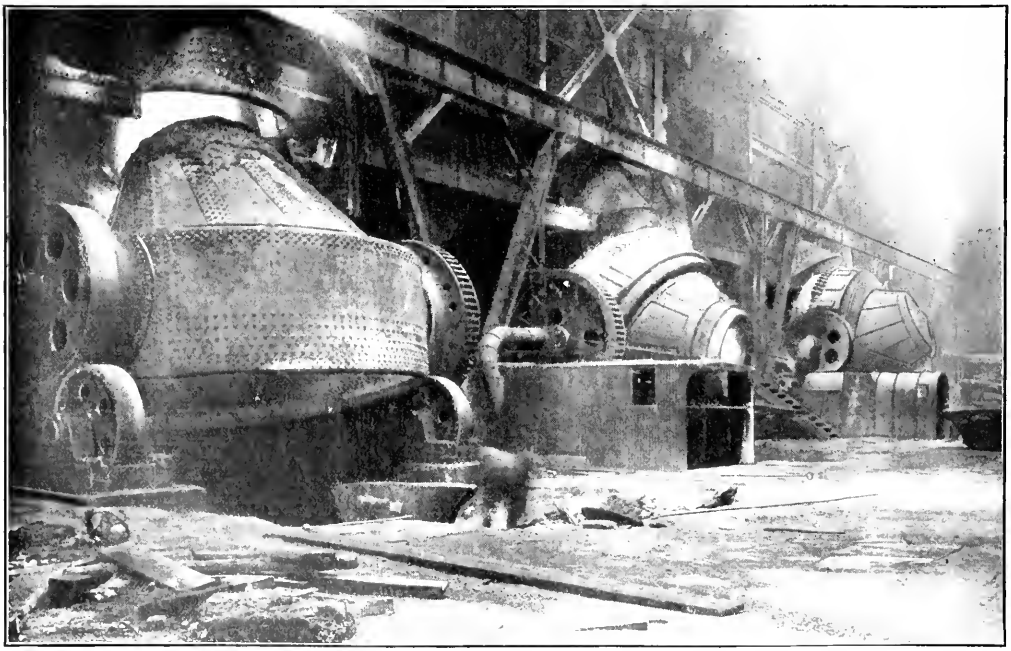
The Pittsmont Copper Co., Butte, Mont., for 1914 reports that its bonded indebtedness to the East Butte Copper Mining Co. was reduced $77,231 and that $80,590 was paid on bond interest through rentals received from the East Butte. The obligations of the company were: Bonds, $1,286,258; accounts payable, $75,997, and cumulative dividends on preferred stock at 6%, $420,000. At the close of the year the company had $1206 in cash and $7100 in accounts receivable.

Photographs from the Field



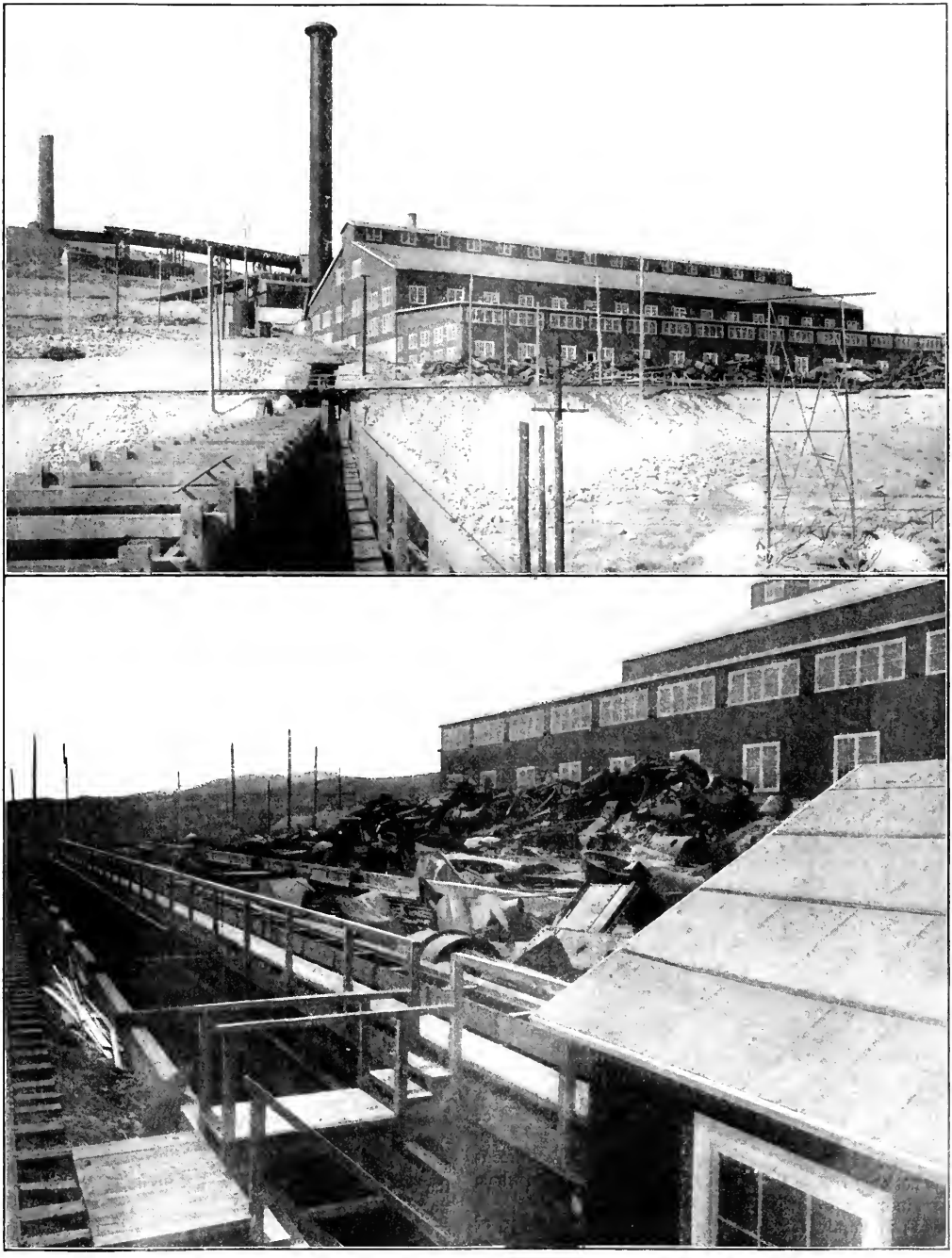
MODEL OF YUBA NO. 14 DREDGE

A reproduction in miniature of a 16-cu.ft. bucket dredge, the original of which is one of the largest and most modern of gold dredges. It is operated by the Yuba Consolidated Gold Fields, at Hammonton, Calif., on the American River. The hull and machinery of the model are made to a scale of 1 to 20, and the buckets 1 in. to the foot. The model is complete in every detail, except that for display purposes the housing has been left off and only one set of gold-saving tables installed. One of these models is in the Palace of Mines at the Panama-Pacific International Exposition and another in the California State Building



THE GREAT FALLS CONVERTERS AT ANACONDA

The big vertical converters developed by the Great Falls metallurgists have now been adopted as standard for the Washoe Reduction Works at Anaconda. This is in line with the unified metallurgical policy indicated in the appointment of a metallurgical engineer for the two plants. The converters are approximately 20 ft. in diameter and are basic lined. Seven have been installed to replace the horizontal-type converters previously used



Upper View—2000-Ton Leaching Plant of the Anaconda Copper Mining Co., at Anaconda
Lower View—Precipitating Tanks at the Leaching Plant

Correspondence and Discussion

The Unemployed Engineer

I have read with a good deal of interest the articles that have appeared in the JOURNAL of late with reference to the "Unemployed Engineer."

There is a phase of unemployment or rather scarcity of business affecting the independent practicing engineer which, while it may not be so apparent to the man with his office on Broadway or the prominent consulting engineer, works quite a hardship on the man of the West. I refer to the practice of the faculty of our engineering universities bidding for and engaging in custom work. I am presenting a condition as it appears in the West and as such it is worthy of consideration.

When a technical graduate elects teaching as his specialty, his efforts should be restricted to that field. If his position gives him time to engage in custom work; if his salary as an instructor enables him to do the work more cheaply; if his connection with the institution gives him a large amount of free advertising, then he is possessed of an advantage over the other man which is neither derived through merit nor built up by long practice. The competition is obviously unfair and results show it.

At one of our Western universities last winter the department of metallurgy was headed by a Columbia graduate of the previous year and a stranger to that community. Yet, while the long-established firms doing a general work in assaying and chemistry were having nothing to do to speak of, the laboratories of this university were constantly employed in custom assaying, coal and chemical analysis and metallurgical work in general. The professors were off on private work in periods ranging from two weeks to three months. They were always engaged on reports, maps and other outside work.

When a condition like that prevails it is almost hopeless for the independent engineer to try for any work. We are deeply indebted to our faculty members for a great deal of research work that has been done. Let them confine themselves to such research work and if they desire to do custom work let them do it free of charge. How long would they then continue?

I heard one professor in a public address make the statement that "the reason people come to us to have their work done is because they know they will get a square deal; that an honest effort will be made to perform the service asked; that a correct report will be made of same; and that they will not get stuck for a fat fee whether any service is rendered or not." This sentiment is not only ridiculous but is also a reflection on the whole engineering profession.

It is unfair for a faculty to instruct a number of students in preparation for a profession and then turn around and try to keep them out of that profession after they are graduated. This competition is doing that very thing every day.

I believe this matter could be very aptly handled by the JOURNAL by the creation of a higher standard of professional ethics between the practicing and collegiate engineers.

S. A. CRANDALL.

Tacoma, Wash., June 23, 1915.

Recent Progress in Flotation

In the JOURNAL of June 19, 1915, A. Schwarz discusses our article on "Recent Progress in Flotation," published in the JOURNAL of May 29, 1915.

He states he believes the basic patent on the process of sulphatizing of oxide and carbonate ores belongs to him, and that it was taken out in 1905. He also says he has been at work on the idea ever since. Such being the case, he has doubtless accumulated a great fund of information on the subject which the metallurgical profession would welcome at the present time, for, so far as we know, there has been very little published on the actual results obtained when using this kind of flotation. Our own work extends over a period of one year, during which time Mr. Cameron has given undivided attention to the subject and has been assisted by two other men at different times, Mr. Ralston having general direction of the work. For this reason we feel that we can assure Mr. Schwarz that our conclusions have not been hasty, and that we really have accumulated a great deal of data which we expect to publish in due time.

Meanwhile, replying to the inquiry raised in Mr. Schwarz's letter as to the conditions under which our tests were run, on which we based our statement that only a low-grade concentrate of lead was obtained, the ores tested were of "low-grade" (as stated in our paper), and to make this more definite, we may add that they contained 3 to 5% of lead, and 3 to 10 oz. of silver, associated with the carbonate of lead. The treatment of such ores gave us a concentrate of about 20% Pb, which we think is unsatisfactory. On the other hand, we agree with Mr. Schwarz that a 20% copper concentrate is thoroughly satisfactory. We are particularly glad that our statement has brought out the fact that Mr. Schwarz has obtained concentrates of lead carbonate running as high as 53% and 71.50% Pb. We believe that with heads running over 10% in lead, as carbonate, that it would be possible to get concentrates of a grade approximating that obtained by Mr. Schwarz, as this is a general principal of ore dressing, namely, the higher grade the heads, the easier it is to get high-grade concentrates and high extractions. Mr. Schwarz does not state what the conditions were under which his tests were run, but we venture to predict that they were on ore of a higher grade than was ours. We have retreated our 20% lead froth and got as high as a 36% product, which still leaves much to be desired. We intend to continue our work until more favorable results can be obtained, unless Mr. Schwarz can see his way clear to publish his own

results and thus save our duplicating his work. We appreciate what he has already told us and hope that we may hear from him further on this subject.

OLIVER C. RALSTON,
FRANK CAMERON.

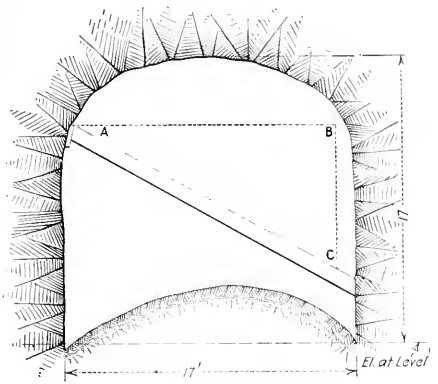
Salt Lake City, Utah, June 24, 1915.

Timbering Stopes for Safety

I hope the following will answer the inquiry of "Sourdough" in the JOURNAL of June 5:

The method used to determine the angle between the timbers of a truss and the consequent miter bevel in "Timbering Stopes for Safety"[1] is herewith explained. For example, let the figure represent a stope to be timbered where the main timber is to be a stull, the position and inclination of which are determined by means of a tape or slide staff and also by the shape of the ground at *A* for heading.

The hitch is then cut and the stull placed firmly in position with a head board at the upper end. A tape is now stretched to indicate the positions which the two other timbers of the truss will assume later, as shown by the dotted line *A, B, C*, in the figure, the tape representing the outside edge of these two members. The tape is read at *B* and at *C* to determine the lengths of numbers



SAFETY TIMBER IN STOPE

AB and *BC*, and the angles at *A*, *B* and *C*, which will be the angles formed by the timbers *AB*, *BC* and *AC* after the truss is framed, are measured.

The timbers of the truss are cut at a bevel equal to half the angle which they will form later when in position. The angles are determined by means of the tape as shown by the dotted line in the sketch; the position of the tape depends upon the shape of the ground. The angles made by the tape in its position are measured by means of a carpenter's miter, the legs of which, for instance, in measuring the angle *ABC* are made to coincide with the two portions of the tape *AB* and *BC* respectively, the apex of the miter being coincident with the point *B* on the tape.

The determination of the proper miter bevel is readily done. If the carpenter's miter used is a degree miter, the angle *ABC* can be read in degrees and the miter set for one-half angle *ABC*, which gives the miter bevel desired. If the miter is not a degree miter, the distance between the two legs is measured with a rule and the miter then reset to half the distance measured on the rule, which gives an angle of one-half *ABC* as before, since the two legs of the miter are of the same length and form the sides of an isosceles triangle where the median bisects the angle included between the legs of the miter, the rule forming the third side of the triangle.

As the tape was stretched so as to represent the outside edge of the truss members *AB* and *BC* and the lengths noted, these distances can be laid off on a fairly straight stick of timber and the bevels cut at the proper point by placing the carpenter's miter on the timber, so that one leg coincides with the edge of the timber, the other giving the desired bevel at which the timber is to be cut.

The material used for timbering the back of a stope for safety is practically all recovered and the short blocking as well. After all the ore has been removed from the stope through the chutes in the set timbers below and these set timbers removed to be used again in another stope, the stope is filled with rock or waste up to the next level and graded to 1% in favor of the load. The back of the stope before it was timbered was mined to a height of from 15 to 18 ft. above the elevation of the level or floor at which the stope will proceed upward again. This affords ample space to stand the set timbers again, upon which to mine and carry the stope up another lift, and it also permits good working room for the miners to drill. Furthermore, it enables the timbermen to recover the timber easily from the back of the stope without staging.

The set timber used consists of 8-ft. legs and caps, which measure about 12 in. in diameter, on top of which is placed about 18 in. of lagging, most of which is obtained from the lagging recovered from the back of the stope. This brings the over-all height of the set timbers to about 10½ ft. above the floor. The set timbers are then loaded with rock filling on the sides up to a height equal to the bottom of the chutes and braced. The timber is then removed from the back of the stope; the timbermen working from the top of the loaded set timbers starting at one end clean and prop the loose rock in the back as they proceed. The lagging recovered from the back is placed ahead on the set timbers to cover them as they advance; the blocking is thrown down the chutes to be used again elsewhere; the main timbers of the truss are used as props, if necessary—if not they are taken out through the set timbers on the level. By removing the back timber from on top the set timbers, the timbermen are right at their work. A plank or two about 2 ft. above the top of the set timbers on the stulls may be used once in a great while when the back of the stope is 18 ft. above the floor, to enable the men to remove the timbers from the back with more ease. The stopes are not mined to an excessive height above the floor.

Where the lower end of the stull is so low, as shown in the figure, that it would interfere with the erection of a set, the set is stood up on either side of the stull timber, which causes no inconvenience.

When the sides of the stope are bad, as shown in Fig 10, p. 812, of the JOURNAL of May 8, and they must timbered all the way down, this timber is recovered from time to time as the rock filling rises. The timbermen stand on the fill from which they work, the timber being hoisted.

H. H. HODGKINSON.

Franklin Furnace, N. J., June 9, 1915.

[1] "Engineering and Mining Journal," May 8, 1915.

NEW PATENTS

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

ALKALIS—Process of Producing Chlorates of Alkalis and Alkaline Earths. Walter Laib, Rittman, Ohio, assignor to The Ohio Salt Co., Wadsworth, Ohio. (U. S. No. 1,143,586; June 15, 1915.)

ALUMINUM—Compound for Welding Aluminum and Aluminum-Containing Alloys. Erland Thaulow, Frederiksberg, near Copenhagen, Denmark. (U. S. No. 1,139,923; May 18, 1915.)

ALUMINUM—Treatment of Surfaces of Aluminum or Alloys of Aluminum in Order to Prepare them for Receiving a Metallic Deposit. Francois Auguste Roux, Paris, France, assignor to Société L'Aluminium Francaise, Paris, France. (U. S. No. 1,144,000; June 22, 1915.)

ALUMINUM NITRIDE—Process of Manufacture of Aluminum Nitride. Adrien Badin, Paris, France, assignor to Société Générale des Nitrures, Paris, France. (U. S. No. 1,143,482; June 15, 1915.)

ANODES—Process for Manufacturing Anodes of Manganese Dioxide Ore. Percy Claude Cameron Isherwood, Bushey Heath, England. (U. S. No. 1,143,828; June 22, 1915.)

ARSENATE OF LEAD—Method of Manufacturing Arsenate of Lead. Edwin O. Barstow, Midland, Mich., assignor, by mesne assignments, to The Cleveland Trust Co., trustee, Cleveland, Ohio. (U. S. No. 1,141,920; June 8, 1915.)

BRICK—Pure Kieselguhr Brick and Process for Making the same. Arthur Ch. Hesselmeyer, Chicago, Ill. (U. S. No. 1,143,826; June 22, 1915.)

BROMINE—Process of Making Bromine. Edwin O. Barstow, Midland, Mich., assignor to The Dow Chemical Co., Midland, Mich. (U. S. Nos. 1,141,921 and 1,141,922; June 8, 1915.)

CASTING—Automatic Metal-Feed for Continuous Casting Machines. Grenville Mellen, West Orange, N. J., assignor to Continuous Casting Corporation, Newark, N. J. (U. S. No. 1,139,888; May 18, 1915.)

CASTING—Guide for Continuous Casting Machines. Grenville Mellen, West Orange, N. J., assignor to Continuous Casting Corporation, Newark, N. J. (U. S. No. 1,139,889; May 18, 1915.)

CASTING POT. Grenville Mellen, East Orange, N. J., assignor to Continuous Casting Corporation, Richmond, Va. (U. S. No. 1,139,886; May 18, 1915.)

COMPOUND METAL ARTICLES, Process for the Production of. Byron E. Eldred, New York, N. Y., assignor to The Commercial Research Co., New York, N. Y. (U. S. No. 1,140,135; May 18, 1915.)

CONCENTRATORS—Combined Batea, Jig and Pan Motion Concentrator. Karl Senn, Alameda, Calif. (U. S No. 1,141,419; June 1, 1915.)

CRUCIBLE FURNACE. Emil Hallgren, Bellevue, Penn. (U. S. No. 1,138,866; May 11, 1915.)

CRUSHER—Rock Crusher. Edward H. Moyle, Los Angeles, Calif. (U. S. No. 1,142,116; June 8, 1915.)

CRUSHERS—Roll-Crusher. William H. Lieber, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis., a Corporation of Delaware. (U. S. No. 1,141,643; June 1, 1915.)

DISINTEGRATOR—Ore-Disintegrator. Leon St. D. Roylance, San Francisco, Calif. (U. S. No. 1,142,462; June 8, 1915.)

DISTILLATION FURNACES—Closure for Distillation Furnaces and Particularly Coke Ovens. Hermann Joseph Limberg, Gelsenkirchen, Germany. (U. S. No. 1,143,411; June 15, 1915.)

DRILLS, AIR—Jack Hammer-Drill. Samuel Oldham, Philadelphia, Penn. (U. S. No. 1,141,650; June 1, 1915.)

DRILL—Power Rock-Drill. Frederick Perley Porter, Kellogg, Idaho. (U. S. No. 1,140,185; May 18, 1915.)

DRILL—Miner's Drill. Samuel T. Skeen, Sandoval, Ill. (U. S. No. 1,140,077; May 18, 1915.)

DRILL-BIT CLUTCH. John W. Roby, Hammon, Okla. (U. S. No. 1,142,460; June 8, 1915.)

EXCAVATING MACHINE. Henry McDermott, Iron Mountain, Mich., assignor to McDermott Mechanical Co., Iron Mountain, Mich. (U. S. No. 1,139,690; May 18, 1915.)

FILTER-MASS WASHER. Joseph Kraus, Anaconda, Mont. (U. S. No. 1,139,776; May 18, 1915.)

FLOTATION—Ore Concentration. John W. Littleford, San Francisco, Calif., assignor to Minerals Separation, Ltd., London, England. (U. S. No. 1,142,822; June 15, 1915.)

FLOTATION—Separation of Mixed-Sulphide Ores. Henry Lavers, Surrey Hills, Victoria, Australia, assignor to Minerals Separation American Syndicate (1913) Ltd., London England. (U. S. No. 1,142,821; June 15, 1915.)

INGOT MOLD. Samuel E. Hitt, Elyria, Ohio, and Joseph L. Peyton, Washington, D. C. (U. S. No. 1,139,284; May 11, 1915.)

INGOT MOLD. Joseph L. Peyton and Samuel E. Hitt, Sydney, N. S., Canada. (U. S. No. 1,139,219; May 11, 1915.)

MINING MACHINE and Truck. Edwin R. Merrill, Columbus, Ohio, assignor to The Jeffrey Manufacturing Co., Columbus, Ohio, a Corporation of Ohio. (U. S. No. 1,142,348; June 8, 1915.)

OPEN-HEARTH FURNACE—James C. Davis, Hinsdale, Ill., assignor to American Steel Foundries, New York, N. Y. (U. S. No. 1,143,690; June 22, 1915.)

ORE-TREATING APPARATUS. Rubin Colvin, Park City, Utah. (U. S. No. 1,142,497; June 8, 1915.)

PERCUSSIVE TOOL. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,142,478; June 8, 1915.)

PIPE JACK. George F. Voigt, Charlestown, Ind. (U. S. No. 1,143,739; June 22, 1915.)

PNEUMATIC TOOL. Benjamin M. Carmina, New York, N. Y. (U. S. No. 1,142,671; June 8, 1915.)

PULVERIZER. Peter C. Forrester, West Tacoma, Wash. (U. S. No. 1,142,159; June 8, 1915.)

PULVERIZERS—Lubricating System for Pulverizers. Morris Benjamin, Atlanta, Ga., assignor to Benjamin Pulverizer Co., New York, N. Y. (U. S. No. 1,142,746; June 8, 1915.)

RADIO-ACTIVE ORES—Method of Treating Radio-Active Ores and Intermediate Products. Erich Ebler, Heidelberg, Germany. (U. S. No. 1,142,154; June 8, 1915.)

RADIO-ACTIVE SUBSTANCES—Manufacture, Isolation, and Enrichment of Radio-Active Substances by Adsorption from Solutions. Erich Ebler, Heidelberg, Germany. (U. S. No. 1,142,153; June 8, 1915.)

REDUCTION FURNACE. Hermann Pape, Oker-in-the-Harz, Germany. (U. S. No. 1,144,054; June 22, 1915.)

REDUCTION FURNACE. Furnace for Working up Ores. Hermann Pape, Oker-in-the-Harz, Germany. (U. S. No. 1,144,053; June 22, 1915.)

ROASTING—Ore Roasting or Drying Furnace. Harry Mackenzie Ridge, London, England. (U. S. No. 1,143,438; June 15, 1915.)

SCREENS—Gravel Screening and Washing Machine. Chas. P. Biesanz, Winona, Minn., assignor to Biesanz Stone Co., Winona, Minn., a Corporation of Minnesota. (U. S. No. 1,141,169; June 1, 1915.)

SEPARATOR—Apparatus for Continuously Separating Solids from Liquids. John Van Nostrand Dorr, Denver, Colo. (U. S. No. 1,140,131; May 18, 1915.)

SEPARATION—Process of Separating the Constituents of Rocks. Gunnar Sigge Andreas Appelqvist and Einar Olof Eugen Tydén, Stockholm, Sweden. (U. S. No. 1,143,797; June 22 1915.)

WATER JACKET. Eulalio Medina, Douglas, Ariz. (U. S. No. 1,143,642; June 22, 1915.)

WELL-BORING APPARATUS, Gripping Device for. George S. Myers, Electra, Tex. (U. S. No. 1,143,430; June 15, 1915.)

WIRE—Low-Expansion Composite Wire. Byron E. Eldred, New York, N. Y., assignor to The Commercial Research Co., New York, N. Y. (U. S. No. 1,140,136; May 18, 1915.)

ZINC—Process and Apparatus for Removing Drossy Residues from Vertical Muffles in the Extraction of Zinc. Alexander Roitzheim, Duisburg, Germany. (U. S. No. 1,144,066; June 22, 1915.)

ZINC SULPHATE—Production of Zinc Sulphate. Ramón Bonastre Llopart, Cordoba, Argentina. (U. S. No. 1,142,795; June 15, 1915.)

Manufacture of Nitrite of Soda

In a recent paper read before the Canadian section of the Society of Chemical Industry, James Turner said that of the various methods of converting sodium nitrate into nitrite, practical experience had shown that reduction by means of metallic lead was the method best adapted for working on a large scale. The reason was that both lead and saltpeter melted considerably below the temperature required for the reduction, and therefore the two substances could be brought into very intimate contact. By careful regulation of the process, 90% of the theoretical yield of nitrite might be obtained.

A process was patented in England in 1896 by Doctor Paul and Read Holliday & Sons, Ltd., for the reduction of sodium nitrate by means of caustic soda and sulphur. This process had not proved to be so cheap as the lead process, on account of the difficulty in separating the sodium sulphate from the nitrite, and the maximum yield was only 80% of theory.

Alite, the Mixture of Composition $8CaO$, Al_2O_3, $2SiO_2$, was found to possess a maximum melting-point, 1385° C., in the ternary system, $CaO - Al_2O_3 - SiO_2$, and it therefore probably represents a definite compound. It has a specific gravity 3.035, refractive index 1.63, and hardness 7 on Moh's scale. The substance known as alite, which crystallizes from cement clinker, exhibits all the properties of the above compound and it is maintained, mainly on optical grounds, that the substances are identical, according to E. Jänecke (Zeit. für anorg. Chem., Vol. 89, p. 335).

Mining Ore From a Caved Stope

By James E. Harding*

SYNOPSIS—Methods used in mining a block of ore which caved after a square-set stope started in it had burned. Waste filling was used and stulls turned tapering in lathe and placed butt end up were pulled by hydraulic jacks and reused.

A difficult problem of ore extraction was presented to the staff of the Mina Santa Francisca† in getting out ore from a stope on the 200 level which had caved in after a fire had burned out all the supporting timbers. This stope, started several years before, had been raised with square-set timbers from four to six sets above the level, when it caught fire and was necessarily abandoned. All the timbers burned and the stope caved in from above. The rock was very hard and siliceous and caved down in huge slabs, a fact which had much to do with the later method of working. In one or two places the eaves extended through to the surface, but were of very small dimensions. After a lapse of several years it was decided to make an effort to recover the ore which was known to remain in the stope.

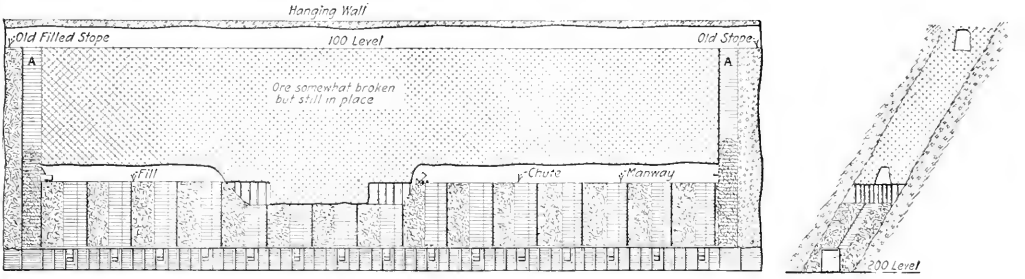
The difficulties of this undertaking were increased by the fact that either directly over the stope or in its immediate vicinity was located the entire surface equipment of the mine, including power plant, sampling mill, machine shop, offices, warehouse, sorting patio, ore bins and railroad tracks. In case of any extensive cave-ins, these buildings would be injured; and their removal entailed a prohibitive expense.

Thus in the consideration of various methods of working the stope, all methods which left a possibility of such happenings automatically eliminated themselves. The dimensions of the orebody were known to be about 20 ft. in width and 300 ft. in length. Square-setting was considered and rejected, first, because of the expense, and second, because it was impossible to obtain sufficient timber owing to interrupted traffic.

The mine was already excellently equipped with a system for waste filling whenever necessary. Previously an old shaft had been cleaned out from the surface to the 300 level and was used to convey the waste filling into the mine; this waste being merely shot into the shaft from a glory hole on the surface and allowed to run down, then drawn out from a chute on each level and conveyed in cars to the desired point.

The fact that plenty of filling was readily available within a very short tram from the stope largely determined the method finally adopted, which was a combination of overhand slicing and close waste filling.

The preliminary work consisted in driving the 100 level and redriving the 200 level through the burned and caved zone. At the same time, a raise with solid cribbing was carried up at each end of the ore to connect the two levels. This work was handicapped by the heat occasioned by the former fire. Little running ground was encountered and spiling had to be resorted to on only two or three occasions. One unexpected feature, however, caused considerable trouble. The rock, of course, was dry and dusty. This dust consisted largely of ferrous sulphate, which, getting in a man's nostrils, caused such violent sneezing that he was temporarily incapacitated, sometimes for several hours. Sponges and rubber nose guards were used, but these by no means prevented the trouble. Nevertheless, the connections were finally established and excellent natural ventilation soon rendered the working places comfortable.



Section Through Stope at Mina Santa Francisca, Showing Mining and Filling Method

As the work progressed on the 200 level, regular sill-floor sets were placed. These sets were made of 10x10-in. timber with posts 8 ft. 6 in. long, and caps 7 ft. long were placed 4 ft. apart in the clear. It may seem that this was unnecessarily close timbering, but remembering that no chances could be taken of caving the surface, it seemed advisable. At the time the timber was placed, chutes of 3x12-in. plank were built in every fourth set. The levels and raises being completed, the real work of taking out the ore began. Starting from both ends of the stope on both sides of the sill-floor timbers, a room as high as the sill-floor timbers was taken out across the vein. As fast as this ore was taken out stulls and headboards were placed in position to support the back.

One very special feature of this work was the use of these stulls, which were specially selected, straight-grained, hard pine, cut green and seasoned, about 10 ft. long and about 8 in. in diameter at the small end. They were placed in a lathe and turned down to round with a 2-in. taper from butt to tip and put in place always big

*Mining engineer, Vantrent, Calif.; recently foreman, Mina Santa Francisca.

†An A. S. & R. Co. property, situated at Asientos, Ags., Mexico.

end up. The reason for all this precaution and trouble will appear later.

The raises A at the ends of the stope were filled with waste, and whatever waste was encountered in the ore was thrown behind. Filling was drawn out of the waste raises to fill the first room close up to the face, burying the stulls and being stowed to the walls and close to the back. When the distance from the waste raises prohibited shoveling, a chute was placed in the cribbing of the waste raise and a track laid upon the caps of the sill-floor sets. A small drift was also carried through the rock above the sill-floor sets to permit the passage of a mine car, and thus the work was carried on until eventually the sill-floor slice was all taken out and filled.

Then work was begun on the second slice in exactly the same way as before. A room was started around the extreme end chutes and worked out first around the chutes in the direction of the waste raise and filling drawn in. As soon as this room was worked out half way to the other chute, it was filled and abandoned, the work being taken up at the next chute in the same way as before. While taking out the second slice, all of the stulls put in while working out the first slice were encountered with their large ends sticking up out of the fill. All were very easily pulled with a hydraulic jack, owing to the way in which they had previously been prepared and placed.

When the work of taking out ore from any particular room was abandoned, the chute and manway were built up to the back before filling. It was deemed advisable to carry a manway up with each chute to make each room more accessible and also to make escape easy in case of any accident. The waste drift and track followed closely and the open ground between the face and fill was never allowed to exceed 10 ft. in width, and sometimes in case of exceptionally loose ground was carried much closer than that. In this way the few slight caves which started soon stopped themselves.

The illustration shown on p. 71 in the strike and dip section gives a clear idea of the work. Unfortunately the strike section shows practically every stick of timber used in the work, and from its appearance gives an idea of a far greater ratio of timber to fill than actually existed. However, an examination of the dip section shows this ratio more clearly and gives a better idea of the footage of timber necessary to the ton of ore produced.

The stulls were used over and over again and practically all the timber buried and lost was that used along the level on the sill floor, chutes and manways, and a few planks used to hold back waste in the rooms.

New Map of Pittsburgh

The Pittsburgh Industrial Development Commission, Pittsburgh, Penn., has completed an industrial map of the Greater Pittsburgh district. The map is 4x6 ft. and is printed in four colors. It shows all streets, parks, roads, railroads and street-car lines, and every manufacturing plant in the district having railroad connections. It covers a territory extending from Verona on the north to Mt. Oliver on the south and from Wilmerding and McKeesport on the east to Emsworth and Neville Island on the west. Included is an insert map covering an area of 53 by 65 miles, from Butler and Vandergrift on the north to Follansbee, W. Va., on the south and from Greensburg on the east to East Palestine on the west.

June Mining Dividends

Dividends paid in June, 1915, by 38 United States mining companies making public returns amounted to $10,590,656, as compared with $7,410,317 paid by 31 companies in June, 1914. Industrial and holding companies allied to mining paid $7,432,952, as compared with $12,915,007 in 1914. Canadian and Mexican companies paid $355,268 in June, 1915, and $1,018,580 in June, 1914.

The totals for the first six months of the year 1915 are as follows: Mining companies, $26,001,044, as against $32,925,883 in 1914; metallurgical and holding companies, $34,164,152, as against $11,714,103 in 1914; Canadian and Mexican mines, $4,535,622, as against $9,894,912 in 1914. The accompanying table shows details of the month's payments:

United States Mining Companies	Situation	Per Share	Total
Anchor, s.	Nev.	0.03	$15,000
Argonaut, g.	Calif.	0.10	20,000
Brunswick, g.	Calif.	0.06	23,717
Bunker Hill, g.	Calif.	0 02½	5,000
Bunker Hill & Sullivan, l s.	Ida.	0 25	81,750
Butte & Superior, z.c.	Mont.	3 25	684,359
Caledonia, l.s..	Ida.	0 02	52,100
Calumet & Arizona, c.	Ariz.	0 50	308,693
Calumet & Hecla, c.	Mich.	15 00	1,500,000
Champion, c.	Mich.	3 00	300,000
Chino, c.	N. M.	0 75	652,455
Federal M. & S., l.s.	Ida.	0 00	119,861
Golden Cycle, g.	Colo.	0 02	30,000
Hecla, l s.	Ida.	0 02	20,000
Hercules, l s.	Ida.	..	175,000
Homestake, g.	S. D.	0 65	163,254
Nevada Con., c.	Nev.	0.37½	749,796
North Star, g	Calif.	0 20	50,000
Old Dominion M. & S., c.	Ariz.	11 00	1,782,000*
Oroville, g.	Calif.	0 12	78,270
Quincy c.	Mich.	2 00	220,000
Ray Con., c.	Ariz.	0.37½	545,364
St. Joseph, l.	Mo.	0.05	70,470
Seven Troughs Coalition, s.	Nev.	0.12½	37,500
Socorro, g.	N. M.	0.05	18,865
Stewart, c.	Ida.	0 10	123,826
Success, z.	Ida.	0 03	45,000
Superior & Pittsburg, c.	Ariz.	0 20	299,958
United Globe, c.	Ariz.	6 00	138,000
United Verde, c.	Ariz.	0 75	225,000
Utah, c.	Utah	1 00	1,624,489
Wasp No. 2, g.	S. D.	0 01	5,000
West End, g.s.	Nev.	0.03	93,429
Yellow Pine, z.c.l.s	Nev.	0 07	70,000
Yukon, g.	Alaska	0 07½	262,500

* Including distribution of Old Dominion Trust Fund.

Iron, Industrial and Holding Companies			
American Sm. & Ref. com.	{ U. S. Mex. }	1.00	500,000
American Sm. & Ref., pfd.		1.75	875,000
General Development	U. S., Mex.	1 50	44,982
International Nickel, com.	U. S., Can.	5 00	1,901,375
LaBelle, pfd.	U. S.	0 50	49,577
Lackawanna, pfd.	N. Y.	1.75	612,115
National Lead, pfd.	U. S.	1.75	426,433
National Lead, com.	U. S.	0.75	154,916
Old Dominion of Me., c.	Ariz.	1.00	393,354
Phelps Dodge, c.	Ariz., Mex.	5.50	2,475,000
Canadian, Mexican and Central American Companies			
Hedley, g.	B. C.	0 50	60,000
Hollinger, g.	Ont.	0.20	120,000
Lucky Tiger, g.s.	Mex.	0 09	64,380
Peterson Lake, s.	Ont.	0 01½	63,000
Seneca-Superior, s.	Ont.	0 10	47,888

Whatever may be the general state of business of the country, the rising tide of prosperity in mining circles is shown by the increased dividends of Ahmeek, Chino, Butte & Superior, Nevada Con., North Butte, Old Dominion (both mining and holding companies), Osceola, Quincy, Ray Con. and Utah Copper.

Du Pont Company Wins Decision

The United States Circuit Court of Appeals, on July 2, at Philadelphia affirmed the verdict rendered in the Federal District Court in the case of the Buckeye Powder Co. against the E. I. du Pont de Nemours Powder Co., Eastern Dynamite Co., and the International Smokeless Powder Co. The action against the du Pont concerns

was to recover $4,000,000 for alleged violation of the Sherman anti-trust act. It was charged that the defendants stifled competition in the manufacture and sale of black blasting powder. The evidence produced did not sustain the charges.

Volcano, a New Nevada Strike

By Francis Church Lincoln*

The new mining camp of Volcano is situated 18 miles east of Tonopah. It is within the forest reserve and upon an old road used in the early days for hauling fuel wood to Tonopah. Leaving Tonopah by the main highroad to the east, one crosses the Tonopah hills near the Belmont mine and comes to the Ralston Desert. Here the road to Manhattan branches to the left and the road to Ely to the right. Looking toward the north, the mountains at Manhattan and Belmont can be seen and toward the south, those at Goldfield. Across the Ralston desert, in the low hills on its eastern boundary, Volcano lies at an elevation of 6300 ft. Although in a forest reserve, there are no trees in the neighborhood of the original strike and few elsewhere in the district.

The first strike was made on Apr. 18, 1915, by John Musser and Charles Glenn, who traced some rich float to its source. A second discovery was made by Ed McKelvie on May 7, about two miles from the first strike at a camp which is now called Sylvanite. At both of these camps are encountered in irregular bunches. A piece of this silver ore, which did not show horn silver, was found to contain 12.08 oz. silver and a trace of gold.

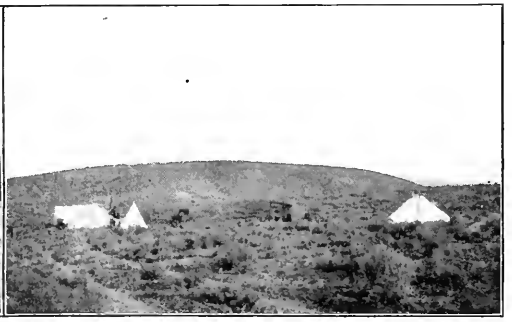
The country rock at Sylvanite appears also to belong to the rhyolite group, although it is not so fine-grained as that at Volcano. The ore contains horn silver. An assay of specimens of this ore gave 64.68 oz. of silver and a trace of gold; and the average grade is said to be between $15 and $30. The vein in which the ore occurs strikes north 25° West magnetic, and dips 80° toward the northeast. At a depth of 10 ft. the width of the vein is 2 ft.

The camp at Volcano is typical of the new strikes which are continually being made in the various parts of Nevada; some of them develop into paying mines. At the present time not sufficient work has been done to determine whether the values will persist in depth.

Removal of Rust by Chemicals

For a variety of purposes it is eminently desirable to find some chemical reagent that will readily remove rust from iron. In many cases the loss of a little iron along with the rust is not of importance, but on the other hand, in the cleaning of specimens for museums, it is important to lose as little iron as possible. Of course, in scientific investigations which have for their object the quantitative determination of corrosion by weighing the iron before and after attack, it is essential that the loss of unoxidized metal be reduced to the absolute minimum.

Original Discovery at Volcano



First Camp at Sylvanite

tent settlements have sprung up and also at the well near the Sylvanite camp. It is interesting to note that old workings are situated only a short distance from the present strike at Sylvanite, and that rather extensive workings occur within a few hundred feet of the original strike at Volcano.

The country rock at Volcano is rhyolite. When this fine-grained rhyolite is freshly broken it emits a strong odor of hydrogen sulphide. The ore is a dark quartz showing free gold. The dark color of the quartz is caused by the presence of silver sulphide. This ore is about a foot in thickness and has a strike of about 85° East magnetic, dipping roughly 30° toward the south. An assay of specimens of this ore, made at the Mackay School of Mines, gave 270.04 oz. silver and 13.44 oz. gold per ton. The average grade is said to be better than $200 per ton. In the hanging wall of this vein silver chlorides

*Reno, Nev.

The subject has been reviewed by J. Newton Friend and C. W. Marshall in an article published by the British Iron and Steel Institute.

The authors explain that electrochemical methods have frequently been suggested, the rusty iron being suspended as cathode in a suitable electrolyte, the anode consisting of some inert material such as carbon or platinum. By adjusting the current density, the hydrogen set free at the cathode appears to loosen the rust by what is asserted to be a purely mechanical process, not involving the solution of any iron; and for such processes considerable accuracy is claimed. Scraping with knives and polishing with sand or emery paper or cloth has been the process usually adopted for small specimens, and the method has proved satisfactory. For large test pieces these methods will not do.

In the literature on the subject, different investigators have frequently alluded to dilute solutions of sodium

citrate as suitable media for loosening rust without dissolving any iron. A series of experiments was undertaken to prove this and to extend the inquiry to the action of other chemical reagents upon rusty iron.

The metal chosen for the tests was mild openhearth steel sheets, cold rolled and charcoal annealed. They were 2x1 ft. in area and 22 B.w.g. in thickness. Several of the sheets were soaked in water and exposed to the air for a month, after which they appeared to be corroded equally over their surfaces. They were then cut up into squares measuring $2\frac{1}{4}$x$2\frac{1}{4}$ in., weighing approximately 19 grams. In order to further insure uniformity, the results obtained with the small plates were compared with one another only when they had been cut from the same large sheet. The plates contained approximately 0.2 gram of hydrated ferric oxide in which there was only the merest trace of ferrous iron. Several of the plates were thoroughly cleaned with emery paper, an even loss in weight being taken as a standard for comparison with the result obtained by chemical means. The accompanying table shows the degree of accuracy which may be expected, noting the losses of weight with small plates cut from the same sheet:

PLATES CLEANED MECHANICALLY

	Sheet 1 Gram	Sheet 2 Gram.
Plate 1	0 2495	0 1772
Plate 2	0 2347	0 1682
Plate 3	0 2336	0 1718
Plate 4	0 2398	0 1628
Mean	0 2394	0 1700

Solutions of sodium citrate were used, in 1, 2, 5, 10 and 20% solutions, the results being shown in the accompanying table:

RESULT OF CLEANING WITH SODIUM CITRATE

Loss in Weight of Rusty Plates

Days	1 Gram.	2 Gram.	3 Gram.	4 Gram.	5 Gram.
3	0 1248	0 1576	0 2266	0 2770	0 3810
4	0 1746	0 2100	0 2718	0 3260	0 4326
5	0 2110	0 2334	0 2994	0 3576	0 4574
6	0 2412	0 2534	0 3218	0 3714	0 4764
7	0 2942	0 2738	0 3474	0 3874	0 5048
8	0 3802	0 3160	0 4146	0 4258	0 5598
Sodium citrate.	1%	2%	5%	10%	20%

Next solutions of boric acid were used, ½, 1, 1½, 2 and 3½%, the last named being saturated. The table shows the loss of weight in the plates at different times in these solutions. Various other chemical reagents were tried, but none of them proved as useful as boric acid, and it did not appear possible to find a reagent that would remove rust quantitatively without also dissolving some iron. A 10% solution of aluminum sulphate cleaned the iron in 24 hr. and yielded an excellent metallic surface. A 1% solution of chromic acid removed rust exceedingly slowly, a plate of metal not becoming clean in six weeks, during which period it had lost 0.2448 grams in weight.

RESULT OF CLEANING WITH BORIC ACID

Loss in Weight of Rusty Plates

Days	1 Gram.	2 Gram	3 Gram.	4 Gram.	5 Gram.
1	0 0472	0 0890	0 1622	0 1968	0 3260
2	0 1242	0 1044	0 1646	0 1990	0 3566
3	0 1310	0 1968	0 1696	0 2030	0 3602
4	0 1742	0 1984	0 1736	0 2100	0 3620
7	0 3060	0 3400	0 2720	0 2184	0 3690
11	0 3742	0 3857	0 3584	0 3742	0 3878
14	0 4002	0 4131	0 3614	0 3764	0 4054
Boric acid	0.5%	1 0%	1 5%	2 0%	3.5%

Saturated solutions of zinc sulphate and of magnesium chloride were also tried. In the former the rust turned black; and signs of cleaning were apparent in the latter only after 11 days. A 10% solution of ferrous sulphate cleaned a piece of iron in a fortnight, the loss in weight being 0.4588 grams. An attempt was made to clean some plates by immersing in 5% caustic-potash solution in contact with granulated, and in some cases powdered zinc, the surface of the plates being scratched free from rust in places to insure good contact. The rust was converted into a blackish mass containing a high percentage of ferrous oxide, but no satisfactory cleaning action was observed. A plate of pure iron foil (Kahlbaum's), entirely free from rust, when immersed in caustic-potash solution in contact with the zinc, slowly gained in weight after the first day.

Formation and Distribution of Bog Iron-Ore Deposits*

The simplest cause of precipitation of iron is oxidation from the soluble ferrous to the much less soluble ferric compounds. Ferrous carbonate, soluble in carbonated waters, is also precipitated as the carbonate by evaporation of the excess CO_2. Certain bacteria precipitate iron by building the hydrated oxide into their body cells. Iron is precipitated as the sulphide when vegetation decays in the presence of sulphates of lime and magnesia, with a deficiency of oxygen. There are many other means by which, under special conditions, iron may be precipitated in nature. Oxidation, evaporation of CO_2 and iron bacteria have usually been held to be most important.

Bogs are often accompanied by thin layers of iron ore consisting largely of hydrated ferric oxide, frequently with considerable amounts of ferrous carbonate and sometimes ferrous sulphate and silicate. In marine marshes, under the influence of the sulphates of sea water, iron may go down as the sulphide. Bog ores, however, consist essentially of limonite with subordinate amounts of carbonate. Such ores are usually high in phosphorus and almost invariably preserve abundant fossil fragments of leaves and plant remains which serve to identify them as of bog origin.

Northern Deposits

Those countries best known as producers of bog ores are Norway, Sweden, Germany, Poland, Finland, and Canada. Many deposits occur in the northern United States. Careful examination has shown that the overwhelmingly large number of the known bog deposits occur in the northern portions of the three northern continents.

A very small percentage of our bog-ore deposits is to be found outside the glaciated regions, while within those regions they are characteristic and abundant, both in Europe and in North America. The ores accumulate in the smaller swamps, while in large neighboring morasses they may be entirely wanting, probably by reason of the fact that the concentration is greater in the smaller swamps. Glaciated areas are more favorable to iron accumulation because they present numerous small swamps, rather than the immense ones, such as are common to the lower flood plains and deltas of large rivers or the saline marshes of low coastal plains.

Another factor, doubtless, is the proximity of available sources of supply for the iron. From 1 to 3 per cent. of

*Abstract of paper to be presented at the San Francisco meeting of the A. I. M. E., September, 1915, by C. L. Dake, Assistant Professor of Geology, Missouri School of Mines.

the glacial drift is said to be made up of magnetite; and other iron compounds are present. The unconsolidated condition of the drift renders this iron content easily accessible.

Tropical Deposits

The prevailing red color of soils in the tropics has been assumed to be a result of a higher oxidation of the iron and its superficial dehydration. It seems possible that the rapid decay of vegetation in tropical regions and the resulting lack of accumulation of partly decayed vegetable matter may effect the accumulation of bog iron ores.

Two alternative suggestions have been tentatively advanced. First, that iron does not go into solution in the tropics as abundantly as in colder regions; and secondly, that it goes into solution abundantly, but is not so readily precipitated.

Most tropical soils, by reason of long, hot, dry seasons, are deficient in humus and contain iron in a high state of oxidation, and therefore are relatively insoluble. But regions of nearly continuous heavy rainfall are covered with rank vegetation, and rapid decay yields plentiful humus. In such regions, therefore, iron may go into solution freely, but the abundant rains will cause excessive leaching of the humus, removing the dissolved iron. Thus tropical soils may, on the average, be low in humus, while the rivers carry, nevertheless, much organic matter and hold iron in solution. The high state of oxidation of the iron as a whole, together with the extensive leaching of such iron as is soluble and its rapid removal in waters with a high solvent power, together with the absence of small swamps giving opportunity for concentration, may possibly furnish a partial explanation of the infrequent occurrence of bog ores in the tropics.

Lake ores, described as occurring chiefly in Sweden, Finland, European Russia and Canada, may be classed with bog ores, since they are essentially the same in distribution, method of formation and character, and frequently show graduations into bog ores.

Summary

Bog ores are widely distributed, but occur chiefly within the colder temperate regions and for the most part within the glaciated area. No important deposits are known to be forming in marine bogs.

The probable causes of this distribution are:

1. Swamps are more numerous in the glaciated area than elsewhere.

2. Glacial swamps are of smaller size and allow greater concentration of chalybeate waters.

3. There is abundant available iron in glacial soils.

4. Possible climatic factors involve the high state of oxidation of the iron in warmer regions, together with the lack of iron solvents in large areas of tropical soils and abundant organic matter in many of the rivers, keeping in solution the iron once dissolved and permitting it to be carried out to sea, instead of being redeposited in swamps.

The writer believes that glaciation is probably the most important factor, operating through the favorable conditions presented by the presence of numerous small swamps and the abundance of iron available in glacial soils.

[The original paper has 39 citations covering a wide range of authorities.—Editor.]

Chronology of Mining for June, 1915

June 1—Lower lake freight rates on iron ores became effective.

June 2—J. P. Morgan & Co. announced purchase of $10,000,000 of 10-year 6% bonds of Kennecott Copper Corporation.

June 3—Decision adverse to the Government in its suit to dissolve United States Steel Corporation rendered by the Federal District Court at Trenton, N. J.

June 4—Appellate Division of the New York Supreme Court rendered decision in favor of plaintiff in case of A. Chester Beatty vs. Guggenheim Exploration Co.

June 7—Amalgamated stockholders' meeting in Jersey City voted for dissolution of company.

June 8—Decision, as to motion to dismiss, favorable to Government in six suits pending in California against Southern Pacific Co. in oil-land cases.

June 9—Ohio Copper Co. leased mine and mill to General Exploration Co.—The Tonopah Merger and Tonopah Victor mines voted to merge with Tonopah Extension.

June 10—Cave-in in Longacre Chapman mine, Joplin district, buried six men; four rescued after 120 hours' imprisonment.—Flywheel at mill of Mine La Motte burst, doing considerable damage and injuring several men.

June 12—Calumet & Hecla distributed bonus of over $500,000 among nearly 10,000 employees.

June 14—Stores in Butte forced to declare holiday on anniversary of big Butte labor riot in 1914 on account of action by clerks' union and defection in employers' association.

June 15—Fire destroyed machine shop and equipment of Conrey Placer Co., at Ruby, Mont.; loss, $125,000.—Last spike driven in Mascot & Western Ry., Arizona, connecting Mascot copper mines with Southern Pacific Co.

June 16—Greene-Cananea resumed operations at mine and smeltery with two blast furnaces and one reverberatory.

June 18—First section of Ohio copper mill started by lessee.—First copper produced at Cananea after long idleness.

June 21—Earthquake in Imperial Valley, California, did considerable damage.

June 22—Disruption of the International Lead Convention owing to secession of the Australian producers.—United States Supreme Court decides against Lackawanna in coal-ownership cases.

June 23—First copper made at Chuquicamata.

June 24—Success Mining Co., Idaho, changed hands by sale of 1,100,000 shares of stock for $1 a share.—Unexplained accident wrecked shafting in west half of Washoe concentrator, necessitating 24-hr. shutdown of Anaconda's Butte mines.

June 28—Strike of zinc miners in Joplin district, Missouri.

June 29—Portland Gold Mining Co. given possession of Stratton's Independence.—First section of Inspiration mill put in operation.

June 30—Miami increased its dividend to 75c. quarterly.—Sterling exchange touched 4.7575, the lowest in 40 years.

Editorials

New Jersey Zinc Co.

The real Croesus among the zinc companies is the New Jersey Zinc Co. This company owns the marvelous Franklin mine, affording an ore that makes the high-grade spelter, which realizes the highest price. Conquently the New Jersey company gets all there is in this business without division among other interests. Besides this it has an extensive Western smelting business, which is now immensely profitable, and some important Western mining interests. As if this were not enough there is the spiegeleisen business in the East, which also has become exceptionally lucrative.

Even in normal times the New Jersey Zinc Co. was a bonanza. Previous to 1912 it is said to have paid $30 per share annually on its 100,000 shares, and in 1912 to 1914 reports say that its dividends were $50 per share per annum, besides which a cash surplus of about $25,000,000 was accumulated. This week the company is increasing its capital stock from $10,000,000 to $35,000,000 and cutting one of the biggest melons in corporate history for distribution among its shareholders.

The spectacular success of the New Jersey Zinc Co. is based primarily upon two things; namely, the possession of the phenomenal Franklin mine and the Wetherill process of magnetic separation. The Franklin mine is a unique deposit of mixed zinc, iron and manganese minerals which previous to about 20 years ago was exploited with only moderate success. Then John Price Wetherill introduced his process of separating the component minerals in a more effective way than ever before. August Heckscher consolidated conflicting property interests, and the new company set out upon its wonderful career. Profiting by its long and successful experience and its efficient organization, it went into the mining and smelting business in the West, operating there as the Mineral Point Zinc Co., the Prime Western Spelter Co. and the Empire Zinc Co. At present it is probably the largest zinc mining and smelting company in the world, and certainly it is the most profitable.

Selling Copper for Export

The war is without doubt destined to change more than one custom in the copper trade. Among these is the influence that the speculative market for "standard" copper in London has had on our market for refined copper. In previous times the existence of that market has enabled arbitrage transactions to be made whenever the two markets were out of joint, but recently the British restrictions have prevented any such operations to any important extent, and when the difference between the price for "standard" copper and the nominal quotation of the London Metal Exchange for electrolytic spread to £14 per ton, the absence of any broad commercial meaning to the fluctuations in the price for "standard" copper became self-evident. There should never be a difference in excess of about £2½, for at that discount refiners should easily be able to buy up all the "standard" copper and turn it into electrolytic. Of late, however, foreign refiners have been excluded from the "standard" market by the governmental restrictions against the export of copper.

For the time being, anyway, and perhaps for longer, no attention need be paid to the fluctuations of "standard" copper in London. Rises or falls are neither bullish nor bearish points, for they have scarcely anything to do with the real movements in the trade for the metal.

Another time-honored custom that has been upset to a considerable extent—and will be abolished, it is to be hoped—is the selling of copper for export in terms of foreign money—pounds sterling in London, francs in Paris, etc. At least one of the important American producers is now selling only on the basis of dollars. Its prices include freight, insurance, etc.; that is, they are made in terms of dollars and cents, c.i.f., and this producer says it will never again sell in terms of foreign money.

A factor contributory to this innovation is the uncertainty with respect to the future of sterling exchange. The producer selling copper for delivery two or three months hence is now unable to judge closely what he is going to realize if payment is to be made in pounds sterling or francs, inasmuch as sterling exchange may fall in the meanwhile to 4.70 or lower. If sales be made in dollars there is of course no risk in this respect. Anyway, the dollar exchange in this market is further to be commended by the fact that after all it is an American market, about 70% of the copper production of the world being supplied by American refiners. The JOURNAL would like to see the custom of the trade modified one step further, would like to see copper quoted only in terms of cents per pound, cash, in New York and the rest of the world compelled to buy here on our own terms. However, this is too much to expect right away, for our copper producers, in their competition among themselves and with those of the rest of the world, will no doubt feel themselves obliged to court their customers by naming a price delivered to them or to some port with which they are familiar. Nevertheless the method of doing business with them may be altered if Congress next winter makes such a declaration of the Sherman law as will render it clear that it was not intended to apply to combination among sellers in foreign markets. The arguments upon this point at the recent hearing of the Federal Trade Commission were impressive, and there is reason to believe that Congress will view favorably that which exporters want it to do; that is, make it positive that concerted action in foreign business is not contrary to the Sherman law.

John D. Ryan made the following illuminating remarks about the way the business of American producers in selling copper for export has been conducted heretofore:

The business has been done in foreign countries largely with foreign dealers who made combinations, withheld their business when there was any overproduction or when there was any chance of making or breaking the price, who manipulated the speculative markets for copper abroad, who kept the actual consumers out of the market and prevented their buying until such time as they had driven the price about as low as they thought it could be made. Then they bought all that they could buy of us, and when they got through buying the domestic consumer, who never was allowed to combine with others and who had to cover his demands, followed them along, and as a result paid seven-eighths of a cent a pound more.

I know by our own experience. We sell large concerns in Europe. It is a daily occurrence to get a cable from our representative saying that so-and-so is in the market for a thousand tons or three or four thousand tons or whatever the quantity is, and will give us the business on equal terms with "A," who is our competitor and whom the buyer represents as bidding 10 shillings under us. Now, "A's" office is only two blocks from my office here, but I don't dare to call him on the telephone to ask whether that consumer in England or in Germany is telling the truth or not. I might be violating the law. The chances are nine out of ten that the foreign consumer is not telling the truth, but is simply telling our representative that somebody is quoting 10 shillings under him for the purpose of trying to bring our man down to the basis of the quotation he wants. But we fight one another, and the consequence is that the buyer gets the advantages. We cannot even compare notes as to what our prices are.

It is not unlikely that a change in American laws that will better enable American copper producers to meet the situation that Mr. Ryan has so lucidly described will be another one of the innovations that will date from this period of upheaval.

The Plaint of the Prospector

Now and again we receive communications from prospectors which as a rule are valuable only in that they are human documents filled with sentiments which truly come from the "heardt oudt." We have one such now in hand, complaining of the high cost of beans, bacon and flour, and the JOURNAL subscription, and setting forth in several foolscap pages his reasons for believing that the ore finder, the prospector, is the man, and technical journals should devote a larger share of their columns to his welfare. He cannot understand why an agriculturist can negotiate a considerable loan at the bank, secured only by his undeveloped ranch land, before a crop has been raised, while the prospector cannot raise a loan at the bank on his mining claim, not even after he shows a considerable vein. He says he is not taking any journal now because he is "perfectly aware of the best places to strike for the ore, and it is quite plain sailing, and what I need is plenty of powder and grub." All of which is the usual plaint of the prospector.

The prospector leads a most picturesque life, when viewed from a comfortable office in a New York skyscraper; but out on the side of a hill, miles from any other habitation and many miles from a population of any size; in a rough board shack, with the walls pasted over with newspaper to keep out unwelcome drafts and to take off some of the rough bareness of the room; with a bare or oilcloth-covered table in the corner with bottles of condiments and the sugarbowl covered over with a towel, long since dirty; with a woodbox filled with knots from the scraggly pines on the hillside; with an unattractive and not very comfortable bed in one corner, loaded with dark-colored bedding that has not been moved from around the nest formed by the sleeping body for months; with only a mangy cat for company, and with his latest literature dated perhaps a year back—the picturesqueness of the prospector's existence is completely swept away, and he deserves much sympathy in many ways.

But this particular wail contains its own best answer. If the prospector would discard his pre-glacial literature and read the current journals he would know where to go with his orebodies when he has assured himself of their existence, and he would find a wealth of information about the various mining districts old and new, mining development past and present, which would make his search for a new prospect more expeditious and the result more satisfactory.

Labor Troubles in Mining

What is going to happen in the actions of the labor unions with respect to the mining industry is one of those things that Lord Dundreary used to say "no fellah can find out," or figure out. The Coeur d'Alene, which used to be the scene of turbulence, the dynamiting of mills and the reversion to martial law, has been peaceable for a good many years. On the other hand, the Lake Superior copper region, which for half a century was regarded as the Altruria of the mining industry—the happy land of both magnate and miner—surprised everybody two years ago by becoming the locus of one of the most virulent strikes on record. Mystification over the outbreak of these miners of a relatively permanent population—as compared with the migratory workmen of the Far West—is not cleared away by the knowledge that they were stirred up and misled by professional agitators, or by the knowledge that the same people who in 1913 were reviling Mr. MacNaughton as the root of all evil were in 1915 contributing their dimes to give him a testimonial befitting his position as the benefactor of his workingmen. Nay, it will ever remain a mystery how the aforesaid workingmen could so suddenly have been locoed. Of course there was never any mystery about the parts of Moyer and his coadjutors, of the congressional committee of investigation, and of Brother Wilson who sits at President Wilson's cabinet table.

Lake Superior thus having fooled everybody, it remained for Butte in the following year to refute all prophets in the opposite way. From time immemorial Butte was the center of unionism—the place where the war chest was filled for battles elsewhere. Even the Lake Superior strike was financed to a large extent from the contributions of the Butte union, and looking at Butte everybody said, "What a pity the mining companies should be so under the domination of the union, not daring to call their souls their own. If there should be any resistance there would surely be doings in Butte." And everybody was looking for that to happen some day and was looking for the very Armageddon of labor wars.

Well, last year there were doings in Butte, but they were between rival labor unions, not between labor and capital, and the unions immediately made themselves ridiculous and were laughed out of popular consideration. The easiest way to get rid of an annoying person is to give him an opportunity to make an ass of himself if he has any disposition that way; and the same expedient proved to be very effective with labor unions.

The next result of the humorous developments at Butte was to show the miners of that place—who were supposed to be terrible swashbucklers, but in reality were merely honest, hard-working men (like most people)—that they

did not need any union whatever. Then the joke was fastened on the professional labor leaders, and to them it was a ghastly joke, for it raised visions of their having to go to work with sweating brows, just like their whilom dupes. Their efforts to revive the unions have so far been unavailing, as related last week by the JOURNAL's Butte correspondence in the following illuminating paragraph:

When the old Butte Miners' Union surrendered its Western Federation charter, it revived itself as the Butte Miners' Union and solicited members among the miners who are opposed to Moyer. The union has been going it alone nearly two weeks and has succeeded in getting a membership of about 40. Moyer's federation agents have been working to get members back into the fold for six weeks or more and are now operating under the name and charter which the old union surrendered, but in six weeks they have obtained only about 200 members, and that seems to be about the limit of the federation sympathizers. Then there is the original rebel organization of I. W. W.'s, the Butte Mine Workers' union, which still maintains an organization through a few officers, but has no members. There are more than 12,000 miners working in the Butte district again, and the results of the efforts to organize unions indicate that the men who work with their hands are satisfied to stay on the outside and that they have no particular sympathy with the men who work with their jaws only. The miners are getting their $4 a day, and they have neither union nor contract to enforce the payment, but they find that the employing companies are a pretty decent lot of corporations and will do right if permitted to do it.

Evidently the miners of Butte have perceived that there is no use in paying dues that do them no good, but support parasites who "work with their jaws only."

The third paradox in the affairs of mining labor is now before us in the Joplin district, where a strike is in progress, and whither the agitators are hurrying hot-foot. The motives for the strike are simple enough. The operators have been making extraordinary profits through the unusually high price for zinc ore, and the miners think they ought to participate in them to a greater extent than has been granted them. It is out of the ordinary, however, for Joplin miners to strike in a large body, to enforce the closing of mines where the men want to work, and to listen to the advice of professionals like Moyer. Heretofore Joplin has been noted for its freedom from unionism and for the independence of its men, who have been notorious strikebreakers in Colorado and elsewhere. However, a reversal of form on the part of the Joplin men is no more surprising than what was witnessed last year in Butte and in the previous year at Lake Superior.

BY THE WAY

On each copy of the latest bulletin of the Institution of Mining and Metallurgy is the following paster:

Notice—All members, associates or students of the Institution of Mining and Metallurgy, of German, Austrian, Hungarian or Turkish nationality, are hereby requested to abstain from attending any meeting or visiting the house of the Institution during the continuance of the war.

⁂

The supply of rifle cartridges available for use in Mexico is said to be very small, owing to the attention of cartridge manufacturers being diverted elsewhere. This class of ammunition is now quoted at 6c. per cartridge, f.o.b. El Paso. Real money now being scarce in Mexico, the warriors are experiencing great difficulty in keeping their belts well filled, though a few of the mines are being worked for this purpose. If one cartridge costs 6c., gold, how much does it cost in Villista paper to kill a man in battle?

⁂

An interesting story is told of a peculiar "practical" mining incident which occurred in one of the Mexican states some years ago. The superintendent of a mining property induced his friend, the federal mining agent, to let a denouncement of an "abandoned" mine slip through in spite of the fact that the bullion output from the property had been uninterrupted. As the operation of the mine yielded continually increasing profits, the advisability of securing the "good will" of the governor of the state became apparent. The said governor had been a sandal-footed bandit in the days when Porfirio Diaz roared about the hills in search of loot and glory, but many years of prosperity had educated him to the point where he was quite a stickler for ethical proprieties and legal formalities. In fact, he was about as particular as some New York or Philadelphia corporation lawyers. The matter was adjusted by Don Daniel taking the governor's personal note for the sum of money which changed hands. "A gentlemen's agreement" was entered into, verbally, to the effect that Don Daniel should never present the note for payment. Don Manuel was never dunned for the amount, but after his death the practical American miner cashed in on the note, thus depleting the late governor's estate not only for the total amount, but with interest at six per cent.

⁂

Reported in New York

The increase in the Miami dividend from $0.50 quarterly to $0.75 was rather unexpected, but was in line with the increases that had previously been made by the Utah, Nevada, Anaconda and other companies, which reflect the increased earnings of the copper-producing companies and exhibit confidence in the future of copper.

⁂

In the suit brought against the Reading companies for violation of the Hepburn clause of the Interstate Commerce law, the United States Circuit Court at Philadelphia has decided in favor of the companies. The court holds that the Philadelphia & Reading R.R. Co. does not own the stock of the Philadelphia & Reading Coal & Iron Co., the stocks of both being held by the Reading Co., a distinct organization. The relations between the coal and the railroad companies are simply those of miner and shipper on the one hand and of common carrier on the other. It is understood that the Government will take an appeal in the case.

⁂

Kennecott Copper, the owner of the Bonanza mine, in Alaska—originally an enterprise of J. P. Morgan & Co. and the Guggenheims, with whom Kuhn, Loeb & Co. subsequently became a partner—was recently listed on the Curb market, the purpose being manifestly to bring in the public. It is rumored that the distribution of the stock is being managed by an important operator, with the usual accompaniments of private tips and public press notices. Anyway, the stock had a sharp rise within a few days of its introduction. This of course attracted the attention of speculators, some of whom got in and out at a profit, while others without doubt will overstay their market and become involuntary investors. This is the usual way of a promotion.

Jones Mixer Suit Finally Decided

At Philadelphia last week the protracted patent litigation between the Carnegie Steel Co., complainant, and the Cambria Iron Co., defendant, entered its final stage when Judge McPherson of the Circuit Court of Appeals affirmed the decree of the Western District Court against Cambria, and ordered it to pay costs in the appellate court, the costs in the district court to be awarded by that tribunal. The question decided related to the method of accounting for profits earned by the infringement.

The decree of the lower court ordered Cambria to pay to the Carnegie company $586,306, with interest from May 1, 1912, to date of payment. The suit grew out of the Jones patent, granted for an improvement in the method of mixing molten pig iron, and charged the Cambria Iron Co. with infringement. Judge Buffington, then sitting on the Western district bench, sustained the validity of the claim and held that the process used by the Cambria works was an infringement upon the Jones patent. The suit has been in the courts for several years.

Dome Mines Report for 1914

The report of the Dome Mines Co., Porcupine, Ont., for the year ended Mar. 31, 1915, shows that 248,550 tons of ore was treated, which yielded $1,055,496, or $4.25 per ton of ore. The following table will show the financial affairs of the company during the year:

Receipts from bullion	$1,055,496.78
Receipts from interest, discount, etc.	6,878.41
Total receipts	$1,062,375.19
Charges:	
Mining	$205,492.20
Milling	248,407.38
General	114,816.89
Selling expense	5,160.21
Development	173,319.02
Additional construction and equipment, less salvage	106,792.49
Written off buildings and equipment	29,808.55
Total charges	$883,796.74
Balance of receipts	178,578.45
	$1,062,375.19

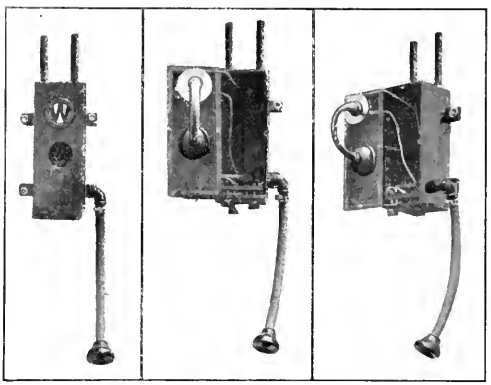
Development work consisted of 1971 ft. of drifts, 2411 ft. of crosscuts, 1226 ft. of raises, 532 ft. of box-holes, 83 ft. of shaft—total, 6223 ft. In addition to this work diamond drilling amounted to 5875 ft., and enlarging and straightening drives, station construction, and sumps, 85,000 cu.ft. The development work was distributed on the various levels within a zone of 1500 ft. long by 400 ft. wide. Ore reserves are estimated to contain 2,782,811 tons of ore, having an average value of $4.15 per ton.

The mill is expected to reach its maximum capacity of 28,000 tons per month during the coming year. During the year under review, operating 342 days, or 93.7% of the total possible time, it treated 248,550 tons of ore. The average value of the ore sent to the mill was $4.68, of which $2.70, or 57.6%, was saved by amalgamation and $1.54, or 33%, was saved by cyanidation. The total mill extraction was 90.6%. An increase in amalgamating plate area is in process of erection, as a greater extraction by amalgamation is expected.

The small 16-cu.ft. cars used for tramming and hauling ore on the main level and up the incline shaft to the crusher have been replaced by 93-cu.ft. cars. The cost of crushing and conveying has been reduced from 25.2c. to 12.6c. per ton. A system is being installed consisting of 5-ton cars for underground use, a large underground crusher, automatic loading hoppers, 4-ton skips, and a surface haulage with 5-ton cars to the crusher from the No. 2 shaft. The operating costs, based on a total cost of $737,551, were as follows per ton of ore milled: Mining, including hoisting, 68.2c. per ton; development, 69.7c.; crushing and conveying, 12.6c.; reduction, 99c.; general, 46.1c.—total, $2.967 per ton milled. The company ended the year with $484,040 in current assets and $43,011 in current liabilities. An issue of 50,000 shares of treasury stock is contemplated to furnish funds to carry on development to determine as quickly as possible the tonnage of ore that may be profitably mined.

Weiss Mine Telephone

A new mine telephone has recently been developed and is being placed on the market by L. T. Weiss, of New York City. The troubles in the generally accepted mine telephone are due to rapid battery deterioration, grounding of the battery, breaking of parts because of extremely rough handling, corrosion of small wires, corrosion of transmitter diaphragm, breaking down of induction



THE WEISS MINE TELEPHONE

coils, etc. A central-energy system, phone and the present circuit were worked out. The central relay and battery are located in a suitable place on the surface. The whole system can be quickly installed on the old wiring without change.

The phone itself consists to outward appearance of an iron box with an opening to speak into, an armored rubber hose for listening purposes and the two buttons. No cord, wiring, or mechanism are visible. The transmitter, receiver and wiring are permanently locked up. The transmitter is connected to the speaking opening by a connection also in the box, which prevents any moisture, expectoration, or mechanical injury reaching the diaphragm. The only damage that can be done is by the removal of the armored rubber listening tube. Even this would not put the phone out of service and anyone could readily slip the hose or another one in place, or could listen at the hole over which the tube was placed.

This phone has been in operation in several mines for over a year. It is claimed by its maker to be absolutely foolproof and able to meet any possible condition.

PERSONALS

Fred C. Alsdorf has been in New York for the past few weeks but expects to return West soon.

J. V. N. Dorr will spend most of the month of July in Colorado. During August he will be in San Francisco.

Dr. F. W. McNair, president of the Michigan School of Mines, is visiting the mining centers of northern Ontario.

W. B. Bretherton has resigned his position as head chemist at the Dome Mines, Porcupine, Ont., and has gone West.

A. A. Hassan has been appointed consulting engineer for the Crimora Manganese Corporation, operating at Crimora, Virginia.

G. C. Bateman, of the Canadian Mining & Exploration Co., recently examined the Beaver Lake and Herb Lake districts, in Manitoba.

Irving A. Palmer has been appointed superintendent of the Altoona zinc-smelting plant (Altoona, Kan.) of the United States Smelting, Refining & Mining Co.

John D. Ryan left New York on July 2 for Michigan, after which he will visit Montana and the Pacific Coast, not expecting to return until late in the summer.

W. H. Glasgow has been made assistant general superintendent of the H. C. Frick Coke Co., with headquarters at Scottdale, Penn. Clay F. Lynch is general superintendent.

Robert E. Harris, president of the Nova Scotia Steel & Coal Co., Ltd., has been appointed a judge of the Supreme Court of Nova Scotia, which will necessitate the election of a new president.

Archibald Jones, formerly general manager of the Bartlesville Zinc Co., at Bartlesville, Okla., has been appointed general manager of the American Zinc & Chemical Co. of Langeloth, Penn., succeeding N. L. Heinz.

Joseph Cooper was appointed assistant superintendent of the Farrell openhearth steel works of the Carnegie Steel Co., succeeding Norman S. Powell, who has been appointed superintendent of the North Sharon openhearth works.

W. S. Greenawalt, assistant superintendent of the openhearth department of the Pennsylvania Steel Co., has been appointed superintendent of the openhearth plant of the American Iron & Steel Manufacturing Co., Lebanon, Penn.

F. E. Parks has been appointed manager of the Minnequa works of the Colorado Fuel & Iron Co., succeeding J. B. McKennan, whose appointment as general manager of the company, with headquarters at Pueblo, Colo., was recently announced by President Welborn.

L. Jorgensen has resigned from the firm of F. G. Baum & Co., San Francisco, and will engage in general electric- and hydraulic-engineering practice, specializing in the design of arch dams. His office is 1404 Chronicle Building, San Francisco. Mr. Jorgensen is inventor and patentee of the constant-angle multiple-radius dam.

Robert I. Kerr, for many years bookkeeper at the Kennedy mine, has been elected to the position of secretary of the California Metal Producers' Association at San Francisco. He succeeds John Mocine who resigned to accept the position of superintendent of the Pittsburgh Silver Peak mine in Nevada. Mr. Mocine was formerly a resident of Nevada. Mr. Kerr is a member of the California legislature for Amador County and was chairman of important committees which rendered good services to the miners during the last session of the legislature.

OBITUARY

James H. Goudie died at Newberry, Mich., June 24, aged 67 years. He was born in Scotland, but had been in Michigan for 30 years, during most of which time he had been engineer of the Metropolitan Iron & Lead Co., with headquarters at Ironwood.

R. C. Scott, secretary and treasurer of the Morris Machine Works, Baldwinsville, N. Y., died suddenly July 4, while playing golf on the links of the Onondaga Club. He was 66 years old and was well known as a manufacturer of mining, pumping and general machinery for many years.

Robert Patterson Andrews died at Denver, Colo., June 24, aged 73 years. He was born in Pennsylvania and graduated from Lafayette College at Easton. He went to Colorado in 1863 and worked as an assayer at Aspen, Creede and other camps. For 30 years past he had been assistant assayer and melter at the Denver Mint.

Ernest Porter, receiver for the New York State Steel Co., Buffalo, and former superintendent of the steel plant of the Carnegie Steel Co. at North Sharon, Penn., died at his home in New Wilmington, Penn., June 16, aged 42 years. He was graduated from Westminster College and was first employed as a chemist at the North Sharon works, rising to become superintendent of the plant. He was also for a time in charge of the openhearth furnace department of the Tennessee Coal, Iron & Railroad Co., Birmingham, Ala. He leaves his widow and four sons.

SOCIETIES

American Institute of Mining Engineers—The next meeting of the Utah section will take place on July 15 and will take the form of an excursion to the Tintic district leaving Salt Lake City on the morning of that day and returning on July 16. Arrangements have been made for special cars for the members and facilities will be provided for visiting the different mines in the district. While at Eureka, the members will be guests of the district. A session will be held there, at which two papers will be presented; one by G. W. Crane on "Geology of Ore Deposits and Geological Methods Applied to Mining in the Tintic District;" and the other by D. A. Lyon on "The Zinc Problem in the Treatment of Low-grade Zinc and Zinc-Lead Ores."

American Society for Testing Materials—The 18th annual meeting of this society was held at Atlantic City, N. J., June 22 to 25, with a large attendance. The meeting was a busy one, no less than 55 committee reports, papers and addresses being on the program. Among the committee reports were those on standards for high-carbon steel, splice bars and track bolts; boiler tubes; welded steel and wrought-iron pipe; chemical analysis for alloy steels; chains; methods of sampling and analysis of pig iron; bars for springs and many other important topics. The report of the executive committee recommended an increase in dues for the purpose of meeting the increased expenses for publications incurred by the association. A number of the committee reports were debated and referred to letter ballot by the association. Announcement was made that owing to the European war, the congress of the International Association which was to have been held at Petrograd, Russia, in August, has been indefinitely postponed.

INDUSTRIAL NEWS

The Waterbury Co., manufacturer of manila, sisal and wire rope, on July 1 removed its general offices from 80 South St. to 63 Park Row, New York City.

The National Slag Co. announces the removal on July 1 of its offices from 30 Church St., New York, to the Kinney Building, Broad and Market St., Newark, N. J.

William Jacks & Co., of 5 East India Ave., London, and 111 New St., Birmingham, states that it is not connected with the Glasgow firm of the same name which has been prosecuted in Edinburgh by the British Government under the "Trading with the Enemy Acts"; that no member of the London firm has any interest in such Glasgow firm, and that no member of such Glasgow firm has any interest in the London firm.

The litigation that has been carried on for the last several years between the Marion Steam Shovel Co. and the Marion-Osgood Co., has been amicably adjusted. This settlement covers all machinery heretofore shipped by the Marion-Osgood Co. and grants to it shop rights to continue the use of those patents held by the Marion Steam Shovel Co., which are involved in the Marion-Osgood Co. machines as at present constructed.

On June 1 the Ingersoll-Rand Co. opened a branch office in San Francisco, Calif., at 139 Townsend St. with a view to giving closer attention to users of Ingersoll-Rand machinery than it is possible for any agency to do. Harron, Rickard & McCone will still coöperate in the sale of Ingersoll-Rand machinery after the expiration of its agency contract on July 22 next. H. L. Terwilliger is district manager for the territory handled by the San Francisco and Los Angeles offices, with headquarters in San Francisco.

Editorial Correspondence

SAN FRANCISCO—June 30

The Field Process Co. is reported to have complied with the requirements of the California "Blue Sky" commission and has been authorized to dispose of sufficient stock to build a new plant at Redding. This is evidently the same process that was installed at Redding more than a year ago and which attracted chiefly the interest of farmers. Whatever improvements may have been made, there is no record of practical commercial demonstration of the process. The first plant was built with money furnished by farmers who were fighting the smelters and the probability is that the stock for the present undertaking will be disposed of to the same men.

Guggenheim Interests on Yuba River complain that old-fashioned miners with pans and rockers have been encroaching upon the Guggenheim dredging ground between Marysville and Smartsville. The May rains and consequent high water in the streams offered a temptation which the old-type placer miners, who have been on the job for the past 50 years, could not very well resist. The Guggenheims have sent the sheriff after them, but it is understood the 20 or 30 miners have cleaned up enough to satisfy their present wants or grubstake them for prospecting trips in regions not controlled by the big interests. When the camp was being installed on American River for the construction of Natomas No. 10, the first all-steel dredge operated in California, an old prospector and miner who knew the ground better than the Natomas people did, was cleaning up big pay in a long tom. He was asked by the manager if he knew whose land he was on. He replied in the affirmative and abandoned his digging. He was told to return and get what he could off the surface until the dredge got in operation, but this extraordinary offer of the manager caused him to be suspicious that some sort of trap was being laid for him. In many placer districts in California the value of the ground for dredging has been brought to the attention of dredging companies by the operation of these old timers and usually large companies would rather encourage than drive these prospectors away.

Semi-monthly Pay Day provided by Assembly bill 487 has become a law in California. Under its provisions all wages or compensation in private employments shall be due and payable at least semi-monthly. The act does not prevent payment more frequently than twice a month. Every employer is required to establish regular pay days and maintain notices of such pay days. All wages earned and unpaid prior to the first day of any month shall be due and payable not later than the 15th day of the month following the one in which the wages were earned and all wages unpaid prior to the 16th day of any month shall be due and payable not later than the last day of the same month. Employees are safeguarded against practice of some employers of paying in non-negotiable paper by the provision that payment of wages shall be in lawful money of the United States or by a good and valid negotiable check or draft payable on presentation at some bank or established place of business situated in the state. Such payments are without discount. If an employee is absent on the regular pay day he shall be paid within five days after making demand. Violations of the law are misdemeanors and the Bureau of Labor Statistics has power to enforce the law. Some of the mining companies have complained that the enforcement of this law will retard mining and work a hardship upon those mines which are in the habit of cleaning up once a month. The talk that a semi-monthly pay day will put some of the mines out of business is not considered seriously. There may be a few mines in the state which would suffer some inconvenience and possibly temporary hardship. But the California mine that is unable to pay wages twice a month would not last very long anyway. One trouble with California mine operators is that they have been subjected to so few legislative regulations that anything in the way of mining law is considered a hardship. So far the only legislation that has done any injury to mine operators is the insurance clause of the Workmen's Compensation law. That has been softened by the action of the Metal Producers' Association.

BUTTE—July 1

Compensation Law—The Anaconda Copper Mining Co. posted notices at all of its Butte mines, at the Washoe plant at Anaconda and at the Great Falls plants that it had adopted the No. 1 plan of the new compensation law which went into effect July 1. Under this plan the company carries its own insurance. If an employee meets with an accident settlement is made direct by the company with the injured employee or in the event of his death with his heirs. Settlement is made under the schedule provided in the new law, referred to in the "Journal" of June 19. Beside the Anaconda company, the North Butte and the Butte-Alex Scott also posted notices to the effect that they had adopted plan No. 1 of the new law. The Butte & Superior, East Butte, Butte-Ballaklava, Davis Daly, Butte Zenith and many of the smaller companies posted notices that they would elect plan No. 2 of the new act. Under this plan the companies insure against accidents with guarantee companies approved by the state industrial accident board, which has charge of the enforcement of the compensation law. In case of accident the insurance companies settle with the injured, or with the heirs in case of death. Most of the mining companies of Montana, outside of Butte have adopted plan No. 2. The Anaconda company also posted the following notice from the Industrial Accident Board:

Notice to employees:

In accordance with the provisions of the workmen's compensation act, chapter 96, Session Laws 1915, this is to advise you that unless you serve written notice on your employer, and file a copy with the industrial accident board, Helena, Montana, of your election not to come under the law, that the act as adopted by your employer, will immediately apply to you.

If you do notify your employer and the above named board that you elect not to come under the said act, you may afterwards revoke such claim by a notice in writing, served on your employer and a copy filed with the above-named board, which notice shall take effect on the first day of the next succeeding month, after which time the law as adopted by your employer will apply to you.

Injury Not Resulting in Death—Notice of—An employee who has been injured in the course of his employment and whose incapacity extends over a period of two weeks shall serve written notice of such injury on his employer (from whom blank forms may be obtained) a copy of which report must be sent to the Industrial Accident Board, Helena, Montana, and which notice shall be signed by the person injured, or someone in his behalf, and shall state in ordinary language the time, place and cause of the injury.

Injury Resulting in Death—Notice of—When death results from an injury received by an employee in the course of his employment, notice shall be served by his beneficiary or dependants, or someone in their behalf.

Limit of Period of Notification—Notice of injury, not resulting in death, must be given to the employer within 60 days after the happening thereof, and claim for compensation for personal injury or death shall be made within six months, or in the event of an injured workman who is mentally incompetent and without a guardian, or an injured minor under 16 years of age who may be without a parent or guardian, a guardian in either case may be appointed by any court of competent jurisdiction and notice shall be given within six months after the appointment of the guardian or when such minor arrives at the age of 16 years. No proceeding for compensation under this act shall be maintained unless these rules are observed.

Each of the employees of the mining companies was presented with a copy of the hospital agreement under which they agree to pay $1 per month for hospital fees. This includes a waiver of the provisions of Section 16-F of the compensation act.

SALT LAKE CITY—July 2

The Utah Copper Co.'s Production in May was 14,063,765 lb. of copper, compared with approximately 13,000,000 in April. Ore production has been increased, and according to reports in Bingham, as high as 28,000 tons of ore a day have been handled. The Bingham & Garfield R.R. has run 9 or 10 ore trains of about 40 cars each a day, which would mean from 17,000 to 20,000 tons of ore, the remainder being carried by the Denver & Rio Grande, which handles 7500 tons daily under contract, and at present is carrying 1500 tons extra, or about 9000 tons all told. In March, the Utah Copper raised its quarterly dividend rate from 75c. to $1 per share. The company began paying dividends in December, 1908, with 50c. quarterly, and has not missed a payment since that time, being the only one of the important copper producers to maintain its rate following the outbreak of the European war. On June 30 the company paid $1,624,489.

A Better Mining Year for Utah in 1915 than had been anticipated, which will compare with, or equal, the record year of 1913, is predicted by the U. S. Geological Survey, based on reports from its Salt Lake office. The survey states that the outlook in Utah is bright, though mining was dull after the beginning

of the European war, and did not improve until March, when increased demand for metals caused the mills and smelteries to increase capacity. Following higher metal prices, the immense stockpiles of ore at one or two of the smelting plants in Utah are being rapidly worked up for their lead and copper, and only producers of carbonate or siliceous ores have preference or find a ready market. In some cases, as in the purchase of zinc ores, buyers have been powerless to take more and refuse to consider ore which has not previously been arranged for by contract. Lead producers during a few days of extremely high prices found smelters refusing to make contracts except on previously prevailing prices, with only half of the new quotation added. Producers with contracts for the sale of lead ore increased their shipments slightly, and enjoyed the high prices.

The Ohio Copper at Bingham, which is being operated under lease by the General Exploration Co. has two sections, Nos. 1 and 3, of the mill in operation treating 1900 to 2000 tons of ore daily. The third section will be started in a few days, and will increase the capacity to 2500 tons. When the company was operating, up to 3000 tons per day was treated. Operations by the leasing company have not yet been brought up to capacity, partly on account of some repairs made to the compressor machinery. A caving system is being used, and the mining costs have been placed at 25c. a ton. Since December, 1909, the Ohio Copper Co. has mined 3,058,000 tons of ore by caving. The orebody consists of crushed quartzite impregnated with pyrite, chalcopyrite and chalcocite, also a notable amount of cuprite in places. It occurs between two fissures, several hundred feet apart, and extends from the 100 level down to the 1300 or Mascotte tunnel level. The ore is mined in 100-ft. blocks, and delivered by three main chutes to bins on the Mascotte tunnel level, from where it goes direct to the mill. The ore is concentrated about 30:1, and the concentrates are shipped to the A. S. & R. at Garfield. At present between 200 and 300 men are employed.

FAIRBANKS, ALASKA—May 31

The Rate on Ore to be transported from Fairbanks to either Seattle or Tacoma is quoted as follows by the American-Yukon Navigation Co.:

Ore Sacked	Rate per Ton
1 to 5 tons	$25.00
5 to 20 tons	22.50
20 to 50 tons	20.00
50 to 100 tons	17.50
100 to 250 tons	15.00
Over 250 tons	Special

The ore will be routed via St. Michael in connection with either the Alaska Steamship Co. or the Pacific Coast Steamship Co. This "Special Development Rate" now in effect, will, unless revoked before that time, be effective until the close of navigation in 1915.

SEATTLE—June 28

A Report on Tolovana, the first authentic summary of the prospects for the new district are contained in a report given out by Delegate Wickersham, of Alaska, who has just completed a thorough investigation of the district. He reports that the latest strike continues to draw the interest of miners in the North and at the present time there are about 300 in camp, busy prospecting and doing development work on already proven ground. Enough pay has been found to establish at least a small camp and there is every indication that it will be a larger one. More work has been done in opening the new district in the last six months than was done in the entire Fairbanks district during the first two years. Some gold is being rocked out in small quantities, but no sluicing has yet been done although an outfit on Olive Creek expects to start shortly and the first cleanup will be reported about Aug. 1 which will show what has been located on that particular creek. On Livengood Creek a line of pay has been opened extending some two miles. Along the line of the different holes sunk, pay averaging between $1.25 and $1.50 has been found on bedrock on the right limit bench and fourth tier. Lower down along the creek another line of pay has been opened showing about dollar dirt; however, it lies 30 ft. to bedrock, while the bench pay runs between 90 and 100 ft. The diggings are deep, not shallow as was at first supposed, and necessarily the prospecting is slower and more costly. In both the Shushanna and Nelchina camps it was only a few feet to bedrock, which explains their rapid development, once pay was found. In the Tolovana district it is necessary to have hoists, boilers, cables, buckets and equipment which is heavy to transport and at present the transportation facilities are poor. The summer trail from Fairbanks is impossible for heavy wagons and is being used now only by packers. The Alaska Road Commission is now investigating routes with a view of constructing a summer highway. Water transportation is the only solution this summer and small steamers and power launches go up the Tolovana 150 miles to what is called the Big Jam, extending over three miles which is impassable. There is a 2100-ft. tram being built across the portage, effecting a saving of about 30 miles whence small boats travel to within about 6 miles of the diggings on Livengood Creek and most of the freight is going this way. The Fairbanks Telephone Co. is now stringing wires to the new camp from Fairbanks. Possibly the best bunch of experienced mining men and prospectors that ever went into a new Alaskan district are opening up the Tolovana and it only needs the news that good cleanups are made when the sluices are working, to start one of the biggest stampedes the North has ever seen.

WALLACE—JUNE 30

The Sale of the Success Mine is the most important deal consumated in Wallace in many months. On June 24, H. F. Samuels sold his holdings of 1,100,00 shares of Success Mining Co. stock for $1 per share. The total outstanding stock is 1,500,000 shares. The purchasers are said to be Duluth people, the same who acquired control of the Reindeer-Queen property at Mullan. The Success mine is located on Nine Mile Creek, about one and one-half miles from the Interstate-Callahan property and is one of the oldest locations in the Coeur d'Alenes. It was first operated by the Granite Mining Co. and under that control produced $600,000 in lead and silver. As depth was obtained the ore became richer in zinc but at that time there was no market for zinc ore mined in the Coeur d'Alenes. Mr. Samuels obtained control in 1905 and formed the Success Mining Co. A large amount of development disclosed a large tonnage of high-grade zinc ore containing enough lead to pay the operating costs. A 200-ton mill was constructed which has proved successful in separating the lead and zinc at a ratio of concentration of 2:1. Dividends were suspended Apr. 20, 1913, up to which time $345,000 had been paid. Dividends were resumed Apr. 20, 1915, and since that time three dividends, 17 cents in all, amounting to $105,000, have been paid. During the month of June the mine is said to have earned 8 cents per share. The company has an excellent smelting contract which runs until May, 1916.

DULUTH—July 3

Ore Shipments for June via Duluth-Superior docks were as follows:

	June, 1915	June, 1914
Duluth & Iron Range	1,224,026	1,075,193
D. M. & N.	2,146,501	1,045,734
N. P.	2,043	19,472
Soo Line	122,408	50,659
Great Northern	802,085	1,944,606
	4,357,063	4,135,664

Total 1915 shipments to July 1 aggregate 8,892,792 tons, as against 5,817,791 tons for 1914.

JOPLIN—June 30

Our Early and Repeated Warnings regarding wildcat zinc mining investment that would follow an era of high ore prices have already been justified. Every old worked-out mine and abandoned prospect in this district is being rigged up to sell, but while a number of investors are coming in they are not throwing their money away as they did 15 years ago.

A General Strike Was Called on June 28 by the zinc miners in the Joplin district and 2000 or 3000 marched about the district calling on all the other miners to quit work and join them. The demand is for more wages. Wage increases were granted recently when zinc ore reached such a high price, and when prices dropped, some of the operators reduced wages, but none are said to have been cut to what they formerly were. Several of the large producers have shut down for two weeks and they assert they will remain closed indefinitely rather than deal with Moyer and the Western Federation who have a hand in the strike in another effort to get a formidable foothold in the Missouri fields.

TORONTO—June 28

As a Result of Outrages in Canada by alien enemies, there is a strong feeling in Northern Ontario in favor of interning the Germans and Austrians, at present employed in large numbers in the mining districts. Petitions to the government to that effect, circulated principally in Cobalt, Haileybury and New Liskeard, have obtained about 1000 signatures, and have been endorsed by the Cobalt Board of Trade. The presence of so many men of enemy nationality in the mining camps is regarded as especially dangerous owing to the large quantity of explosives which are accessible, and the fact that many of the foreigners are accustomed to their use. The petitions will be presented to Gen. Sam. Hughes, Minister of Militia.

The Mining News

ARIZONA

Gila County

INSPIRATION (Miami)—First section of Inspiration mill started up June 29.

Maricopa County

SUNFLOWER CINNABAR (Phoenix)—Preparing to resume operations at property 65 miles northeast of Phoenix. Company plans to build wet-process plant. At present 3-ton retort is being used for extracting quicksilver.

Mohave County

OATMAN GOLD M. & M. (Oatman)—Installing machinery at main shaft; will sink 500 ft.

UNION BASIN (Golconda)—Has just commenced operating new 30-ton oil-flotation plant, and as work progresses expects to erect zinc-tailings regrinding plans and add further flotation equipment.

Yavapai County

ROSALIE COPPER (Mayer)—Preparing to resume work on property 18 miles east of Mayer. George C. Meese, of Los Angeles, is president.

BIG LEDGE DEVELOPMENT (Humboldt)—Has more than 40 claims three miles east of Humboldt on which diamond drilling is proving up orebody said to average 7% copper.

CALIFORNIA

Amador County

SOUTH EUREKA (Sutter Creek)—Orebody on the 2000-ft. level has widened out and developed some high-grade ore.

MOUNTAIN KING (Pine Grove)—Robinson Co. recently obtained new bond and option and is prosecuting development work. Large amount of ore extracted but mine will be deepened before treatment is undertaken.

Butte County

NUGGET GRAVEL (Lovelock)—Reported that Smith Bros. encountered rich gravel, taking out $400 in one week. One nugget was worth $180. Property is situated on upper end of old Indian Springs mine.

BERRY CREEK DISTRICT—Mining camp near Oroville on Western Pacific R.R. is credited with recent strikes of good ore. M. A. Chapan is hauling in machinery for development. Charles Nelson has opened up gravel claim in same district.

Calaveras County

ROYAL GOLD (Hodson)—Dropping 40 stamps; preparing to add 10 more immediately, to be followed by 10 more, making 60-stamp mill with 300-ton capacity.

Fresno County

HIGHWAY COMMISSIONERS have been appointed by Board of Supervisors. An engineer will be selected and it is proposed to bond county for $3,000,000 for good roads. Coalinga oil district is in this county and will receive a large share of the benefit from road construction.

Inyo County

REWARD GOLD (Russ Mining District)—Property located east of Mt. Whitney is preparing to install cyanide plant. Thomas & Rudderow, of San Francisco, is financing the company.

Kern County

ATOLIA (Atolia)—High-grade ore is being extracted from 900 level of Churchill group. Reported that company has large contracts for tungsten.

KING SOLOMON (Randsburg)—Cleanup of 110 tons at Red Dog mill returned $6100, an average of $54.50 per ton. The largest part of ore came from 300 level.

CONSOLIDATED (Randsburg)—Water encountered in shaft in January has increased sufficiently to provide almost enough to supply 5-stamp mill which is running three shifts. About two years ago water was encountered by this company in Wedge shaft. Early in period in which this first water was pumped, there were many conjectures as to source, and doubts were freely expressed that water would be permanent. Company is now selling water from Wedge shaft to neighboring mines which formerly had water hauled in in railroad tank cars.

YELLOW ASTER (Randsburg)—Superior Court of Los Angeles denied petition of Mrs. Stella de Pauw for removal of Ward Chapman from position of coëxecutor of estate of John Singleton, Mrs. de Pauw's former husband and one of discoverers of Yellow Astor mine. Reported that Mrs. de Pauw has gone to San Francisco to take matter up with A. Van Coenen Torchiana, consul general of the Netherlands. Mrs. de Pauw by her second marriage has become a citizen of Holland and evidently is of opinion that American courts have no jurisdiction over her affairs except the decision be in her favor.

Nevada County

ERIE (Graniteville)—Number of leasers started work under supervision of Fred Weiss, agent for owning company.

GOLDEN CENTER (Grass Valley)—Collar of new incline shaft has been timbered and connections are being made with old workings. Sinking will be resumed and shaft deepened to 1000 ft.

ERIE (Graniteville)—Property will be worked by leasers under management of Thomas Haddy of Virginia City, Nev. J. W. Swearingen will have charge of mill. Property is owned by West Virginia men.

CASSIDY (Grass Valley)—Unwatering shaft is progressing. New electric pumps have been substituted for air pumps and sinking will begin as soon as water is out. Twenty men are employed. George St. John is manager

Placer County

FEDERAL DRIFT (Dutch Flat)—Recent find of ore reported in crosscut tunnel connected with old Rough and Ready works indicates that Dutch Flat may again be placed on mining map of California. Camp was producer in days of early placer mining.

CALIFORNIA-HAWAIIAN DEVELOPMENT (Auburn)—Reported that property on Ralston divide in Long Cañon district will be reopened and that tunnel from south side of ridge will be driven in hope of tapping channel which tunnel on north side failed to reach. Property is situated in northern portion of Eldorado National forest.

San Luis Obispo County

CAMBRIA (Cambria)—More than one-half mile of tunnel, started last fall, has been completed. A bucket tramway will be installed for carrying ore from the mine to the furnaces.

Shasta County

INDEPENDENT AND EXCELSIOR (Arbuckle)—A suit has been brought by Frank A. Greene and others against John H. Purcell and others to clear title to these claims and Daisy No. 1, 2 and 3.

ANCIENT-RIVER prospecting near Redding is in progress. The drift is in 30 ft., disclosing blue gravel. A 50-ft. chute connects with string of sluice boxes bringing water from Whitlaw Creek. Mr. Nelson is manager.

NOBLE ELECTRIC STEEL CO. (Heroult)—Reported that preparations are being made for running electric smeltery to its full capacity. One furnace has recently been in operation and produced 25 tons of steel. Manganese ore is being shipped to smeltery from Mendocino County. Ore is mined about 5 miles from Redwood Valley. Preparations were being made in middle of May for shipment of one car load per day. Hoist tramway and ore bins have been installed and 20 men are employed.

Siskiyou County

GEORGE MILNE (Scott Bar)—G. A. Milne has completed his cleanup of one month's hydraulic mining which returned $1950, all specimen gold. Smallest pieces average little more than one dollar each, and largest $438.

NORTHERN (Callahan)—Company composed of San Francisco men has taken over placer ground of Grouse Creek Mining Co. at confluence of east fork of Scott River and Grouse Creek. Edward C. Latchem is manager. Property will be worked by hydraulic methods.

SPENCER (Yreka)—T. W. Kirk, of Humbug, made recent cleanup of 73 tons of ore from old dump which had been put through an arrastre. Return was $408 or more than $55 per ton. There are several thousand tons of dump ore at mine which will probably run an average of near this value. Recent cleanup was from samples taken from various parts of the dump. Spencer is one of oldest operated mines on Humbug Creek. There are number of old mines in this region that were former producers which have large amounts of ore on dump that would pay well under modern treatment.

Tuolumne County

NYMAN CONSOLIDATED (Jamestown)—Ore is being extracted from Knox and Boyle vein on 300, 400, and 600 levels. Extensive development is planned in Nyman claims, where good ore was formerly found. Ten of 40 stamps are dropping and mill will gradually be worked up to capacity. This property is commonly known as Santa Ysabel.

Yolo County

PLACER GOLD is reported to have been discovered in Casey Flat west of Amaranth. Yolo County has no record of gold production nor of any other metals. There have been traces of oil and gas.

COLORADO

Boulder County

WHITE RAVEN (Ward)—Contract has been let to sink shaft 100 ft. to 340 level. Contemplates sinking shaft to depth of 500 ft.

ALICE (Jamestown)—This mine produced principally lead-silver ore in earlier operations but now shows shoot of gold-telluride ore 5 ft. thick.

HUMBOLDT (Ward)—Hallett and others are building mill which will run both for custom ores and for treatment of product from this mine.

HOODOO (Gold Hill)—Mutual Coöperative Mining Co., of which Frank E. Wire is secretary, will reopen and operate this old group, including Columbus mine.

TROJAN MINING & ORE REDUCTION CO. (Ward)—This is new company formed to take over and develop New Market properties. Shaft is 500 ft. deep and vein is now developed by five levels from 200 to 500 ft. in length. New company contemplates remodeling of mill and installation of addi-

tional equipment. It is considered probable that some heavy sulphide ore developed can be satisfactorily smelted and installation of hot-blast pyritic smelter is under consideration.

Clear Creek County

KANSAS LEASING (Idaho Springs)—Company is developing Kansas vein through Newhouse Tunnel. Vein 30 in. wide has been opened assaying $12 to $14 per ton.

IDAHO BRIDE (Idaho Springs)—New compressor plant being installed. Extensive drifting and sinking are planned. Idaho tunnel will be pushed to intersect several strong veins. Mill is running two shifts.

ENGINEERS' LEASING (Idaho Springs)—Winze sunk to 110 ft. below tunnel level on Dyke vein. Drift east 100 ft. and raise from this drift has opened 15-in. vein of $60 ore. Large flow of water is under control.

SYNDICATE (Dumont)—New machinery for 50-ton milling plant has arrived and will be installed in old Kaverne mill building. Will treat ore from Syndicate and other properties in district.

BIG FIVE (Idaho Springs)—On account of increase in number of operators in Big Five tunnel, company has found it advisable to install additional air compressor operated by electricity. Will have capacity of 1700 cu.ft. of free air per minute. W. P. Daniels is president and general manager.

LAKE (Idaho Springs)—Tunnel No. 2 is now in 1200 ft. from portal. Concentrating ore is being opened in this tunnel and in Tunnel No. 4, which is driven at higher level. Electric drills and ventilating equipment will soon be installed. Property is being developed by Quigley & Co.

JOSEPHINE (Georgetown)—Mendota Leasing Co. has secured lease on this property and has commenced construction of 25-ton mill to treat ore from dumps and old stopes. Machinery for plant has been purchased and mill will be in working order within next 30 days.

Dolores County

PRO PATRIA (Rico)—Shelhamer and Batchlor, who opened small but rich shoot last March, have made second strike of similar ore in Jumbo No. 2 vein that has heretofore been considered worthless.

Gilpin County

KANSAS (Central City)—This mine is being operated through Argo tunnel with portal at Idaho Springs. Leasers have opened strong shoot of $12 ore and are making good shipments.

Lake County

DERRY RANCH GOLD DREDGING (Snowden)—Construction of dredge proceeding rapidly under superintendence of Robert Gore, formerly superintendent of Rovett boat at Breckenridge now owned by the Tompah Placers Co. New dredging site is about 12 miles southwest of Leadville along the Arkansas River. Dredge will have 5½-cu.ft. buckets. Colorado Power Co. is erecting 6½-mile transmission line. R. F. Lafferty is general manager.

San Juan County

SILVER LAKE (Silverton)—Mill has started as custom flotation plant. First mill run was made on ore from Big Giant property.

GOLDEN MONARCH (Gladstone)—Development will be commenced on this property which lies south of Gold King mine. Work will be under the direction of J. M. Kloster.

BROAD GAUGE (Silverton)—J. M. Laqueer and associates, of Pueblo, have secured an option on this property in Burns Gulch and will start development work in near future.

HAMLET M & M (Silverton)—Mine and mill have been placed in working order and operations have been resumed. E. A. Ritter, of Colorado Springs, is consulting engineer.

BANDORA (Silverton)—Operations will be resumed at property in South Mineral Creek in near future. Company contemplates development work on Bandora, Little Todd and Cataract veins.

San Miguel County

HUMBOLDT MINES (Telluride)—New organization formed by Bulkeley Wells and associates to take over Humboldt, Sailor's Fortune and Tom Payne properties together with all property of Old Dominion Mines Corporation. Property will be developed and operated through adit level of old Sheridan mine. Ore is similar to that of Smuggler-Union and will be transported over Smuggler system of tramways to Pandora mill for treatment. Work of extending power lines for operation of electrical equipment at Humboldt properties under way. Men have been put to work on development and management hopes to have mines in condition to produce 150 tons per day within about five months. Bulkeley Wells is general manager and C. N. Bell will be superintendent.

Teller County

SITTING BULL (Victor)—Main shaft has been sunk to 400 ft. and levels are being driven.

TRAIL (Goldfield)—Shoot recently opened on 1200 level has been developed 100 ft. by drift and shows 1-oz. ore 5 to 10 ft. wide.

KOYHNEO (Victor)—Claim is within city limits. Promising discovery made on 200 level almost beneath high-school building.

LAST DOLLAR (Victor)—Gibbons lease, 1200 level, after long deadwork, has 5-ft. shoot of $14 ore. Company pushing development on 900 level.

IDAHO

Shoshone County

HECLA (Burke)—New addition to Hecla mill is now running on full time and full capacity. Mine production is about 16,000 tons per month.

TERRIBLE EDITH (Murray)—Has begun shipment of zinc ore to Eastern smelters. Ore shoot has widened to 8 ft. and stope is now 70 ft. long. Charles Conn is manager.

HYPOTHEEK (Kingston)—Shaft is now down 1085 ft. and will be sunk 100 ft. deeper before crosscutting, making next level 300 ft. below 900 level. Down to that point levels have been opened at intervals of 200 ft. Work at mine is limited to shaft sinking until final depth is reached.

HERCULES (Burke)—Mine and mill still idle and no new developments regarding smelting contract situation. Rumor has it that St. Regis and Superior, towns in Mineral County, are both under consideration for location of smelting plant. Location would serve mines at Wallace, Saltese, and the Iron Mountain and Amador districts. Osburn is also candidate.

MICHIGAN

Copper

MICHIGAN COPPER (Rockland)—After an idleness of five or six years will resume exploratory work. An assessment has been levied and largest creditors have consented to withhold their claims, pending results of development. Butler shaft, sunk many years ago to depth of 300 ft. will be deepened to 700 ft.

Iron

OLIVER (Ironwood)—All of Oliver mines at Ironwood are now working six days a week. For almost a year past they had worked but four days out of every six. Oliver is shipping strong from Gogebic Range. Shipments are already far ahead of 1914 for same months. Next to Oliver heaviest shipper is Oglebay, Norton Co.

MINNESOTA

Cuyuna Range

INLAND STEEL (Crosby)—Experimental concentrator now washing 500 to 600 tons daily, having been in operation for several days.

BUFFALO & SUSQUEHANNA (Hibbing)—D. M. & N. Ry. is now hauling output from this mine instead of Great Northern as formerly, 6000 tons daily going forward.

CUYUNA-SULTANA (Ironton)—Contrary to press reports widely circulated, U. S. Steel Corporation has made no attempt to secure control of this property and has no interests on Cuyuna Range and displays no interest in acquisition of any property here.

BRAINERD (Barrows)—Capitalization increased from $25,000 to $125,000. Company owns fee to Barrows Mine, formerly operated by M. A. Hanna & Co. Recent drilling on property has greatly increased tonnage and improved grade of ore. No announcement made as to reason for increase of capitalization.

BRAINERD-CUYUNA (Brainerd)—Following unique custom of Cuyuna Range stock companies, this company conducted excursion to its property for benefit of its Duluth stockholders, 120 miles distant, on July 4. At that time mine hoisted its first ore, although no considerable tonnage will be hoisted for several months.

Mesabi Range

MISSABE MOUNTAIN (Franklin)—After standing 15 years, 75,000-ton stockpile is now being loaded for shipment.

GLEN (Chisholm)—This property, idle since 1913, is about to be reopened. Men are now preparing workings and machinery.

CHISHOLM (Chisholm)—Has started to operate full time with two shifts working. Force was reduced last fall when slump came. Ore in stock is being shipped.

ROGERS-BROWN (Hibbing)—Is now shipping its ore over Duluth, Missabe & Northern instead of Great Northern. Is shipping 6000 tons daily from Buffalo-Susquehanna pit.

OLIVER IRON (Virginia)—Operations are to be increased at the Wanless, Alpena, Shiras and Mesaba Mountain mines. Another shovel will be added at Mesaba Mountain and all of ore in stock shipped.

DUNWOODIE (Chisholm)—Three shovels are at work stripping in pit. Some ore is now uncovered. It is not likely that shipments of ore will be started this year. Mine adjoins Monroe and orebody is continuation of Monroe deposit.

OLIVER (Chisholm)—This mine will not be ready to ship this year. Work of erecting the permanent mine buildings will be started shortly. Construction and development work is not being rushed as operators are in no hurry to get ore out.

EVELETH—Mines in this city are now working six days per week instead of four. Adams-Spruce property is employing about 750 men. About 350 are working underground. Five shovels are at work loading ore. Shovels in Fayal pit are also active; 350 men are employed. Leonidas is working about 100 miners underground. Conditions are better than at this time last year and most of Eveleth mines will work to capacity until fall.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—Development work going on steadily; tunnel is now at point where proposed crosscut will be run to central vein and work of proving up the ore will begin. Tunnel at its present face is about 1000 ft. vertically beneath surface and at 3000 ft. directly beneath mountain apex, it will be at depth of about 1500 ft.

Lewis and Clark County

MINING ACTIVITY IN THE HELENA DISTRICT—Reported that Helena Mining Bureau has transferred Eastern Bell lode to Huffaker and Hill at an advance over price in Bureau's lease and bond. Bureau has been examining number of properties in district and is now preparing to make an extensive examination of Silver King property between Helena and Clancy. This property is near old Legal Tender from which much high-grade silver ore has been taken. Estimated that more than $100,000 has been brought into this region for investment since Bureau began distributing its advertising matter.

BARNES KING DEVELOPMENT (Marysville)—Sale of Shannon property to this company was completed at Helena June 25. Actual cost of property to Barnes King is approximately $227,000, and of this amount $13,700 was paid over in cash, balance to come out of profits from ore mined. Barnes King agrees to sink shaft 200 ft. It is to be allowed $3.75 per ton for mining and milling after deducting 10% for loss in treatment. Out of first proceeds realized beyond this

amount owners of property are to receive $39,523 to reimburse them for moneys expended. After this amount is paid, profits above $3.75 and 10% treatment losses are to be divided half and half until owners of property receive $60,000. Following this payment will come final payment of $115,000 to owners of property to complete deal. Shannon mine is located close to Piegan-Gloster mines.

Silver Bow County

BUTTE-ALEX SCOTT (Butte)—Statement of net earnings of this company for year ending June 1, 1915, as filed with county assessor June 25 shows same to have been $20,000, as compared with $10,000 last year.

NORTH BUTTE (Butte)—It has been reported that company intends to increase output to between 45,000,000 and 60,000,000 lb. per annum by gradual development of recently acquired east-side properties as well as by an increased development of present workings.

BONANZA-BUTTE (Butte)—Company organized to develop Bonanza, Bonanza Extension and Ruth claims located about 4 miles north of center of Butte City and west of Moulton reservoir in Walkerville. Mayor Charles H. Lane of Butte heads new company.

ELM ORLU (Butte)—First statement filed with assessor of Silver Bow County by this company, June 24, shows net earnings for year ended May 31, 1915, amounting to $465,711. Gross proceeds from ore taken out were $1,944,983. Deductions from this were as follows: Mining, $322,074; transportation, $845,624; milling, $593,852; construction, $267,722; total, $1,488,272.

BUTTE & SUPERIOR (Butte)—Company has closed another contract, June 30, with U. S. Smelting, Refining & Mining Co. to handle 5000 tons of concentrates in addition to 4000 tons recently contracted for with same company. This will materially aid company in caring for surplus of concentrates which have been carried for past month or two. While it will not take care of entire product which company is able to turn out above other smelting contracts, it will nevertheless make heavy inroads into that surplus.

ANACONDA COPPER (Butte)—Main line-shaft floor in west half of concentrating mill at Washoe works in Anaconda was completely wrecked June 26 by an accident that compelled closing down of entire half of mill. Huge steel shaftings, driven by two 1200-hp. motors, were twisted like hairpins, and big pulleys and journals were smashed to pieces. No one was on the floor at the time of accident and its cause is a complete mystery. As result of accident capacity of concentrator was temporarily cut down by 40%, which, in its turn, necessitated the closing of all of the company's Butte mines for 24 hr. Ore on hand was sufficient to supply Great Falls plant and uninjured portion of Washoe plant. Rapid work is being done at Anaconda concentrator in getting wrecked part of mill into operation. It will probably be a week before plant will be running at full capacity again.

NEVADA

Clark County

BOSS (Goodsprings)—Platinum ore of good grade has been discovered on third level; some carrying as high as $1000 per ton in gold and platinum.

AZALIA (Goodsprings)—Shipments of zinc-carbonate ore resumed early in June, being hauled by motor truck to Jean. Road and ore-bins being constructed. In conjunction with Green Monster property, owned by Hearst Estate, is expected that this property will construct new motor-truck road to Jean.

WHALE—The option on this property held by Salt Lake capitalists was recently exercised, and the mine is being actively developed under the direction of T. A. Vardon. A compressor plant has been installed, and a tunnel is being driven to tap the vein at a depth of 300 feet. Some zinc ore is exposed in the mine and it is expected that shipments will be made in the near future.

Eureka County

UNION (Union)—Is shipping one car per day of ore to Salt Lake smelters. Ore chute is said to be 8 to 12 ft. wide and averages $14 to $50 per ton. Company is close corporation, owned in Philadelphia.

Storey County

COMSTOCK PUMPING ASSOCIATION (Virginia)—Reopening 2700 level continued.

UNION CONSOLIDATED (Virginia)—West crosscut on 2650 level continues in porphyry and quartz.

OPHIR AND CON. VIRGINIA (Virginia)—Jointly reopened old main north drift on 2500 level to 80-ft. point through caved ground.

SIERRA NEVADA AND UNION CON. (Virginia)—Jointly made good progress reopening west crosscut on 2500-level boundary line. Total repair, 214 ft.

MEXICAN (Virginia)—Mill started on June 22; crushed 70 tons of ore; average value, $15.48 per ton. Repairs on 2500 level and track laid 120 ft.

OPHIR (Virginia)—Central tunnel saved 334 cars milling ore and shipped 225 tons to mill. Andes crosscut reached footwall without disclosing pay values at that point.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Mill received 921 tons dump rock; shipped one bar bullion. Fair milling values in southwest drift 1300 level of Belcher. Low-grade rock saved from Crown Point east crosscut, 1300 level.

SOUTH DAKOTA

Lawrence County

NORTH HOMESTAKE (Maitland)—Shaft is being unwatered, preparatory to resumption of exploratory work at 600-ft. level, where last work was done on property.

MINNESOTA (Maitland)—Burns & Sanford have been given contract to extend adit tunnel on Unionville claim, face of which is at present almost vertically below outcrop; additional work is necessary to intersect oreshoot on its pitch.

ORO HONDO (Deadwood)—Shaft has reached depth of 1600 ft. Two shifts of miners are employed in sinking; engineers on third shift are engaged in handling water in skips from sump on lower level to which it is lifted by sinking pump. Workings are making about 50 gal. per min.

Pennington County

COLUMBIA (Keystone)—Shaft has been repaired and sinking has commenced. Plans call for sinking to 300 ft. and the crosscutting of the formation for 1000 feet.

UTAH

Beaver County

PALOMA (Milford)—New 20-hp. electrically driven hoist recently installed.

BEAVER GOLD (Beaver City)—Horse whim has been installed at this property in Fortuna district to facilitate sinking.

LADY BRYAN (Milford)—A Knox tractor has been received in Salt Lake and will be sent to this property for hauling ore and supplies. Mine is in Star district, southwest of Moscow.

Juab County

TINTIC ORE SHIPMENTS for week ended June 26 totaled 186 cars, estimated at 9300 tons valued at $232,000 as compared with 142 cars week previous. Largest week's shipments for more than year.

Piute County

FLORENCE (Marysvale)—The Standard Chemical Co., of Toledo, Ohio, has taken an interest in the Florence company's alunite holdings and contemplates erection of potash plant near mine.

WEDGE (Marysvale)—Shipment of 24 tons of high-grade gold ore carrying some silver has just been made from this property in Horse Heaven country, near head of Bullion Cañon. Property has been under lease to J. U. Sargent, of Marysvale, who recently made shipment of six tons of sorted ore, which brought $3000. Sargent lease expired July 1. Ore occurs in fissure vein in porphyry, and pay streak has width of from ½ in. to 20 in., occurring principally along the footwall side, though sometimes on hanging. Vein was first opened by shaft and has been reached by 150-ft. crosscut tunnel, having been drifted on 65 ft. Wedge is just over ridge from alunite properties which are now being developed. N. W. Sonnedecker is superintendent, and E. P. Mowers, president and general manager.

Salt Lake County

SALT LAKE & ALTA R.R. (Salt Lake)—J. G. Jacobs, general manager, reports supplies and freight going into camp of Alta to be three times as much as year ago, which reflects increased activity in this camp and district.

UNITED STATES SMELTING (Bingham)—Judgment in favor of this company was rendered July 1 by Judge John A. Marshall in suit filed by Col. E. A. Wall, who was suing for an easement for Ashland No. 2 tunnel, on Galena claim.

UTAH METAL & TUNNEL (Bingham)—Is shipping two cars of ore daily from large orehody recently opened. Ore brings net smeltery returns of $20 to $25 per ton in silver, lead, gold and copper. Car of pyritic ore shipped recently carried over 3 oz. gold per ton.

Summit County

PARK CITY ORE SHIPMENTS for week ended June 26 totaled 2918 tons estimated at $116,000 compared to 2479 tons week previous.

Washington County

HAMBURG (Modena)—Three feet a day progress is being made in lower tunnel, being driven for vein. About 50 ft. remain to be driven.

GOLDSTRIKE BONANZA (Modena)—Four feet of ore has been opened on which good assays have been obtained. This ore was found 15 ft. below surface, where main vein is cut by cross fissure. Property is about mile west of Hamburg. C. J. Rice is superintendent.

CAMP OF GOLDSTRIKE continues to grow, there being at present population of about 200. Recent visitors include George Wingfield and party, who were in camp for several days, and Hays-Monette people of Goldfield have also been making an inspection.

CANADA

Ontario

COLUMBUS COBALT—Cross cut being run at 400 level to pick up some surface veins.

GIBSON CLAIM (Goodfish Lake)—Shaft has been put down to 100 level. Drifting and cross-cutting are being undertaken in charge of A. E. Cullen.

HURONIAN (near Larder Lake)—L. H. and N. A. Timmins have secured an extension of their option on this mine. They have 20 men sampling and prospecting and are also diamond-drilling.

DOMINION REDUCTION CO. (Cobalt)—Company has leased plant of American Eagle Mining Co. in Mimico Township for purpose of developing claims held under option in that locality.

NORTH THOMPSON (Porcupine)—Huronian Belt Co. is increasing its equipment by addition of 125-hp. boiler which will give them a total of 225 hp. The 3-compartment shaft has been put down nearly to 200 level.

VIPOND (Porcupine)—Vein on which winze was being put down from 300 to 400 level showed good width and values for 45 ft. down at which point it faulted. Crosscutting will be undertaken at 400 level to pick it up.

The Market Report

Metal Markets

NEW YORK—July 7

All of the markets were dull during the last week. Copper and tin were a shade weaker in tone, while lead was a shade firmer, and spelter experienced a rise of about ¾c. per lb. It is the common opinion that none of these changes is of broad significance.

Copper, Tin, Lead and Zinc

Copper—At the beginning of our week of record there were some important inquiries in the market which there thought to be the forerunners of a new buying movement of importance, but something or other has prevented their coming to a head so far. While the principal producers have adhered to their previous asking prices, exhibiting no concern over the absence of buying, some of the smaller producers and dealers have been desirous of selling more copper than they could place, notwithstanding their offers at material concessions. These concerns must sell copper constantly against what they take in on contract. Moreover, it has been possible to buy crude copper in the open market on terms permitting the sale of electrolytic at relatively low figures and still affording a handsome profit. The recession in the market on this business is without any broad significance, inasmuch as the buyers needing large quantities of copper could get it only by paying the prices asked by the principal producers. The latter are so well sold ahead that their present position is very firm.

The brass manufacturers of Connecticut are now said to be doing a larger business than ever before in their history, and are reported to be making important additions to their plants.

A new feature of the copper business is the negotiation of sales in Europe for copper to be delivered in the United States. Some of the brass manufacturers are unwilling to take the risk of buying copper and spelter under present conditions and will take contracts for the manufacture of brass and brass products for military purposes only upon a toll basis.

Copper Exports for the week ended June 26 were 6,955,353 lb. The chief items were 4,177,617 lb. to Great Britain, 1,120,263 lb. to Russia and 1,033,000 lb. to Italy. Imports were 6,001,879 lb. metal and 6,416,191 lb. in ore and matte; 12,417,070 lb. in all. The larger imports were from Canada, Chile, Spain and Peru.

Visible Stocks of Copper in Europe, June 30, are reported as follows: Great Britain, 22,623; France, 4670; afloat from Chile, 1325; afloat from Australia, 4300; total, 32,913 long tons. This is an increase of 2689 tons over the June 15 report.

Tin—This market was dull. Arrivals were fairly liberal but the demand was rather quiet.

Visible Stocks of Tin, including tin afloat, on July 1 are reported as follows: London, 6136; Holland, 62; United States, excluding Pacific ports, 9729; total, 15,927 long tons, an increase of 1281 tons during June.

Lead—Fair business was reported by producers, all of whom realized the price of the leading interest in the New York market, while lead in St. Louis was bought and sold at 5.60@5.67½ cents.

Spelter—Transactions amounting to several thousand tons were reported, which was rather more than in the previous week. The bulk of the business was for deliveries during the last quarter of the year. Producers were evidently aiming to sell as liberally as possible, at good prices, for such deliveries, and maintained a relatively high price for prompt and early deliveries in order to facilitate the more important transactions. The business done for prompt, July and August delivery was relatively small. Prompt spelter was offered for resale right through the week at 22c. per lb., without finding buyers. It is probable that a good deal more spelter is available for prompt delivery than is commonly supposed. The buying of last week was almost entirely confined to brass makers.

The Grasselli Chemical Co. is reported to be adding two blocks of furnaces to its Meadowbrook plant.

The United States Smelting, Refining & Mining Co. has purchased the smeltery of J. B. Kirk at Iola, Kan., and also the old dismantled plant at La Harpe. The latter is to be rebuilt with three blocks of furnaces. Including the Altoona plant, the purchase of which was previously noted, the plans of the United States company contemplate an aggregate smelting capacity of 8000 retorts, which will correspond to about 35,000 tons of spelter per annum.

Zinc Sheets are strong, base price $27 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged. The demand is strong and business is active.

Other Metals

NEW YORK—July 7

Aluminum—The market is rather quiet and supplies are not abundant. Prices are firm, current quotations being 32@33c. per lb. for No. 1 ingots, New York.

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
1	4.7619	48¼	19.45 @19.65	39	5.75	5.60 @5.67½	19.00 @21.50
2	4.7625	48¼	19.45 @19.65	38⅞	5.75	5.60 @5.67½	19.50 @21.50
3	4.7625	48¼	19.45 @19.65	38¾	5.75	5.60 @5.67½	19.75 @21.75
5	..	...	.....	.	.....	.....	.....
6	4.7638	48	19.45 @19.65	39	5.75	5.60 @5.67½	19.75 @21.75
7	4.7688	47¾	19.45 @19.65	39	5.75	5.60 @5.67½	19.75 @21.75

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0 17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0 20c. on domestic business. The price of electrolytic cathodes is 0 05 to 0 10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
1	22 15/16	80¼	81½	94½	20.51	170½	167½	25⅜	5.59	100	21.73
2	22 15/16	79⅛	80⅜	93½	20.31	170½	166	24⅞	5.40	100	21.73
3	22 15/16	.....	.....	.....	.....					.....	...
5	22 15/16	79⅜	81	93½	20.31	172½	168	24 3/16	5.25	100	21.73
6	22 15/16	79⅜	81¼	93½	20.31	171½	167	24 3/16	5.25	100	21 73
7	22 15/16	78⅜	80¼	93½	20.31	170½	166	24⅛	5.30	100	21 73

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4 29c.; £30 = 6 43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0 21¾c.

Antimony—A fair business has been done in buying for immediate needs. Chinese and other ordinary brands are sold at 37½@40c. per lb. The special brands are largely nominal, Cookson's being held at 50@52½c. per lb.

Quicksilver—Business has been rather quiet, and confined chiefly to moderate sales. New York quotations are $92@95 per flask of 75 lb. San Francisco reports an inactive market, with irregular quotations, $80@95 per flask being asked. London price has been dropped, and is now £15 per flask.

Gold, Silver and Platinum

Gold and Silver Movement in the United States five months ended May 31 as reported by the Department of Commerce:

	Gold		Silver	
	1914	1915	1914	1915
Exports.....	$35,867,471	$4,760,539	$20,871,093	$20,880,502
Imports.....	26,926,310	92,585,696	10,768,169	12,119,293
Excess.....	E.$8,941,161	I. $87,825,157	E. $10,102,824	E. $8,761,209

Exports of merchandise for the five months this year were valued at $1,432,811,254; imports, $708,114,681; excess of exports, $724,696,573. Adding the gold and silver gives $645,632,625 as the net export balance.

Gold sales from the New York Assay office in June were $2,743,110, being $182,540 more than in May, but $1,462,517 less than in June, 1914. For the six months ended June 30 the total sales were $37,012,497 in 1914, and $15,913,008 in 1915.

Platinum—The market remains quiet, but steady, with little change in any way. Current quotations are $37@39 for refined platinum, and $41@44 for hard metal, according to grade.

Silver has declined owing to limited buying. The exports while not up to the shipments of a year ago are still rather larger than the market can absorb on an advancing or even steady figure. Consequently recessions have been rather frequent of late with little reaction.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 3

The base price paid this week for 60% zinc ore was $100@105 per ton. The base price paid for 80% lead ore was $70 per ton.

SHIPMENTS, WEEK ENDED JULY 3

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,027,650	294,800	581,160
Year	95,154,030	3,496,890	13,785,890

Shipped during week to separating plants, 5,146,000 lb. zinc ore.

JOPLIN, MO.—July 3

Blende, high price $112.75; base per ton of 60% zinc, premium ore $110; medium to low grades, $100@95, in car lots. Calamine, base per ton 40% zinc, $75@60; average price, all grades of zinc, $97.68. Lead, high price, $73.75; base $66@60 per ton 80% metal content; average, all grades of lead, $72.98 per ton.

SHIPMENTS, WEEK ENDED JULY 3

	Blende	Calamine	Lead	Values
Totals this week	10,554,140	769,160	1,818,030	$610,500
Totals this year	299,156,030	25,958,500	44,766,250	12,376,180

Blende value, the week, $530,630; 27 weeks, $10,660,950.

Calamine value, the week, $22,620; 27 weeks, $545,280.

Lead value, the week, $57,250; 27 weeks, $1,169,950.

The shipments and settlements shown are from last week's production; the production this week of the entire Missouri portion of the district was less than 1000 tons. The first strike of general proportions in the history of the district began with the walkout of a few miners last Saturday night, and spread from mine to mine until practically every mine producing blende in Missouri was closed down by Wednesday.

Iron Trade Review

NEW YORK—July 7

The trade continues active with new orders coming in, many of them for export. Domestic business is also improving. Structural business is better, some large contracts having been placed; some of these have been under negotiations for some time past.

The pig iron market is also better, many inquiries and some orders for foundry and basic iron being reported.

Iron and steel imports on a tonnage basis in April, 1915, amounted to 16,564 tons, compared with 8025 tons in March, 1915. This increase is traceable to the heavy importing of rails, the tonnage of which in April was 8921, compared with only 430 in March. This increase, doubtless, is due to the shipments from the Algoma Steel Corporation.

PITTSBURGH—July 6

Under date of June 30 the American Steel & Wire Co. sent out circulars reaffirming prices of 1.40c. on plain wire and $1.60 on nails, thus withdrawing cut prices of $1 a ton which had become common, and not only eliminating cut prices on barb wire, but advancing prices $2 per ton above the former official quotations, making painted barb wire 1.70c. and galvanized barb wire 2.50c. The differential on galvanized nails was advanced from $1.50 to $1.75. Advances of this sort coming at the very time of year when wire products are usually dullest and weakest show the great influence of the war demand. The wire mills are said to be practically as busy now as they usually are at the height of the spring or fall season. The independent mills have concurred in the advances. Jobbers have been protected at the lower prices, but it is said for shorter periods than usual.

The large mills are not only firm at 1.25c. on bars, plates and shapes, following their withdrawal of the 1.20c. price for prompt shipment, late in June, but are now talking of a general advance to 1.30c. some time before the end of next month. Some small plate mills are still cutting the quotation of the large mills, but only to the extent of quoting 1.20c. In bars there are no cut prices. The rail mill at the Ohio works, Youngstown, and one of the Edgar Thomson rail mills are now rolling large rounds, and it is understood the Ensley mill will soon be turning out a tonnage of this important war product.

Bookings by the steel mills have been large the past few days, and July and August promise to be fuly as active as June has been. Even the June bookings, as they exceeded the June shipments, indicate an increased output in July, and from operating at about 80% of capacity in June the steel mills promise to be running at close to capacity next month. Exports of steel and manufactures of steel have lately represented about 15% of the output, but are expected to reach 20 to 25% by August.

Pig Iron—W. P. Snyder & Co. announce the bessemer average for June at $13.75, an increase of 9.1c. over May, and the basic average at $12.724, an increase of 7.4c. over May. About 15,000 tons entered into each computation. We quote: Bessemer, $13.75; basic, $12.65@12.80; malleable, $12.75; No. 2 foundry, $12.75; gray forge, $12.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—There have been sales of spot lots at $105 and perhaps at slightly higher figures. Contract continues at $100, seaboard.

Chemicals

NEW YORK—July 7

The general market is quiet, but in some lines considerable activity is apparent.

Arsenic—About the usual business is forward and prices are unchanged at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—The market shows a fair demand and prices are steady at $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcel.

Nitrate of Soda—Demand is better and the market is stronger. Current quotations are firmer at 2.35c. per lb. for spot and for all positions this year.

The total indebtedness of the nitrate producers to the Chilean Government under the system of advances adopted in 1914 was $2,880,000, U. S. currency, on May 15. The total amount loaned was $3,356,000, of which $476,000 had been repaid.

Sulphate of Ammonia—The production of sulphate of ammonia in Great Britain in 1914 is reported by the Alkali Works Inspectors as follows: Gas works, 175,930; iron works, 16,008; oil-shale works, 62,749; byproduct coke ovens, 137,430; producer gas and carbonizing works, 34,295; total, 426,412 long tons. The total compares with 432,618 tons in 1913, showing a decrease of 6206 tons; and with 388,308 tons in 1912, an increase of 38,104 tons.

PETROLEUM

The monthly statement of the "Oil City Derrick" shows new wells completed in June as follows: Pennsylvania grade, 240; Lima-Indiana, 30; Central Ohio, 73; Kentucky, 11; Illinois, 54; Kansas-Oklahoma, 304; Texas-Louisiana, 191. In all 903 wells were completed in the fields covered by the report, a decrease of 55 from the May figures. New production amounted to 161,279, or 12,922 less than in May. Among the completions were 231 dry holes and 127 gas wells, an increase of 34 and four, respectively. At the close of June 465 rigs and 1592 drilling wells were reported.

Exports of petroleum from Mexico in May were 1,289,173 bbl., an increase of 85,950 bbl. over April

Assessments

Company	Delinqe	Sale	Amt
Blue Bell, Ida	July 5	Aug. 1	$0.003
Blue Star, Ida	June 19	July 10	0 01
Carbonate, Ida.	June 23	July 23	0 001
Challenge Con., Nev.	July 12	Aug. 4	0 05
Con. Virginia, Nev	July 19	Aug. 10	0 05
*Contact Copper, Mich.		July 14	0.50
Contact Copper, Mich	May 15	...	0 50
Hancock Cons., Mich.	Sept. 1	...	1 00
Hancock Cons., Mich	Jan. 3	...	1 00
Houghton, Mich.	May 23	...	1.00
Idaho-Nevada, Ida	July 14	Aug. 6	0.001
Iron Mask, Ida	July 1	Aug. 10	0 002
Ivanhoe, Ida.	July 12	Aug. 12	0 002
Majestic-Idol, Nev.	Dec 15	July 20	0 005
Mayflower, Ida	June 15	July 17	0 005
Michigan Copper, Mich	July 19	.....	1.00
Mineral Range, Utah	May 24	.....	0 003
Monarch Pitts., Nev.	June 14	July 14	0.01
Moonlight, Ida	June 5	July 8	0 005
Nahob, Ida	July 5	Aug. 2	0.005
New Arcadian, Mich	June 1	...	0 50
New Arcadian, Mich	Dec. 1	.....	0.50
New Baltic, Mich	July 15	.....	0.50
New Baltic, Mich	Jan. 15	.....	0.50
New Yerrington Cop., Nev	July 9	July 27	0 01
Nevada Douglas, Nev.	July 21	Aug. 18	0.10
North Bunker Hill, Ida	June 12	July 17	0 002
Old Veteran, Ida	July 5	July 31	0 002
Rainbow, Ida	July 7	Aug. 7	0 002
Revelator, Utah		July 16	0 001
Revelator, Utah	Aug. 17	Sept. 3	0.001
Revelator, Utah	Oct. 4	Oct. 25	0.001
Rhode Island, Ida	June 24	July 24	0 001
Royal, Ida	June 1	July 6	0.0015
Sierra Nevada, Nev	July 27	Aug. 16	0.05
Silver Mountain, Ida., (post)		July 15	0 002
Silver Pick, Nev	June 5	July 12	0 01
Sonora, Ida.	July 23	Aug. 31	0 004
Springfield, Ida	July 30	Aug. 30	0.002
Sunrise, Ida.	July 17	Aug. 17	0 002
Sunset Dev., Ida	June 30	July 24	0 0025
Tarbox, Ida.	July 17	Aug. 7	0.0025
Umatilla Tonopah, Nev	July 12	Aug. 16	0 01
Union, Nev	June 15	July 9	0 05
West Tonopah Con., Nev	July 10	Aug 10	0.01

*This assessment was levied and payable Apr. 27, '14.

Stock Quotations

Sales at auction last week included: At Philadelphia, 2500 Miners' Gold Mining, $1 par, $1 lot; 2500 Big Revenue G. & Mining, $1 par, $1 lot; $35,000 Columbia Coal Co., 1st 6's, July, 1910, coupon on, $1750 lot; $10,000 Preston Fuel Co. 1st 5's, $200 lot; $7500 Indiana Coal Co. 1st 5's, $375 lot; at Boston, $6000 Clay Products 1st 5s, $1500 lot.

COLO. SPRINGS	July 6
Name of Comp.	Bid
Acacia	03½
Cripple Cr'k Con.	008
C. K & N.	03
Doctor Jack Pot	10½
Elkton Con.	39½
El Paso	90
Findlay	04
Gold Dollar	02½
Gold Sovereign	04½
Golden Cycle	1.80
Isabella	18
Jack Pot	06½
Jennie Sample	02
Jerry Johnson	05
Lexington	005
Mary McKinney	37
Pharmacist	‡ 01
Portland	‡ 43½
Raven B. H	02
Vindicator	1.65

SALT LAKE	July 6
Name of Comp.	Bid
Beck Tunnel	05
Black Jack	10½
Colorado Mining	10½
Crown Point	01½
Daly-Judge	7.00
Gold Chain	20
Grand Central	60
Iron Blossom	83
Little Bell	10
Lower Mammoth	04
Mason Valley	2.00
May Day	19
Opohonzo	00½
Prince Con	84
Seven Troughs	02
Silver King Coal'n	3.62½
Silver King Con	3.62½
Sioux Con.	03
Uncle Sam	05
Yankee	04

TORONTO	July 6
Bailey	01½
Coniagas	5.50
Peterson Lake	23
Right of Way	03½
Seneca Superior	‡ 00½
Silver Queen	01½
T. & Hudson Bay	18.00
Timiskaming	32½
Wettlaufer-Lor	03
Dome Mines	19.00

Dome Exten	10
Foley O'Brien	30
Hollinger	25.75
Imperial	05
Jupiter	08
McIntyre	46
Pearl Lake	01
Porcu Crown	75
Preston E. D.	02
Rea	10

SAN FRANCISCO	June 30
Comstock Stocks.	Miss. Nev. & Cal.
Alta	‡ 04
Andes	‡ 05
Belcher	‡ 32
Best & Belcher	‡ 06
Caledonia	‡ 22
Challenge Con	‡ 06
Confidence	07
Con. Virginia	06
Gould & Curry	‡ 02
Hale & Norcross	04
Julia	‡ 02
Mexican	37
Occidental	‡ 79
Ophir	11
Overman	‡ 06
Potosi	‡ 03
Savage	04
Sierra Nevada	04
Union Con	17
Yellow Jacket	‡ 36

Bellmont	‡ 12½
Jim Butler	1.00
Lone Star	05½
MacNamara	02
Midway	15
Mont.-Tonopah	25
North Star	15
Rescue Eula	08
West End Con.	83
Atlanta	30
Booth	50
C.O.D. Con	‡ 05
Comb. Frac.	09
Jumbo Extension	‡ 56½
Pitts.-Silver Peak	10
Round Mountain	‡ 54
Sandstorm Kendall	07½
Silver Pick	11
Central Eureka	‡ 16
So. Eureka	‡1 50

N. Y. EXCH.	July 6
Name of Comp.	Clg.
Amalgamated	74½
Am.Sm.&Ref.,com	79½
Am. Sm. & Ref., pf.	107
Am. Sm. Sec., pf. B	79
Anaconda	35‡
Batopilas Min	1
Bethlehem Steel	167
Bethlehem Steel, pf.	117
Chloo	45‡
Colo. Fuel & Iron	32½
Federal M. & S., pf.	44
Great Nor., ore., ctf.	36‡
Guggen. Exp	63‡
Homestake	118‡
Inspiration Con.	31
Mex. Petroleum	74‡
Miami Copper	28‡
Nat'l Lead, com.	63‡
National Lead, pf.	109‡
Nev. Consol.	14‡
Ontario Min	2‡
Quicksilver, pf.	3
Ray Con.	23‡
Republic I&S, com.	29‡
Republic I&S, pf.	87‡
Stoss-Sheff'd, com.	34‡
Tennessee Copper	36
Utah Copper	67‡
U. S. Steel, com.	60‡
U. S. Steel, pf.	109‡

N. Y. CURB	July 6
Alask a Juneau	13.50
Alta Con	.67
Beaver Con	.31
Big Four	‡ .05
Blue Bell	‡ 03
Braden Copper	7.25
Buffalo Mines	.62
Can. Cop. Corpn.	1 1/16
Can G & S	.05
Carlisle	‡.50
Cashboy	.06
Chambers Ferland	.15
Chile Cop	20½
Con. Ariz. Sm.	15/16
Con Coppermines	12‡
Con. Nev.-Utah	7/16
Davis-Daly	1 1/16
Diam'Gold-Daisy	‡ .07
Dla. Black B	03
Florence	.53
Goldfield Con	1‡
Goldfield Merger	22½
Greene Cananea	.39
Kennicott Cop.	32‡
Kerr Lake	4 1/16
La Rose	‡
McKinley-Dar-Sa	23
Majestic	.94
Mines of Am.	2‡
Nevada Hills	23
New Utah Bingham	3‡
Nipissing Mines	5‡
Ohio Copper	.17
Oro	09
South Utah	2‡
Standard Oil of N J	398
Standard S. L.	1 9/16
Stewart	2‡
Tonopah	7‡
Tonopah Ex.	2 1/16
Tonopah Merger	.41
Tribullion	5/16
Tularosa	1/16
Yukon Gold	2‡

LONDON	June 24
Alaska Tre'dwell	£7 7s 6d
Cam & Motor	0 14 3
Camp Bird	0 5 6
El Oro	0 7 6
Esperanza	0 7 0
Mexico Mines	3 17 6
Oroville	0 14 0
Santa Gert'dis	0 7 6
Tomboy	1 1 0
Tough Oakes	0 8 6

BOSTON EXCH	July 6
Name of Comp.	Clg.
Adventure	2½
Ahmeek	395
Alaska Gold M	38
Algomah	2‡
Allouez	54
Am. Zinc	57½
Ariz. Com., ctfs.	7‡
Bonanza	35
Butte-Balla'Java	2½
Butte & Superior	71‡
Calumet & Ariz.	63‡
Calumet & Hecla	570
Centennial	18
Cliff	11‡
Copper Range	55
Daly West	3‡
East Butte	12‡
Franklin	9‡
Granby	87‡
Hancock	17
Hedley	28‡
Helvetia	50
Indiana	5‡
Island Cr'k, com.	48
Island Cr'k, pfd.	88
Isle Royale	28
Keweenaw	2‡
Lake	13‡
La Salle	6‡
Mass	12‡
Mayflower	4‡
Michigan	1‡
Mohawk	79‡
New Arcadian	31
North Butte	31‡
North Lake	2‡
Ojibway	2
Old Colony	3‡
Old Dominion	53
Osceola	86
Quincy	86
Santa Fe	2‡
Shannon	8‡
Shattuck-Ariz.	27‡
Superior	$29
Superior & Bost.	3‡
Tamarack	36
Trinity	4‡
Tuolumne	42
U. S. Smelting	42‡
U. S. Smelt'g, pf.	46‡
Utah Apex	4‡
Utah Con	14
Victoria	2‡
Winona	4‡
Wolverine	62
Wyandot	1‡

BOSTON CURB	July 6
Name of Comp	Bid.
Alvarado	.70
Bingham Mines	8‡
Boston Ely	29
Butte & Lon'n Dev.	23
Calaveras	1‡
Calumet-Corbin	05
Chief Con	1 3/16
Corbin	‡ .50
Cortez	.40
Crown Reserve	.64
Hecla & Bully Bell	1‡
First Nat. Cop	2‡
Houghton Copper	4
Iron Cap Cop., pf	05‡
Majestic	.95
Mexican Metals	.24
Nevada-Douglas	.45
New Baltic	3‡
Oneco	1 3/16
Raven Copper	.12
Smokey Dev	.15
So. Lake	‡6‡
Tonopah Victor	‡ .32
Trethewey	.09
United Verde Ext.	43

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.855	28.983	26 553	22.731
February	61 642	57 506	48.477	28.357	26 573	22 733
March	57 570	58 067	50.241	26 669	26 788	23 708
April	59 430	58 .082	50.250	27 416	26 958	23.709
May	60 361	58 .175	49.915	27 825	26 704	23 570
June	58 990	56 471	49.034	27 199	25 948	23.267
July	58 721	54 678		27.074	25.219	
August	59 293	54 344		27 335	25 979	
September	60 610	53.290		27 986	24 260	
October	60 793	50.654		28.083	23.199	
November	58 995	49.082		27.263	22 703	
December	57 760	49.375		26 720	22.900	
Year	59 700	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60. 756	69.488	65.719
February	14.491	14.394	65.259	63. 494	70.188	*
March	14.131	14.787	64.276	66. 152	69.170	*
April	14.211	16.811	64.747	75. 069	69.313	*
May	13.99	18.506	63.182	77. 600	67.786	*
June	13.603	19.477	61. 336	82.574	66.274	95.333
July	13.223	.....	60. 540	.....	64.955	.....
August	*	.....	‡	.....	‡	.....
September	*	.....	‡	.....	‡	.....
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53. 227	.....	‡	.....
December	12 801	.....	56. 841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.005	156.550
February	39.830	37.445	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	.....	142.517	.....
August	*	.....	‡	.....
September	32.675	.....	‡	.....
October	30.284	.....	‡	.....
November	33.304	.....	1 9.391	.....
December	33.601	.....	147.102	.....
Av. year	34 301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4 048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	.....	3.738	.....	19.051	.....
August	3.875	.....	3.715	.....	‡	.....
September	3.828	.....	3 658	.....	‡	.....
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8. 255	21 413	39.819
March	5 250	8.541	5.100	8. 366	21.460	44.141
April	5.113	10.012	4.963	9. 837	21.569	49.888
May	5 074	14.781	4.924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.61
July	4 920	.....	4.770	..	21 568	.....
August	5 568	.....	5.318	.....	‡	.....
September	5 380	.....	5.230	.....	‡	.....
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25 016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.59	$13 23	$13. 45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.96	13.45	14 13	13.95
May	4.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.59	13.96	13.77
July	14 90	.....	13.90	.....	13.90	.....
August	14.90	.....	13.90	.....	14.08	.....
September	14 90	.....	13.90	.....	14 03	.....
October	14.84	.....	13 75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13 83	.....
Year	$14.88	.....	$13 78	.....	$14 01	.....

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Orebodies of the Mesabi Range—I

By J. F. Wolff*

SYNOPSIS—Supplies additional information to the literature on the Mesabi orebodies. Geologic section. Characteristics of the several formations. Typical structure of orebodies. The layers of ore and waste material in the ore concentrations.

The geology of the Mesabi range has been described most exhaustively in the U. S. Geological Survey monographs Nos. 43 and 52. In 1913 the University of Minnesota published a bulletin entitled "Iron Mining in Minnesota," which contains a great deal of valuable information regarding the range. Numerous articles have appeared in different mining papers and particularly in the *Journal* of late regarding Mesabi range mining practice. Notwithstanding all these publications, some indefinite ideas obtain regarding the structure of Mesabi orebodies, not only among mining men not engaged in work on the range, but even among some directly connected with the work. The two Geological Survey publications referred to are so technical geologically that perhaps few practical mining men read them thoroughly. The University of Minnesota bulletin mentioned is valuable to the practical man and should be in the hands of everyone interested in the iron-mining industry. But in none of these publications is the structure of the orebodies described or emphasized in such a way as to be of practical value to engineers in the district.

In order to present a practical and untechnical summary of what is known of the physical structure of these orebodies, in such a way as to be of direct value to men in the district, and to present many newly discovered facts hitherto unpublished, this series of articles has been prepared according to the following outline:

I. General Geologic Structure
   a. General geology.
   b. Typical structure.
II. Actual Orebodies as Developed.
   a. Sections of developed bodies from different parts of the range.
   b. Special sections showing monoclinal folding and large faults.
III. Exploration and Development.
   a. System of drilling.
   b. Structural development of orebodies from drill records.

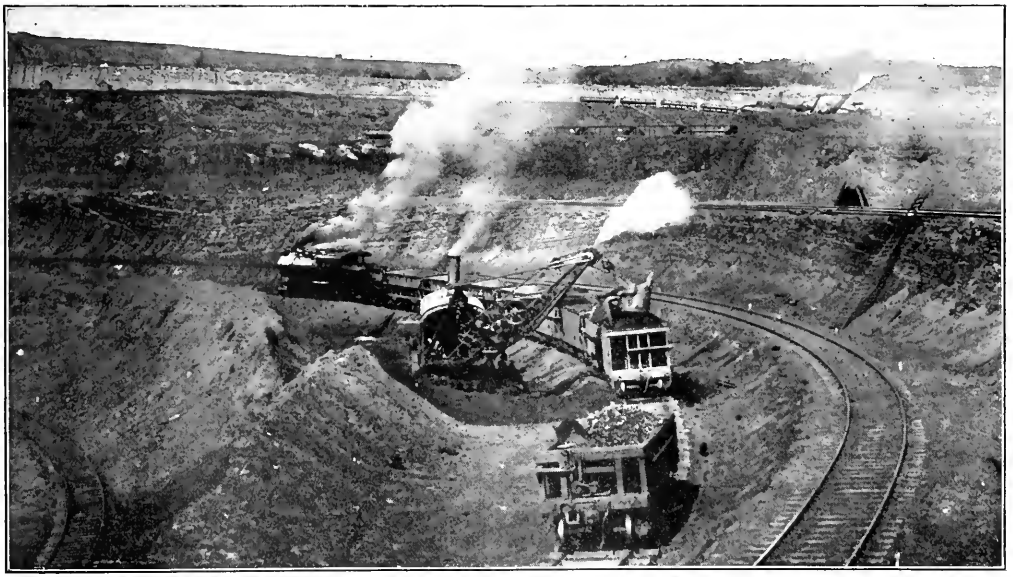


FIG. 1. VIEW IN MAHONING MINE, HIBBING DISTRICT; NOTE DIP OF ORE LAYERS

*Mining engineer, Oliver Iron Mining Co., Duluth, Minn.

IV. Geologic Formation
   a. Three types of orebodies: (1) Trough bodies, (2) flat-layer bodies, (3) fissure bodies.
   b. Geologic conditions causing these three types of orebodies.

These articles present information drawn from a great many sources, from exploration and operating records of the different mining companies and from personal investigations and studies of many engineers in the district.

It is not the purpose here to enter into any details of mining practice or engineering work, beyond the exploration of orebodies and the interpretation of such exploration records, although Fig. 1 shows a typical steam-shovel operation in the Mahoning pit. The practical value of these articles to the engineers in the district will consist of the explanation of how to work out most accurately the structure of the bodies from the results of the drill explorations. A fairly uniform practice in this matter is followed by several mining companies, but it is believed that the present articles will add considerably to general knowledge on this subject. In Fig. 2 is presented a map of northern Minnesota showing the extent and horizontal configuration of the Mesabi range with its relation to the other Minnesota ranges, the Vermilion and the Cuyuna.

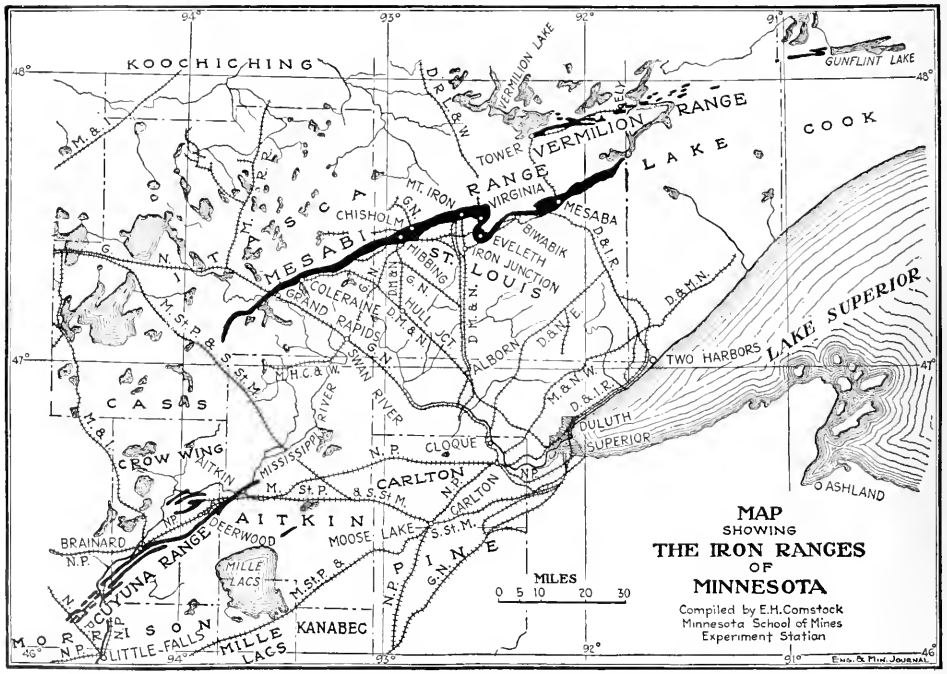


FIG. 2. MAP OF NORTHWESTERN MINNESOTA, SHOWING THE IRON RANGES

Geologic Structure—General Geology

A short statement of the general geology of the Mesabi district is a necessary introduction. The iron formation of the range has been traced by explorations from Sec. 12, T. 142 N, R. 25 W, northeastward to Birch Lake, Sec. 26, T. 61 N, R. 12 W, a distance along the strike of about 112 miles. Its width varies from ¼ to 3 miles.

The topographic feature of the range is a line of fairly prominent and continuous hills north of the iron formation. These hills have been called "Giants Range" from early days.

As correlated by the U. S. Geological Survey and amended, the rock formations of the district consist of the following, arranged from the top down:

Quaternary system
  Pleistocene series .....Glacial drift, 0 to 306 ft. Uncemented conglomerates.
Unconformity.
Cretaceous system
  Conglomerates and shales....0 to 50 ft
Unconformity.
Paleozoic group (?)
  Conglomerates or rubble ore..Fragments
Unconformity.
Algonkian system
  Keweenawan series .....Great basal gabbro (Duluth gabbro) and granite, (Embarrass granite), intrusive in all lower formations.
Unconformity.
Huronian series
  Upper Huronian series:
    Acid and basic intrusives.
    Virginia slate .....0 to great thickness.
    Biwabik iron formation .....760 ft
    Pokegama quartzite.50 to 150 ft.
Unconformity.
  Lower-Middle Huronian series:
    Giants Range granite (intrusive).
    Slate-graywacke-conglomerate formation (equivalent to the Ogishke conglomerate and Knife Lake slate of the Vermilion district).
Unconformity.
Archean system
  Laurentian series .....Granites and porphyries.
  Keewatin series .....Greenstones, green schists and porphyries.

Those familiar with the Geological Survey publications will notice that a Paleozoic group has been introduced here. Close observation by mining engineers on the range has disclosed the fact that there are on the tops of some orebodies one or possibly two conglomerates much

older than the Cretaceous. On one orebody a coarse rubble ore is found so firmly cemented that it is as difficult to break as the original taconite. It certainly is much older than Cretaceous. In another place under 50 ft. of Cretaceous shale and conglomerate is found a conglomerate much harder than the Cretaceous and of different appearance. From this evidence the Paleozoic is introduced.

For the engineer in the district it is not at all necessary to keep in mind the foregoing series and the following geological column is far simpler and entirely sufficient for practical purposes:

Glacial drift
Cretaceous shale and conglomerate
Virginia slate (black slate).
Biwabik iron formation (ferruginous cherts, taconite, and interbedded slates with orebodies).
Pokegama quartzite (granular quartzite, quartz-slate and "flaky" sericitic quartz-slate).
Basement complex of granites, slates, conglomerates, and green-stones.

The possibility of intrusions into the iron formation should be kept in mind also.

Referring to this simplified geologic column, Fig. 4 shows a generalized cross-section and explains the relative positions of the series better than a long description could. From a commercial standpoint the Upper Huronian series, namely, the Pokegama quartzite, the Biwabik iron formation, and the Virginia slate are the important rocks of the district. This series rests unconformably upon the older rocks and slopes away from them to the south and southeast at low angles, 5° to 8°, although locally steep dips are observed. It is obvious that it consists of sedimentaries which therefore have practically parallel bedding. This fact should be emphasized and remembered. At the base of the Biwabik iron formation and resting on the Pokegama quartzite is a conglomerate varying in thickness from a few inches to 15 ft., indicating a slight unconformity. At its top the iron formation has a sharp though conformable contact with the Virginia slate. U. S. Geological Survey publications state that in places the quartzite is absent and the iron formation rests upon the older rocks. More than 300 miles of drilling by mining companies fails to reveal the absence of quartzite at any place.

The quartzite varies in different places from disintegrated, granular quartzite to a compact, granular quartzite, to an extremely fine-grained, dense quartz-slate and to a "flaky" or sericitic quartz-slate. Failure to recognize these different phases as being the true Pokegama formation has caused different explorers to drill completely through the quartzite into the underlying granite, slate or greenstone. Assays of the quartzite have run as high as 33% iron, causing the explorers to think the formation was the true taconite, the local name for the ferruginous chert of the Biwabik iron formation. This mistake always can be avoided by watching the drill cores for the gnarled jasper and conglomerate at the base of the iron formation and on top of the quartzite.

Iron Formation and Intermediate Slate

The iron formation (Fig. 6) consists principally of iron-bearing chert, called taconite, interbedded with both thin and thick layers of gray, green and black slates. Its greatest known thickness is 760 ft. From 150 ft. to 285 ft. (in rock) above the quartzite is the bottom of a main slate layer varying in thickness from 10 ft. to 50 ft., although locally it has a uniform thickness. On the eastern end of the range this distance is 150 ft. or a little more; in the central part it is 180 ft. to 285 ft., averaging about 200 ft. This slate is known as the Intermediate slate and is an important horizon in the formation, as will be shown later. Interbedded with this slate are lenses of taconite. Below the slate is a layer of taconite, yellow in color where altered, from 10 ft. to 50 ft. thick. It grades downward into true gray taconite or ferruginous chert. Its top, the contact with the Intermediate slate, is extremely sharp. Near the bottom of this yellow taconite in some parts of the district there is an interbedded conglomerate.

Above the Intermediate slate is a horizon of slaty taconite 15 ft. to 50 ft. thick, more thinly bedded than the lower yellow taconite. This is really the gradation from the Intermediate-slate layer into the upper taconite and is not sharply defined. Above this layer or horizon is a great thickness, 300 ft. to 500 ft., of "cherty" taconite, as distinguished from "slaty" taconite, in which are interbedded both thin and thick layers of gray slate, not so dark generally as the Intermediate slate. The princi-

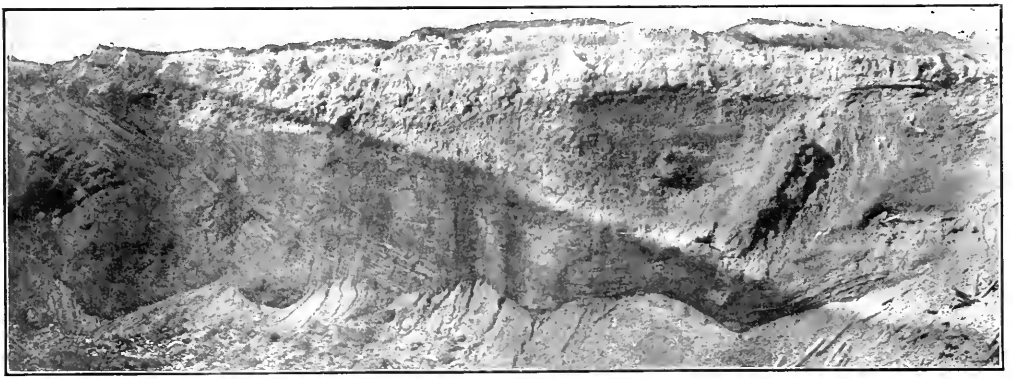


FIG. 3. FACE OF ORE AT NORTH END OF AGNEW MINE, HIBBING DISTRICT

Note the marked slump of ore layers. The orebody is a small trough tributary to a large one. At the right end is a drag fold. On top of the ore is a bed of Cretaceous conglomerate covered by drift

pal one of these slate layers is from 20 ft. to 75 ft. thick and its top is about 135 ft. to 175 ft. above the bottom of the Intermediate slate. There is danger of confusing this slate with the Intermediate slate in drill cores unless all the drill holes are correlated as drilling progresses. If the hole is put down through the Intermediate slate, the two slates will be distinguished readily because of the presence of the lower yellow taconite, usually considerably decomposed, beneath the Intermediate slate.

This slate and slaty-taconite series may be considered broadly as a slate horizon interbedded with the taconite. Its total thickness is 175 ft. or less and its lower 40 or 50 ft. usually is most distinct.

At its top the upper cherty taconite is interbedded with more slate and finally gives way to a fine black slate, the Virginia. Thus, as previously indicated, the taconite or Biwabik formation grades upward into Virginia slate, although the actual contact between the two is well defined. The interbedded slates represent periods when, due perhaps to the rising of the land area north of the shore line, the rivers became more rapid and erosion more active and increased amounts of mud were transported to the sea or lake in which the iron formation was being deposited.

In the eastern part of the district a marked conglomerate 10 to 30 ft. thick is found some distance above the top of the slate horizon just mentioned. Two distinct conglomerates are also found within the slate horizon.

An understanding of the structure just described, and illustrated in Fig. 6, is essential to the correct understanding of the structure of the orebodies to be described later, since the two are genetically related.

The source of the iron in the taconite need not be reviewed here; it is discussed at length in monographs 43 and 52. It is sufficient here to recognize the quartzite-iron-formation-slate series as an ordinary series of clastic sediments (except for the iron) deposited in fairly shallow water, contemporaneous with which an enormous quantity of iron was deposited or precipitated out of solution. It has been shown that most of the iron was originally in the form of ferrous silicate, $FeSiO_3$, occurring as minute green granules of the mineral greenalite, embedded in a matrix of chert. Iron carbonate is present in small quantities.

The iron formation probably was covered completely by the Virginia slate before earth movements caused the series to be raised above the water. When this occurred, erosion at once started, cutting through the overlying slate and exposing the iron formation and quartzite. Thus exposed to ground waters and oxidizing agencies, the ferrous iron of the iron formation became oxidized and the great mass of the iron formation was changed from a greenalite-chert rock to an iron oxide-chert rock, the present taconite or ferruginous chert. The iron oxide is in the form of minute granules (oxidized greenalite grains) and of small irregular masses and layers. This change or primary concentration must have taken an exceedingly long time. The earth movements which raised the Mesabi rocks above water also caused considerable folding, cracking and faulting of the rocks. Where cracks were numerous ground water found its way into the formation most easily. These waters, by means of the CO_2 and other solvents they carried in solution, attacked the silica in such favorable places, dissolved it to a large extent and carried it away in solution, leaving in place the stable iron oxide. This secondary concentration in favorable locations has produced the orebodies as we have them today. The process was a simple one; the leaching out of the silica left the iron oxide of the taconite in place. This removal of silica left voids or pore spaces and decreased the volume. The residual ore slumped or compacted itself of its own weight; this slump is a marked feature in almost every orebody (Fig. 3). Some further oxidization of iron probably occurred at the same time. The orebodies thus formed are of the greatest variety of size and shape. Their total known area is more than 15% of the total area of explored iron formation; their volume is a much smaller proportion. The size, shape and formation of the orebodies will be discussed at greater length in Part IV.

The average iron content of the taconite is about 26%.

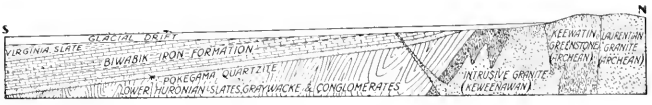


FIG. 4. GENERALIZED CROSS-SECTION OF THE MESABI RANGE LOOKING WEST

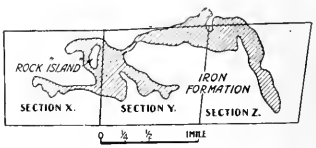


FIG. 5. TYPICAL SHAPE OF AN OREBODY

The average of all ores above 50% iron is between 58% and 60% dried at 212° F. The principal mineral in the ores derived from taconite is hematite; in those from slaty taconite, limonite. The alteration of the interbedded slates makes "paint-rock," a mixture of extremely fine, "powdery" hematite and limonite in a mass of soft clay.

Cretaceous Conglomerate and Shale

In practically all parts of the district are found remnants of a Cretaceous series overlying unconformably the iron formation and the Virginia slate. This series consists of a basal conglomerate of coarse pebbles of iron ore several inches or several feet in thickness, grading upward through a fine conglomerate into a true shale. In some places this shale averages 50% dried iron. Shells and vertebrae and teeth recognized as those of a variety of shark, mosasaur, are found in the shale. In most places the conglomerate is poorly cemented with a siliceous-aluminous material, a true clay. Several bodies of this conglomerate 15 to 30 ft. thick, each containing several hundred thousand tons, have been found by drill explorations. They overlie the Virginia slate or the contact of slate and iron formation; in a few places they cap the other orebodies. Their content is from 50% to 54% dry iron; their alumina content is high, from 6 to 12%. Phosphorus is also notably high, due to organic remains. In preglacial erosion channels and probably old shallow lake basins on top of the iron formation, poorly assorted

uncemented conglomerates of iron-ore pebbles are found. These conglomerates are much younger than the Cretaceous.

Glacial Drift

Covering the sedimentary rocks of the district almost entirely is a mantle of glacial drift varying in thickness from a few feet to over 300 ft. The average thickness over the orebodies developed as openpits is 50 ft. As can be seen in the banks of the openpits, this drift consists of a lower and an upper layer of typical glacial till, between which is a layer of stratified sands and gravels. These latter probably were deposited in a marginal glacial lake, while the former are the ground moraine of two different ice-sheets. This complete series is not found everywhere in the district.

With the foregoing statement of the general geology of the district as a basis, the detailed structure of the orebodies may be considered.

Typical Structure

Three types of orebodies are found in the district, namely, trough bodies, flat-layered bodies and fissure bodies, named in order of their importance. These three types and the conditions of their formation will be discussed in part IV. By far the greater part of the ore occurs in trough bodies; therefore the structure of the trough bodies will be described and illustrated as the typical structure of Mesabi orebodies.

The process of formation of the orebodies as explained in the foregoing discussion developed great troughs in the iron formation, in which the orebodies lie. Some of these troughs are small and isolated, but for the most part they are connected into enormous irregularly shaped bodies. Amoeba-form is the best descriptive word for their shape in plan. Fig. 5 shows the area of such a body. The main body has a trough basin and the individual fingers or lobes each has a trough structure. The main axis of each trough is roughly parallel to the strike of the formation, but the axes of the minor troughs are at all angles to the strike. For purposes of illustration the structure of the minor troughs will be considered. Fig. 7 is a section of a minor trough taken at right angles to the longitudinal axis; it shows the typical structure of a Mesabi orebody. Fig. 6 shows the typical structure of the iron formation where unaltered to ore. A comparison of the two figures discloses at once the direct relation between the structure of the country rock or unaltered iron formation and that of the orebody. The Intermediate slate becomes intermediate paint-rock, the upper slaty taconite and lower yellow taconite become upper nonbessemer and lower nonbessemer ore layers respectively, and the upper and lower cherty taconite are altered to upper and lower high-grade (generally bessemer) orebodies, respectively.

The ore of these high-grade bodies is generally referred to as blue ore, from a slightly bluish cast which it has in the bank.

Fig. 7 is an actual section of an orebody now nearly mined out, except that the width has been reduced 200 ft. in the figure. As is evident, a large thickness of the formation above the Intermediate layer has been removed by glacial and preglacial erosion. Attention is called to the marked slumping of the layers in the middle of the trough and at the contact of the ore with the rock walls. This was previously explained and, as stated, is a marked feature of Mesabi orebodies. At every rock and ore contact it is observed. The seams of ore often can be followed turning up and connecting with ore seams in the rock. In deep troughs the ore layers have slipped down many feet along the rock wall. So persistent and pronounced is this slumping that the presence of underlying rock pillars or the outline of a lower rock wall can be known quite accurately by observing the slump of the ore layers in either underground or openpit workings.

The ore of the upper high-grade body is characteristically fine grained and contains numerous seams and layers of paint-rock, resulting from the alteration of the interbedded slate seams and layers. Little rock, taconite, is found in this body. Mineralogically hematite predominates, but many of the paint-rock seams are limonite.

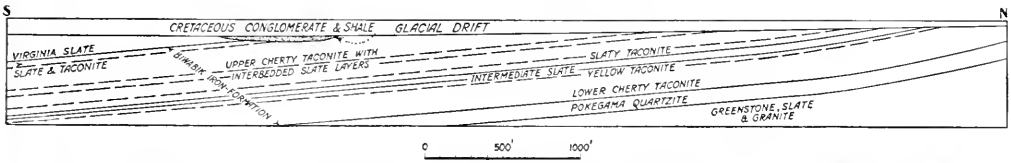


FIG. 6. GENERALIZED CROSS-SECTION OF THE MESABI RANGE, SHOWING GEOLOGIC FORMATIONS AND SUBDIVISIONS OF BIWABIK IRON FORMATION

The ore of the lower high-grade body is much coarser than that of the upper and contains but few seams of paint-rock as compared with the upper. It consists principally of hematite. Most of the lower orebodies so far developed contain considerable rock; their silica content for the same grade of iron is higher than in the upper orebody. This indicates that the alteration and concentration have not been so complete below the intermediate layer as above it. The rock occurs as layers or lenses and as pillars. If large, the pillars are called "horses" of rock or taconite islands. In some cases these rock pillars stand up like slender pyramids. In others the base is found to be altered to ore and they fall over or are blasted down in mining operations in openpits. In many orebodies the lower 10 to 25 ft. of the lower high-grade orebody is exceedingly sandy, making it really a low-grade ore. In such bodies the high-grade ore grades downward through sandy and decomposed taconite to the bottom solid taconite. In other bodies the contact of high-grade ore and bottom rock is sharp. Monograph 52 states that in no place does an orebody rest upon the quartzite. Recent drilling has shown that several orebodies in the western part of the district rest directly upon the quartzite. As early as 1906 part of the orebody of the West Gilbert mine was known to rest on the quartzite. Mining operations have shown that the top 5 ft. of the quartzite, not the conglomerate above it, is so impregnated from the ore above that it analyzes over 50% iron, dried.

The upper nonbessemer layer is an alteration of slaty taconite, is quite soft in texture and finely laminated. It is composed of layers of limonite and a little hematite, the latter occurring in the layers of purplish paint-rock.

The lower nonbessemer ore differs from the upper nonbessemer chiefly in texture. It is derived from a true taconite or chert rather than from a slate. The ore is chiefly hematite; but there are enough limonite streaks in it to give it a yellow color. In texture it is nearly as coarse as is the underlying high-grade ore. Both upper and lower nonbessemer layers are called locally yellow or brown ores, from their appearance. The lower nonbessemer ore cannot in any way be considered as the alteration of the lower part of the Intermediate slate, because the break between the latter and the yellow taconite from which the lower nonbessemer ore is derived is the sharpest division in the Biwabik formation. In fact, as will be shown later, this very break is used to work out the structure of orebodies from drill records and drill cores. As previously indicated the upper nonbessemer ore is a gradation from the Intermediate paint-rock layer into the upper high-grade ore.

The Intermediate slate layer becomes altered to the Intermediate paint-rock layer in an orebody. The paint-rock is a soft, clayey layer, from 5 to 50 ft. thick. The predominating color is red, although there are numerous thin yellow, brown and purplish layers in it. It has a high moisture content and samples taken from it are exceptionally high in alumina and usually in phosphorus also, although there are local exceptions to the latter rule. The iron analyses for the paint-rock layer given in Fig. 7 cannot be compared directly with those of the yellow and blue ores because the moisture in the paint-rock is 50% to 100% more than in the blue ores. Analyses given in Fig. 7 are dried at 212° F. The paint-rock is not a commercial ore; its natural iron is too low, ranging from 35% to 43%.

The high-grade bodies have been referred to as generally bessemer orebodies. In many cases, however, the phosphorus is too high to class them as bessemer. The lower orebody is more uniformly bessemer than is the upper. This is probably due to the greater abundance of paint-rock seams in the upper body (the slates carry higher phosphorus than does the chert), and also to phosphorus precipitated out of solution from ground waters.

Since a 40-acre tract is the unit of ownership on the Mesabi range the complete typical structure does not appear in every such tract. In many places glacial and preglacial erosion has removed part or all of the upper orebody, intermediate paint-rock layer and lower nonbessemer, leaving only part of the lower orebody. In places such erosion leaves the paint-rock layer capping the orebody. In a few cases, including one exceedingly large orebody, there is no alteration below the Intermediate slate, and this layer is the foot wall of the orebody. Then there are extensive flat-layered orebodies which are below the Intermediate slate and there is little or no ore above it.

In Secs. 2 and 3, T. 58 N., R. 15 W a granite intrusion in the iron formation below the Intermediate slate forms the foot wall of the orebody of the Meadow mine.

The typical structure above described applies to the orebodies from one end of the range to the other. It was first recognized by John Uno Sebenius, now general mining engineer of the Oliver Iron Mining Co., in the early days of Mesabi exploration. He carried samples of the Intermediate slate from one part of the range to another in order to establish the continuity of this layer. He compiled the first map of the district and the map published by the U. S. Geological Survey is practically a copy of his map, which has been added to and corrected as explorations progressed. His geologic and mining work in the district make him the foremost authority on the Mesabi range. I am indebted to him for permission to use much of the information contained in these articles. I am also indebted to the officers of the Oliver Iron Mining Co. for permission to publish these articles and to use data from which they have been prepared. The great mass of information collected by them since the early exploration of the Mesabi range has been accessible and without such data the facts presented in these articles could not have been worked out. I take credit only for the close study and correlation of this information and observations in operating mines all over the range. Special acknowledgment is due also to associate engineers in the Duluth office for helpful suggestions and criticisms.

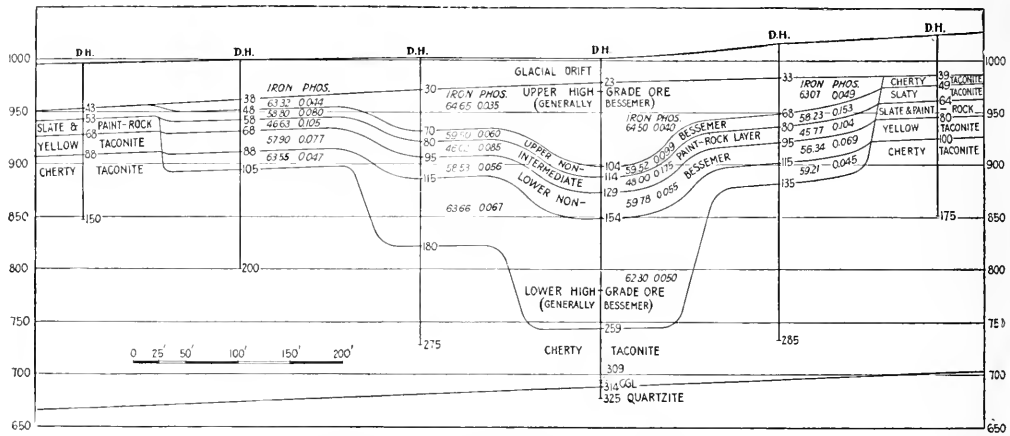


FIG. 7. CROSS-SECTION OF A TROUGH OREBODY, SHOWING TYPICAL STRUCTURE AND ANALYSES OF ORE

(To be continued)

Zinc Corporation and the War

SYNOPSIS—Besides financial tension and disturbed markets, the war closed the outlet for the Zinc Corporation's zinc concentrates which had been smelted in Germany. The chairman reports that the corporation's effort to dispose of its products was further embarrassed by the inability to get a decision from the British courts as to whether its contract with an alien enemy was merely suspended or was canceled.

The difficulties arising out of the war for Australian companies that were having their zinc concentrates smelted in Europe are set forth in an interesting address by Chairman F. A. Govett to stockholders at the recent annual meeting of the Zinc Corporation in London. The chairman said in part:

This company is one of those which has suffered very hardly with the incidence of war—a world-wide war, with all its diverse and far-reaching effects. Some companies and some individuals are making largely increased gains, while others, like ourselves, have been condemned to struggle with adverse conditions to maintain some decent profit, some even to keep alive. Not only have we had to deal with direct troubles in total suspension of our sales of zinc concentrates and in difficult markets for our lead production, but also indirectly, in that we were involved in legal difficulties in our contract with an alien enemy, while, in full and reasonable anticipation of continued peace—for who last summer thought of war, and such a war as this?—we found ourselves surprised, with our financial resources tied up, with our wealth unrealizable, even if our credit was and still is unimpaired. This position, of course, entailed, as we informed you in our circular, the postponement of the final instalment of the preference dividend, which now we pay.

When confronted by factors of sufficient magnitude and great complexity, it is fair to say that none of us are more than theorists or empirics in times like those at the beginning of the war. There was no man—banker, merchant, chancellor or financier—who could do much better than make a hesitating guess at what would happen as a result of any step; consequently, we have passed through many stages of moratorium and questionable relief, including national assumption of hundreds of millions of doubtful bills and attempts to establish here the industries of other countries with no determination to protect them till established; in fact, we have passed through a whole gamut of tentative expedients, and even now the exchanges of the world are in disorder and the financial conditions in some countries—certainly in one, in which we are financially interested, Canada—are still difficult, uncertain and confused.

Lead-Smelting Contract Suspended

I will come back to this point in dealing with our financial position, but first I must trace our history from the outbreak of the war. At that time it was in our judgment probable that while our sale of zinc concentrates was obviously totally suspended, some considerable demand for lead would be continued, and with that idea we kept our lead concentrator in full operation and closed down the zinc. That view was not shared by other people; in fact, I think we were alone in taking it, for the other mines at Broken Hill only worked half time, and that only in order to keep labor employed, while the Broken Hill Proprietary, with whom we had our contract for the sale of our lead concentrates, notified us in consequence of war of suspension of our contract. At first we were under the impression here that they must actually have stopped smelting, in which case the suspension, of course, was justified. Under this impression we issued our circular last September.

It was only later, to our intense surprise, that we found they had never ceased to work full time. Then we protested, for, as the war had not interfered with their working at Port Pirie, the war clause in the contract plainly could not apply. I do not like to suggest that they seized a very thin opportunity to rid themselves of an onerous contract, but we regard the suspension simply as outrageous. The result was that we were forced into a position of either having to put up with what we considered an illegal and unwarrantable suspension of our contract—for the group with whom they had made a working arrangement during the war would not admit us to share in the arrangement for smelting at all unless we accepted that position—or we were left with no possibility of smelting our present output, and with our sole remedy an action against the Proprietary, which, under the circumstances, would have placed us in a most invidious position. In Australia such an action would have been regarded as mean and unpatriotic, for this arrangement with the North and South was primarily an arrangement to keep labor employed, although it has turned out very profitably for those companies. We do not like law, however sure we feel; we wanted to keep our labor employed; we had to sell our concentrates, and therefore we had to put our pride in our pockets and to accept the share which they offered. We were just in a cleft stick.

Coöperative Smelting Arrangement

I am not going to reargue further before you our view of this question, but under this compulsion and our immediate necessity we accepted a four-eighteenths participation and again began to earn some revenue. But I would like to call your attention to the fact that our view of the future of lead sales was right; the demand, of course, has not been normal, but at this moment the price of lead is much higher, and the demand, I think, is going to continue. Now, however badly we may think we have been treated by the Proprietary people, I think this is going to work out "somehow good," for at least there is some sign of real concerted action in lead production and in the selling of lead from Broken Hill. While I am on this subject I may as well deal with the proposal which was before us and which we have accepted. It is this: A company has been formed of £700,000 issued capital, to take over and work the Proprietary smelting works. The purchase price is £450,000, payable as to £300,000 in cash and £150,000 in shares. It appears there is £250,000 working capital. Toward this £550,000 cash the Proprietary subscribed £50,000, which leaves £500,000 in cash to be provided. This is subscribed by the North and South and ourselves.

It is understood that this is to be regarded more as a coöperative scheme than as a commercial enterprise to pay large profits, its object being to treat the Broken Hill output as far as possible as a whole. There will always necessarily be exceptions—for instance, the Sulphide Corporation has smelting works of its own; but this is the first genuine attempt at combined operation, and we regard it as most important, for it should establish the combination in a powerful position as regards the lead markets of the world. We had, therefore, no hesitation of any sort in accepting our share in this combination. The proposal is that this company will also smelt for outside companies, the returning charge being based on a reasonable profit to provide for interest on capital and amortization. That helps to make the money involved secure, and, even if we get no extravagant dividends from our investments, we shall get the equivalent in whatever increased profit there may be in the realization of our concentrates, for the smelting company will control the operations of marketing the lead, and this is an important move in the direction of shaking free from the domination of foreign control of the metal markets of the world. Our participation was necessary, for if we did not participate we could not smelt our concentrates; no matter how we raised the money, we had to take our share, and, therefore, we did not worry you with earlier discussion of this matter.

Alien-Enemy Contracts

I now pass to the zinc position, and here there is involved the question of alien contract. Prior to the war, as indeed you know, we sold our concentrates to German buyers, who, of course, at once notified us of suspension. I think the first three months of the war was spent by H. C. Hoover and myself in a continuous study of this zinc position with a view to finding other outlets, and in consideration of the question of the erection of smelting works here, while Theodore Hoover was in America studying the position of zinc smelting there. Counsel's opinion was at once taken as to these contracts being void, and while the authorities over here seemed all agreed that the contracts actually were void, it was not a positive fact, for there had been no decision and there seemed no way to get a decision, which first was absolutely necessary, seeing the magnitude of the sums involved. We made a gallant effort to get a declaration from the Special War Court of Appeal, but when we appeared in court before six judges they pleasantly told us they could not hear the case as we had not brought the alien enemy into court. While this embarrassing and paradoxical decision may have pleased and satisfied the legal mind, it fairly blocked our road, and the only alternative before us was to wait for state declaration that such contracts are void. The Australian Federal Government appeared to be anxious to take this course, and I interviewed the High Commissioner and bombarded the Colonial Office and the Board of Trade to take joint action, but so far without effect beyond this, that a short act was passed in March making it possible to bring an alien enemy into court by substituted service, and we are now engaged in another attempt to grapple with the difficulty.

This question of the alien-enemy contract was and is of the last importance to this company, for if these contracts were not void beyond all question, but possibly only suspended, it was not open to us to build smelting works for ourselves, nor could we make other contracts, and lastly, unless happily we can get our declaration of avoidance by the act of the Federal Parliament, or by assistance of this short act of which I spoke just now, it looks as if we may be sooner or later involved in lengthy litigation and this litigation might keep us out of business for another period. So much for the legal point. It is not easy to see the present price of spelter and not to feel wild that we are not able to sell our concentrates and take advantage of the price; but one should reflect that the price exists only because we cannot sell, and that if we could the price would not be there.

Temporary Zinc-Smelting Works Impracticable

It has been suggested to us once or twice that in order to get some benefit from this abnormal price, we should run up a cheap temporary zinc smelting plant quickly. I fear the answer is that it would take a year to erect any kind of a new plant, and there is no such thing as a cheap make-shift smelting works; so that unless you think the war is going to last, that suggestion is no use, while as regards the practical point of erection of smelting works, it would be difficult here to get the labor to erect, or when erected, the skilled labor required to operate; while generally, apart from war conditions in England and Australia, frankly I doubt if this policy can be justified. There were in existence before the war even more smelting works than were required to produce the consumption of the world in spelter. To add to their number, except perhaps to a small extent by way of a "control" plant, which would enable us to compare results, would simply mean to increase the competition and depreciate the price of spelter. Before the war many of these plants in America and Holland were actually shut down, and except for patriotic desires it would not seem sense to increase the number unless it be to supply our home consumption, and this only with a full determination to protect the industry, when established, from destructive, certain competition.

These plants are expensive to erect; a plant to handle our production of concentrates alone would cost £500,000, leaving out of consideration the capital necessary to carry and finance the business. Notwithstanding these portentous figures, we spent the first three or four months of the war practically in this continuous study of the problem; we examined various sites all over England, and have had negotiations with the leading smelting people, and others, in the United States, here in London and elsewhere. The president and the engineers of one of the leading companies specially came over, but we could not agree on remunerative terms. But so far as the erection of works is in question, our conclusion is that in the absence of protection or some state assistance, our policy must be, on conclusion of the war, to make some new contract on equitable lines with some existing smelting works. This perhaps may seem a pity, for, in our group, which includes the Burma Mines, we have two mines which look like a sufficient permanent assurance of supply of zinc ore. That is one of the difficulties—the permanence of supply. That, we think, is one of the conclusive reasons why smelting works of any size cannot be erected in Australia, for as the accumulated mountains of tailings disappear—and the progress of disappearance is fast—the current supply of tailings would be insufficient to justify erection, the later supply not being assured. Be-

sides this, there would be the expense of highly paid labor, and the business would not stand it. I think that explains the position as it is likely to be at the end of the war.

Sale of Zinc Concentrates

So far as regards the present we have also had plenty of negotiations for temporary contracts, but without result. We put forward what was admitted to be a reasonable plan with one of the leading American companies, whereby both we and the purchasers could share equitably in the profit resulting from high-priced spelter, but constantly we were met with the objection that other Australian concentrates were offering on very much easier terms. As recently announced, the Amalgamated Zinc has made one small sale—I fear on not good terms—so that I can only conclude that the other companies between them previously must have all but spoiled the whole business, for the only definite terms which I have heard, and on which a contract was actually effected, were such as we should not accept. None the less, I am pleased to say we think we have succeeded in selling 14,000 tons on terms which are satisfactory to ourselves, and we have some hope that this may be followed by other sales. I am not in a position at present to say more than that, for the business is not definitely complete; still I hope that it may enable us to start working, at any rate on some reduced scale or for a time. But it would be no use estimating possible profits under present conditions.

Lead Operations Profitable

We are, however, doing well with lead, for with the present demand for lead we suppose the full production of the smelters is being sold. Against that, however, at present we are working short time, for the production of concentrates has overtaken the smelting works which will be enlarged. Before this, at £20 lead, we calculated we were making profits of about £7000 a month, while each £1 rise in price would mean about an additional £1400. But we did not like to make a monthly definite statement, as the sales of lead were very slow and we did not know that all the lead was being sold. This is the reason for the form of return adopted up till now, but for the future I think we might give some estimated profit based on a given price, say £20 a ton, leaving you to calculate the additional profit if the current market price should be maintained till realization, which, I presume, is three months forward. At the present moment, when we get it, we stand to receive a large sum of money, probably £80,000 or more, and therefore we have no hesitation in declaring the final preference dividend for 1914.

Idaho's Mineral Exhibit

The Idaho mining exhibit at the Panama-Pacific Exposition is not merely a display of ores and mineral products, but a practical, comprehensive exhibit so arranged that the visitor, with the aid of the large relief model, is able to obtain a good conception of the mining geology of the entire state. The relief model stretches across one side of the exhibit space, 60 ft. long, 50 ft. high and 15 ft. deep, forming a background for the various table displays. The model presents a series of cross-sections delineating the various vein types and fault systems within the state. The table displays embrace all the various crude ores, accompanied by the inclosing wall rocks and also the mineral products. It is all arranged by counties or districts, so that one may take up the study of the ores and rocks and products of a district or a county and, with the aid of the labeling and other printed data, quickly gain a comprehensive view of mining in Idaho.

The Coeur d'Alene display is the largest, occupying a table 60 ft. long and 4 ft. deep. This presents an interesting study of the lead-silver and zinc ores, their accompanying rocks and products. Massive pieces of lead sulphide weighing 300 to 1100 lb. from the Coeur d'Alene, and also massive pieces of zinc blende from the Interstate-Callahan mine, form an interesting and attractive feature. The lead-silver, the zinc and gray copper ores from Idaho, Bonner and Boise Counties are arranged on a separate table, thus presenting these characteristic ores so distributed that they form an instructive display and enable the visitor to make acquaintance with the situation and occurrence of this character of ores. The copper display occupies a table 27 ft. long, 5½ ft. deep and contains samples of all the copper ores produced in Idaho, including malachite, azurite, black and red oxides, native copper, disseminated copper and the porphyry ores. The gold display contains ores from Lemhi and Idaho Counties and the free-milling and sulphide ores from Owyhee, Lemhi, Idaho and Blaine Counties. Included with the gold display are samples of gold in an iron mass (limonite).

MINERAL EXHIBIT OF IDAHO AT SAN FRANCISCO

The chief attraction in the structural materials division is a massive piece of sandstone, illustrating the progress from the quarried rock to the finished product, showing in the one piece the stone as originally broken out from the quarry, a portion of it roughly dressed and another part highly polished. The figure presented by the work part of the sandstone describes one-half of an arch. There is a series of photographs illustrating interesting features of Idaho mining and also the mills of the Coeur d'Alene district. Altogether Idaho has given to exposition visitors a practical, comprehensive and sane display of the mineral resources of the state.

Pig Iron Production in the Electric Furnace is carried on successfully at Tinfos, Norway. Coke is used as the reducing material and the ore carries 44 to 47% iron. The power in the furnace is from 1200 to 1400 kw. There are four furnaces at Tinfos, three being usually in operation while one is held in reserve. The output is about nine tons per furnace per day.

Solution of Pulp Problems by Graphic Methods

By W. J. McCauley*

SYNOPSIS—Proper solution and record of pulp problems are important, but are sometimes evaded on account of the time and trouble required for the somewhat abstruse calculations. Most of the problems, however, can be formulated in such manner that their solutions can be expressed in straight-line diagrams. The methods employed are explained in detail.

In many hydrometallurgical plants the importance of making accurate pulp measurements and keeping a systematic record of them is too often overlooked. The importance of such observations can hardly be underestimated, as they are essential to the proper working of any mill. The excuse for their absence usually is that no one on the job has time to look after the work, and as the mill is apparently running pretty well as it is, there seems to be no real need of keeping such records. Most mill men will admit, however, that if such information is systematically kept through several years, it is valuable and often a money maker. The trouble encountered in the taking of such measurements and the difficult nature of the subsequent calculations are sometimes causes for inattention to such details.

Customary Use of Formulas

It is the custom in most mills where such observations and measurements are taken to first determine the constants of the ore treated—the density and such others as the practice of the mill and the systems of measurement make possible. These constants are substituted in the various formulas as one of the three factors of pulp problems. The second quantity is found by measurement and the formula is solved for the third.

It is not the purpose of this article to give methods for making pulp measurements or to derive the formulas necessary for the solution of the problems. This subject has already been thoroughly discussed.

The drudgery of solving each problem every day is eliminated by solving once all the problems concerning a certain measurement which are likely to occur in practice. Tables or curves from which the desired results of any observation may be read directly are then made. Such conveniences are somewhat difficult to formulate because to have them accurate it is necessary to solve substantially every problem within the range of the table or curve. This is usually a task of no small proportions, and should one of the previously determined constant quantities become changed at any time, the labor must all be repeated.

Graphs to Facilitate Operations

With the idea in view of rendering the making of such charts simpler I have undertaken to produce a method of graphic analysis for the solution of pulp problems, and to make a system of straight-line charts which may be drawn in a few minutes and with little or no calculation.

*Mining engineer, Lemmon, S. D.

The basic principles of this system were suggested in an article published by George B. McLain in the *Mining and Scientific Press*, Aug. 3, 1912. In this article the method of making and using a straight-line chart for the determination of the percentage of solution and solids in mill pulps is explained; the density of the ore being a constant and the gravity of the pulp being known.

The equations may be divided into two general classes: First, those in which it is possible to assume one quantity as constant so that when a second is made to vary by equal increments the third will also be found to vary

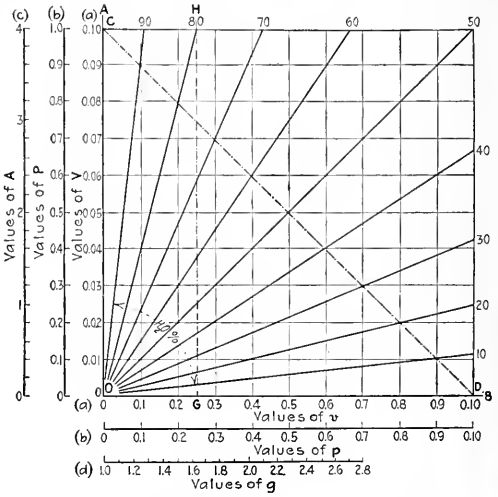


FIG. 1. CHART FOR SOLVING PULP PROBLEMS

by equal increments. Equation (1) is of this character. If in this equation either s or x is held constant it will be found that if y is varied by equal amounts, then will x or s also vary by equal amounts.

$$y = sx \qquad (1)$$

The second class consists of those equations in which the above relationship does not exist. In this case it is impossible to select any one value as constant so that if a second be varied by equal amounts the third will also vary by equal amounts. Equation (2) is of this nature.

$$y^2 = sx^2 \qquad (2)$$

The distinction between these two cases is really that of degree. The equations of the second class are formed usually not by the occurrence of the higher powers of the three variables, but by the way in which these quantities are related to one another and to the constants of the equation.

Let us now consider the nature of such equations and methods for their graphical solution, following up by some practical examples of their applications.

Formula (1) is the equation of a straight line passing through the origin, in which s is the tangent of the angle that this line makes with the axis of x. Such a problem

may be solved for all varying values of x and y, when s is a constant, by simply drawing on cross-section paper a straight line through the origin of points, which makes an angle with the axis of x whose tangent is s. A series of such lines radiating from the origin may be drawn to represent varying values of s, as in Fig. 1. All problems of this nature may now be solved by inspection of the chart.

One or two such practical pulp problems may be worked out. In explaining these charts there will be no attempt to make mathematical proofs of their correctness or the formulas used in making them.

The following symbols will be used throughout:

a = percentage of water by weight, in any pulp, expressed as a decimal.
c = a constant.
d = density of the dry pulp or ore.
g = gravity of the wet pulp.
p = number of pounds of cyanide (KCN or NaCN) per ton of solution.
P = number of pounds of cyanide per ton of solids.
R = water ratio.
t = a length of time measured in seconds.
T = tons of dry pulp discharged in 24 hr. by a pulp stream.
v = dissolved metal (Au or Ag) per ton of solution in any wet pulp.
V = Dissolved metal per ton of solids in any wet pulp.

Determination of the Dissolved Metal in Mill Tailings

The dissolved metal in discharged tailings is usually expressed as a value in cents per dry ton of pulp discharged, the value per ton of solution and the percentage of solution being known. This is accomplished by taking a sample of the tailings and determining the percentage of moisture by the gravity bottle, or other convenient method. The slime is allowed to settle from the solution and a known amount is decanted and assayed. The following formula is then employed:

$$V = \frac{av}{1 - a} \qquad (3)$$

This is of the form of equation (1). Here $s = \frac{a}{1 - a}$, and a chart, similar to the one above described, may be used.

To make this chart lay off along OB, Fig. 1, to any convenient scale, values of v, and to the same scale lay off along OA values of V. Now draw a 45° line CD and divide it into 100 equal parts. Through each of these points of division and a draw diagonal lines as shown. Number these lines from 0 to 100, starting with OB as 0 and ending with OA as 100. These numbers and the lines to which they are attached represent the varying percentages of water or solution in a pulp.

This method of drawing in the diagonal lines is evidently correct. In formula (3) let V and v be made to vary in such a manner that their sum is always a constant. The equation representing these changing values is $V + v = c$. This is the equation of a 45° line intersecting OA and OB in points other than O, such as CD. It will now be found that a varies by equal increments.

To use the chart, follow vertically up the line representing the value of v found by assay until it intersects the line representing the percentage of water previously determined. Thence follow horizontally to the left. On OA will be found the value of V sought.

In practice it is desirable to assay more than one assay ton of the decanted solution from the pulp, and it is usually desired to express V in terms of cents per ton. In this case it is better to lay off values of the actual weights of gold or silver found in milligrams along OB, and to lay off values in cents per ton along OA. Here CD will probably not be a 45° line, but will be one connecting two points, C and D, which have values such that

$$\frac{OD}{x} = \frac{OC}{y}$$

where x is the number of assay tons of the solution taken for assay, and y is the value in cents per ounce of gold or silver.

It sometimes happens that the pulp is too thick to make practicable the method just described of direct decantation and assaying of solution for the value of v. For notes on a method recommended in such cases, and the explanation of a chart for the calculations of same, the reader is referred to the *Engineering and Mining Journal* of Mar. 27, 1915.

Determination of Cyanide Loss

The cyanide loss in tailings is usually expressed as a number of pounds per ton of dry pulp discharged. The number of pounds per ton of solution is found by titration and the following formula applied:

$$\frac{ap}{1 - a} = P \qquad (4)$$

Formula (4) is of exactly the same nature as formula (3) and the same chart, Fig. 1, may be used for both.

It is often desired to know the water ratio of a pulp; that is, the number of tons of solution per ton of solids. The water ratio of any pulp is expressed by the formula:

$$R = \frac{a}{1 - a} \qquad (5)$$

Now, as has been shown, the quantity $\frac{a}{1 - a}$ has the value of s in the equation of a straight line passing through the origin. It is the tangent of the angle which the diagonal line makes with the axis of x, or in Fig. 1 with the line OB. Hence the water ratio is the tangent of the angle which the percentage water line makes with the line of zero percentage water, or OB of Fig. 1. This being the case we may lay off on OA values of R, and to the same scale lay off OG, on OB, equal to unity, and draw GH parallel to OA. Now the percentage water lines will cross GH on that horizontal line corresponding to the desired value of R.

A chart similar to the water ratio chart may be used to determine the number of cubic feet of solution per ton of dry pulp and many other similar problems.

Making Pulp-Stream Measurements

The tonnage measurement of pulp streams of nearly constant volume, such as tube-mill discharges, offers a considerable problem to the metallurgist. Such measurements are usually made by taking the time required for the stream to fill a given volume, such as one cubic foot. The following formula may then be applied:

$$T = \frac{2700\, d\, (g - 1)}{t\, (d - 1)} \qquad (6)$$

in which t is the time in seconds required to fill one cubic foot of volume.

For any ore d is a constant and hence the quantity $\frac{2700d}{d-1}$ is a constant. Once d is known for the given ore the formula becomes:

$$T = \frac{c\,(g-1)}{t} \qquad (7)$$

This equation is a rather special case of equation (1), but it can be solved by the same general methods.

Referring to Fig. 2, on OB lay off values of T to some convenient scale, starting at O as zero, and on OA lay off values of g, starting with O as the point where $g = 1$. Or, which is the same thing and practically more handy, OA may read the actual weights of the cubic-foot volume taken, starting at O with the weight of the container when full of water.

Diagonal lines, similar to those of Fig. 1, may now be drawn representing values of t, so that the horizontal line representing the value of g, or weight found, will intersect the diagonal representing the observed time of filling (t) vertically above the desired value of T.

Now if $g = 1$, T will equal zero and it follows that all the t lines intersect at O. If t is equal to zero then will T equal infinity except for the case where g is equal to unity; here T is equal to zero divided by zero which

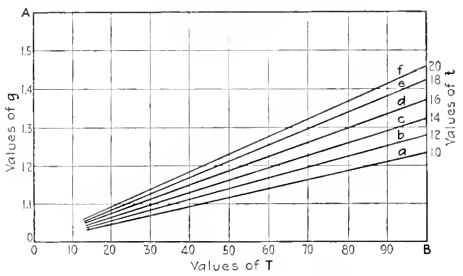


FIG. 2. CHART FOR PULP-STREAM MEASUREMENTS

is an indeterminate and may have all values from zero to infinity. Hence the line representing t equals zero and coincides with OB. If t equals infinity, then will T equal zero, and the line representing t equals infinity and coincides with OA. All other values of t are diagonals lying between OA and OB.

The t lines are all straight lines; because if t be held constant and g varied by equal increments, then will T vary by increments. If g is held constant and t is made to vary by equal amounts, then will T vary along a curve. Practically the best way to draw in the t lines is to solve the equation for each value of t liable to occur in the practice for which the chart is made, holding g constant. By this method a series of other points besides O, such as a, b, c, d, etc., on each desired t line, is found. It now only remains to draw in the t lines and number them.

In the second case the three quantities going to make up the equation bear such a relation to one another that if any one of the three quantities be held constant and a second varied by equal amounts, the third would be found to vary by unequal amounts, or along a curve. In problems of this kind it is impossible to construct a simple chart on the lines previously outlined, for we have no longer the simple equation of a straight line, but that of a curve. It may, however, be solved by a straight-line graphic method by drawing in two sets of diagonal lines, radiating from different points, so as to cross each other. These sets of lines represent two of the three values of the equation, while ordinates or abscissas represent the third. The lines representing any two of these factors meet on that point where the proper value of the third factor, necessary to balance the equation, meets them both.

There is at least one pulp problem of prime importance which falls in this class. By referring again to Fig. 1 it may be discussed.

Percentage of Water in Pulp

This problem was solved graphically in a very ingenious way by Mr. McLain. My method is similar, but in many respects the reverse of that given by McLain. My three quantities entering into this equation are a, d and g. The relationship between them is expressed by the formula:

$$a = \frac{d-g}{g\,(d-1)} \qquad (8)$$

which is evidently of the form of the second case.

On a chart constructed in accordance with Fig. 1, lay off on OB to some convenient scale, the density, d, of the ore. Let this be OF. Now on OA lay off, to the same scale, OE equal to the gravity of the solution; that is, unity as a rule. Divide OF into equal parts varying from unity at O to d at F. These divisions represent the gravities, g, of the pulps which are possible from the ore whose density is d. Draw EF. Now when g is determined by the gravity bottle or other method, the vertical line representing this value of g intersects EF at the same point as does the diagonal line representing the percentage of solution, a, sought.

This last described chart, giving the relation between a, d and g, may be made according to the method outlined only when CD is a 45° line. If the dissolved value chart be made along the line previously suggested; that is, wherein CD is not a 45° line, it is necessary that OF and OE bear a relationship different to one another than that of $OE : OF :: 1 : d$. If the chart is constructed in this manner the relationship between OF and OE will be such that

$$\frac{c}{x} = d\,\frac{1'}{y}$$

where x and y have the same values as that assigned to them in the discussion of the dissolved value chart.

In discussing the various charts a single figure has, for the most part, been used. In the actual use of this method of analysis it is better to make individual charts for each problem to be solved; thus avoiding unnecessary lines and figures.

In what has gone before I have attempted to give the outline of a method of graphic solution of pulp problems, and explain the same by giving methods for the analysis of a few of the more commonly occurring ones. The scope of this field has only been touched; but the underlying principles of the method may be applied to nearly every pulp problem, and little difficulty should be encountered in extending them beyond the scope of this paper.

By drawing such charts to large scale and exercising care in their construction, they may be made as accurate as, or even more so than, the measurements can be taken, and fully accurate enough for all practical purposes.

American Institute Meeting at San Francisco

Elaborate arrangements have been made for the meeting of the American Institute of Mining Engineers, in San Francisco, Sept. 16-18. It will be followed by a series of excursions, which will leave those members who desire to do so free to attend the International Congress at San Francisco, Sept. 20-25. A large number of papers have already been offered for this meeting.

Several other papers of value are now under consideration by the committee, and will be distributed in advance of the meeting. The technical programs have been arranged for several simultaneous sessions on September 16 and 17, in order to allow ample time for the discussion of the various subjects.

Papers to Be Presented

The papers accepted and now in the hands of the printers follow:

Mining Methods and Law—"Fire-Fighting Methods at Mountain View Mine, Butte, Mont.," C. L. Berrien; "Underground Mining Systems of Ray Consolidated Copper Co.," Lester A. Blackner; "Mining Conditions on the Witwatersrand," W. L. Honnold; "Ore Tramming and Hoisting at the Copper Queen Mine," Gerald Sherman; "Churn-Drilling Costs, Sacramento Hill," Arthur Notman; "Application of the Apex Law at Wardner, Idaho," Fred T. Greene.

Mining Geology and Mineralogy—"Formation and Distribution of Residual Iron Ores," C. L. Dake; "Occurrence of Covellite at Butte, Mont.," A. Perry Thompson; "Formation and Distribution of Bog Iron Ores," C. L. Dake; "Geology of the Burro Mountain Copper District, New Mexico," R. E. Somers; "Additional Data on Origin of Lateritic Iron Ores of Eastern Cuba," C. K. Leith and W. J. Mead; "Method of Making Mineralogical Analysis of Sand," C. W. Tomlinson.

Milling Methods—"Kick vs. Rittinger," Arthur O. Gates; "Concentrator of the Timber Butte Milling Co., Butte, Mont.," Theodore Simons; "Hardinge Mill Data," Arthur F. Taggart.

Copper—"British Columbia Copper Co.'s Smelter, Greenwood, B. C.," Frederic K. Brunton; "Hydro-Metallurgy of Copper," L. D. Ricketts, et al.; "Hydro-Electrolytic Treatment of Copper Ores," Robert Rhea Goodrich; "Roasting and Leaching Concentrator Slimes Tailings," Lawrence Addicks.

Gold and Silver—"Metallurgical Practice in the Witwatersrand District, South Africa," F. L. Bosqui; "Mill and Cyanide Plant of Chiksan Mines, Korea," Charles W. De Witt; "Electric Furnace for Gold Refining at the Alaska-Treadwell Cyanide Plant," W. P. Lass; "Cyaniding Practice of Churchill Milling Co., Wonder, Nev.," E. E. Carpenter; "Notes on Homestake Metallurgy," Allan J. Clark; "Zinc-Dust Precipitation Tests," Nathaniel Herz; "Recovery of Mercury from Amalgamation Tailing, Buffalo Mines, Cobalt," E. B. Thornhill; "Slime Agitation and Solution Replacement Methods, West End Mill, Tonopah, Nev.," Jay A. Carpenter; "Amalgamation Tests," W. J. Sharwood; "A Rule Governing Cupellation Losses," W. J. Sharwood; "Tonopah Plant of the Belmont Milling Co.," A. H. Jones.

Lead—"The Salida Smelter," F. D. Weeks; "Lead Smelting at El Paso," H. F. Easter; "Advantages of High-Lime Slags in the Smelting of Lead Ores," S. E. Bretherton; "Mellen Rod-Casting Machine," R. C. Patterson, Jr.

Miscellaneous—"Conversion Scale for Centigrade and Fahrenheit Temperatures," Hugh P. Tiemann; "Thermal Insulation of High-Temperature Equipment," Percy A. Boeck; "Radiography of Metals," Wheeler P. Davey; "Metallurgical Industries as Possible Consumers of Electric Power," Dorsey A. Lyon and Robert M. Keeney.

Petroleum and Gas—"Gasoline from 'Synthetic' Crude Oil," Walter O. Snelling; "Correlation and Geological Structure of the Alberta Oil Fields," D. B. Dowling; "Oil, Gas, and Water Content of Dakota Sand in Canada and United States," L. G. Huntley; "Sliding Royalties for Oil and Gas Wells," Roswell H. Johnson; "Possible Occurrence of Oil and Gas Fields in Washington," Charles E. Weaver.

Iron and Steel—"Duplex Process of Steel Manufacture at the Maryland Steel Works," F. F. Lines; "The Electric Furnace in the Foundry," William G. Kranz; "Some Suggestions Regarding the Determination of the Properties of Steel," A. N. Mitinsky; "Commercial Production of Sound Homogeneous Steel Ingots and Blooms," E. Gathmann.

One of the sessions of the Institute will be a joint session with the American Electrochemical Society, at which papers of mutual interest will be presented and discussed. The Committee on Arrangements for the San Francisco meeting consists of C. W. Merrill, chairman; E. H. Benjamin, F. W. Bradley, Abbott A. Hanks, H. C. Hoover and W. C. Ralston.

The list of special excursions offered to members, from which they can make their selection, is as follows:

Sept. 18, special boat trip around San Francisco Bay, and visit to Selby Smelting Works. Sept. 18, the San Francisco high-pressure fire system, and the gas and electric works. Sept. 18, Spring Valley water works. Sept. 17 and 18, gold dredging and hydroelectric development. Sept. 18 and 19, the Grass Valley mines and hydroelectric development. Sept. 17 to 19, oil fields of Coalinga. Sept. 19, Spring Valley water works reservoirs and pumping stations. Sept. 19, the delta lands of the Sacramento and San Joaquin rivers.

Greene Cananea and Greene Consolidated

The combined reports of the Greene Cananea Copper Co. and the Greene Consolidated Copper Co., Cananea, Mexico, for 1914 show that the Greene Cananea now owns 959,378 shares of the outstanding issue of 1,000,000 shares of the Greene Consolidated. The mines and works owned and controlled by the Greene Cananea produced 21,858,920 lb. of fine copper, 907,310 oz. of silver and 6055 oz. of gold, including production from purchased ores. Dividends paid by this company aggregated $972,645. The average price received for copper was 13.8382c. per lb. during the year, and the total cost of refined copper, after deducting the value of precious metals and miscellaneous revenues, was 10.724c. per lb. This cost includes depreciation charges and all shutdown and other expenses.

A consolidated statement for the two companies shows total receipts of $3,852,998, made up of copper sales,

$2,794,140; silver sales, $471,792; gold sales, $115,741; miscellaneous revenue, $243,202; inventory of copper in process, $228,123. Charged against this revenue is $3,237,206, made up of operating expenses, $2,845,964; legal and general expenses, $41,990; taxes, $49,433; depreciation for 1914, $160,071; inventory of copper in process at Dec. 31, 1913, $139,748. The net income carried to balance sheet was $615,792. During the year $23,717 was added to fixed assets for new machinery, construction, etc. The following table gives details of tonnages treated and production:

STATEMENT, GREENE CONSOLIDATED COPPER CO.

Tonnage	
Wet tons domestic ore mined	384,690
Wet tons of domestic ore treated	383,380
Wet tons foreign ore treated	28,204
Wet tons custom ore treated	6,996
Wet tons Miami concentrates treated	21,007
Total ore treated	439,587
Wet tons domestic ore milled	147,131
Wet tons foreign ore milled	263
Ratio of concentration, tons of ore milled	3646 : 1
Production	
Returnable fine copper in bullion produced from company mines, in lb.	16,169,067
Returnable fine copper in bullion produced from Miami concentrates and foreign and custom ore, in lb.	20,269,226
Silver in domestic bullion, in oz.	636,113.62
Silver in bullion from Miami and custom ores, in oz.	180,278.38
Gold in domestic bullion, in oz.	3,136.468
Gold in bullion from Miami and custom ores, in oz.	1,132.901

Recovery from domestic ores was: Copper, 2.109%; silver, 1.659 oz.; and gold, 0.0082 oz. per ton.

Of the ore 68,000 tons was mined on contract. The total cost of mining, including this ore, was $3.09 per ton. Development work aggregated 31,859 ft. at a cost of 65c. per ton of ore mined and is included in the mining cost. The total cost of smelting new copper-bearing material to the production of converter bars, f.o.b. at Cananea, was $2.678 per ton. The net cost of refined copper was 10.613c., made up of 13.635c. for gross costs less 0.1816c. for gold and silver values and 1.206 for miscellaneous revenue.

Bolivian Copper Concentration

By F. A. Sundt*

Concentration of copper ores is carried on by the Compania Corocoro de Bolivia in a 200-ton mill by a process which is comparatively simple because of the softness and docility of the ore. The ore in question is brought from the Remedios, Capilla and San Agustin mines by means of tramway and ropeway, and is delivered to an 11x18-in. Blake breaker. In this breaker the ore is reduced to 2- or 3-in. pieces and delivered to chilean mills, where it is crushed to $\frac{1}{16}$ in. There are three of these mills, each having two rollers of granite with steel tires. Each roller is 1.5 m. in diameter, while the tire is 4 in. thick and 18 in. wide. The mills make 12.5 r.p.m. and each grinds 3 tons per hour.

From the chilean mills, which grind the ore in water, the pulp is taken to an elevating wheel 9 m. in diameter. This delivers the pulp, at a higher elevation, to a vibrating screen 2x6 ft., working at 240 strokes per min. The screen material is $\frac{1}{16}$-in. ton-cap copper wire. The oversize from the screen returns to the chilean mills for further grinding, and the undersize is taken to a hydraulic classifier of the Lake Superior type. This classifier has six spigots, which feed the three Harz jigs. The jigs have each three compartments and operate at 260 strokes per min. The screens are perforated copper plates, having apertures of $\frac{1}{8}$ and $\frac{1}{16}$ in. Middlings from the jigs are taken to the chilean mills, where they are reground, while the overflow water is used for grinding fresh ores.

Concentrates from these jigs contain about 50% copper. These are reconcentrated in another Harz jig having 280 strokes per min., the final concentrate product from which contains about 85% copper. Overflow from the hydraulic classifier goes to the table classifier, a V-shaped trough-type machine which has no hydraulic water. There are five Overstrom tables which catch practically all the copper. The overflow from the table classifier goes to waste, as also do the tailings from the tables. Middlings are elevated by a Frenier pump to another Overstrom table, where a final copper product is obtained. The middlings of this table return to the Frenier pump.

Concentrates Exported

Copper in the original ore is principally in the native state and amounts to 4 or 5%. The gangue is sandstone and there is very little clay. The concentrates produced have an average of about 85% copper, while the tailings sent to the river contain only 0.3 to 0.4%, thus making an extraction of more than 90%. The concentrates are called *barrillas,* and are put into sacks containing 50 kg., and then exported. The impurities in the concentrates consist principally of sand, and they contain but little iron and no sulphur, arsenic or other impurities, a fact which is due to the clean character of the ore. When smelted, the concentrates yield a copper which is so pure as not to require electrolytic refining.

To smelt the concentrates at Corocoro or on the coast is not economical because fuel is expensive and the export tax on copper bars is, say, 100%, while for concentrates it is only 70%. Milling is comparatively high because the cost of fuel is high and the steam plant is an old one. The company contemplates the installation of a Diesel motor plant with electrical generators. Labor is cheap, varying from 1.40 to 2 bolivianos per lift. Freight charges from Corocoro to on board the vessel at Arica is 24 bolivianos per ton of concentrates. The freight from Arica to England is now 45s. per ton.

Each of the jigs consists of three compartments, each having an area of 82x45 cm. The screens are of $\frac{1}{8}$-in. copper plate with perforations $\frac{1}{8}$ and $\frac{1}{16}$ in. diameter, and they last about 120 days. The bed of the jig is self-made and is 4 in. deep. Concentrates discharge through the screen, while the middlings go to the chilean mills. The length of stroke on these jigs is 5 to 15 mm., and the number of strokes 260 to 300 per min. The hutch product of the third compartment of the jig is low grade and is returned to the same jig for reworking. Classifying for the tables is done in a classifier 4800 mm. long with six spigots. It is 720 mm. wide at the head and 540 mm. at the end and its height is 1400 mm. The angle of the bottom is 60° and the spigots are 1 in. diameter. Its capacity is 200 tons per day of 24 hr. Water for the mill is supplied by a 4-in. centrifugal pump elevating 4 m. The elevator wheel is 9 m. in diameter, has 48 buckets and revolves at 2 r.p.m., average speed.

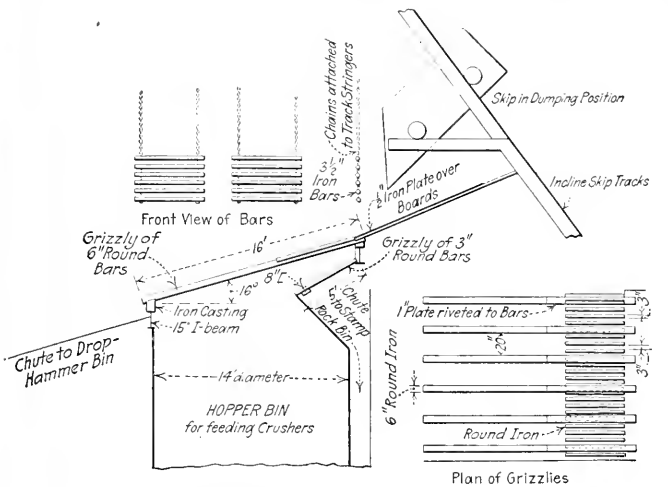
*Manager, Cia. Corocoro de Bolivia, Corocoro, Bolivia.

Details of Practical Mining

Quincy Dump and Grizzlies

By L. Hall Goodwin*

In the Lake Superior copper district it is the custom to break the rock big in the stopes; the sizes sent to the surface range up to the maximum jaw-opening of the crusher, which is generally 24x36 in., or even larger. These large boulders are reduced to about 4-in. maximum size in the rockhouse. The usual practice is to dump the contents of the skip on a heavy iron dumping plate, from which the rock passes over a single set of grizzly screens to remove 4-in. undersize before it is fed to the crusher. The Quincy mine has modified this method in several ways, the principal object being to separate the largest boulders from the rest of the rock. I outlined its practice briefly in a paper describing the rockhouse methods of the company appearing in the *Journal* June 19 and 26 and July 3 and 10, 1915. A more detailed description follows, with a sketch of the dump and grizzlies.



QUINCY DUMP AND GRIZZLIES

The rock from the dumping skip strikes a battery of 3½-in. round iron bars horizontally suspended in front of the dump from chains attached to the track stringers. There are two of these batteries, one for each skip; they serve to deflect the rock downward upon the grizzlies and to spread it evenly over them. Two sets of grizzlies are used. The first one consists of 6-in. round iron bars, 16 ft. long and inclined at 16°, having 20-in. spaces. This allows the larger boulders of copper rock and mass copper to pass over to a bin in front of the drop hammer used to break them before they are fed to the crusher, and the mass copper to be cleaned. The second grizzly set below consists of 3-in. round iron bars, 5 ft. long, inclined at 30°, having 3-in. spaces. The undersize which goes through this grizzly passes directly to the stamp-rock bin; the oversize passes to the hopper bin in front of the crushers. The dump and grizzlies are located high above the crusher floor, as they must be above the hopper bin. They are sided by iron plates 3 ft. high and above this is sheet iron to prevent flying rocks from injuring the men on the crusher floor.

*Assistant with Allen H. Rogers, 201 Devonshire St., Boston, Mass.

The Advantage of Tamping

Exhaustive tests by the Bureau of Mines as to the efficacy of stemming on the effect of explosives have proved conclusively that confinement of the charge in the hole by the use of some inert substance on top increases its efficiency to a marked degree. The Bureau chooses to use the word "stemming" in place of the term "tamping," so commonly used, to differentiate the latter from the name of the operation of placing the stemming. In other words the Bureau favors the adoption of tamping the stemming in the hole. There is always a certain amount of opposition among miners to tamping a hole and some very prominent mining engineers question the advisability of so doing. It is probable, however, that the data on which they formed these conclusions were not carefully and exhaustively drawn.

Tamping a hole has the same effect as putting a wad in a shot-gun shell or inserting the bullet in a rifle cartridge and is easily determined. For instance, take two ordinary rifle cartridges and crowd the bullet $\frac{1}{16}$ in. nearer the base in one than in the other. Then fire the two. The "kick" against the shoulder will readily demonstrate the appreciable difference between the loose and the tight tamping of the powder charge. The same thing happens on a much larger scale when confining the explosive in a drill hole, and the kick of the explosive against the rock to be broken is much increased by close tamping in the throat of the hole.

Safety First in Reloading a Hole

It is not uncommon practice among miners who return soon after a blast to the heading to see the result of their round, and who find a hole which has not broken properly, to reload immediately and shoot it over. This is dangerous practice unless the hole is filled with water and thoroughly cooled, or unless a sufficient time is allowed

to elapse in order to effect the same cooling by air. Instances have been known where a miner loading a hole with gelatin without observing these precautions was blown to atoms through the ignition of the explosive by the heat remaining in the rock.

Mine Messhouse Operation

The mine messhouse is a troublesome adjunct to a mining operation. It is rarely given the attention it deserves, and except for providing good food it is left to take care of itself. Accurate data and details of messhouse operation are therefore of value.

The Arrowrock dam was constructed in Idaho by the United States Reclamation Service under conditions sufficiently resembling mining operations to make the figures for messhouse operations, published in *Engineering News*, June 24, worth while for the mining engineer.

A sufficient charge is made against messhouse operations each month for rental to absorb the cost of messhouse building during the time of construction. A monthly charge is also made to cover depreciation of equipment.

It is very necessary that a careful record of cost be kept and reports prepared each month to show the results accomplished. The principal items of cost should be classified, so that they may be compared from month to month. The following cost-accounts have been used in connection with the messhouse operations at Arrowrock: Labor, cooks and helpers; labor, miscellaneous; subsistence; supplies; utensils; rental; fuel; lights; depreciation of equipment; general and overhead expense.

After the mess has been operated for a sufficient length of time certain standards of cost will be established, and effort can then be made by watching the cost reports to maintain these standards.

From data kept under this classification it is possible to prepare at the end of the month cost reports in the following form:

FIELD REPORT OF MESSHOUSE OPERATIONS AT MAIN MESS, ARROWROCK, SEPTEMBER, 1914

Debits		Account Nos. 730 to 739	Credits	
Inventory			Collections:	
Subsistence	$533 46		Cash	$135 40
Supplies	26 22		Coupons	96.00
Utensils	1500 00	$2,059 68	Meal tickets	$231 40
Received during month:			Deducted on timebooks:	
Subsistence	8134 89		Arrowrock	10,479 25
Supplies	344 71		B. & A. Ry.	598 50 11,077 75
Utensils	35 52	8,515 12		
Labor:				
Cooks and helpers	1559 10		Deductions on disability claims	12 75 12 75
Miscellaneous	21 50	1,580 60		
Miscellaneous expenses:			Miscellaneous credits	
Rental	169 00		Meals served to hospital patients	173 80 173 80
Fuel	247 50			
Lights	15 00			
Depreciation on equipment	50 00	472 50		
			Inventory:	
			Subsistence	788 49
			Supplies	26 15
			Utensils	1,350 00 2,164 64
Profit		1,032 44	Total	13,660 34
Total		13,660 34		
Total cost for month		$10,463 26	Total number men, days	16,249
Total number of meals furnished		48,718	Unit cost per man, day	$) 644
Unit cost per meal		$) 215	Labor cost per man, day	097
Pounds of meat used		21,171	Supplies cost per man, day	021
Pounds meat used per man, day		1 3	Misc. exp. cost per man, day	041
			Gen. exp. cost per man, day	060
			Subsistence cost per man, day	.485

This is on a scale much larger than that appertaining to the usual mine boarding house, so that the cost per man per day of 48.5c. is much lower than the average cost at a mine where the usual charge is $1 per man per day and where the manager is reasonably satisfied if his boarding house breaks even at the end of a year.

Another innovation at a messhouse of this kind was in the use of small tables and serving food in family style—that is, all food is on the table at the time the meal is called. At Arrowrock small tables accommodating eight persons are provided, as this number may be served from one set of dish-ups. With this method one waiter can attend to five tables of eight persons each in an efficient manner. These small tables have been found to be a decided improvement over the long tables commonly used in construction camps.

Sinking Shoe for Soft Ground*

The sinking shoe shown in Fig. 1 was recently used in sinking a shaft in soft ground on the Mesabi Range. In operation, the dirt along the shoe was removed from the inside and the shoe jacked down until sufficient room had been gained for a set of timbers. While this shoe set was a success, it was evident that its design could be improved. As the shoe set was made of the same size as the shaft set, the ground excavated did not give the space required for the lagging. The open space between the shoe set and the last shaft set was unsupported, and to hold the ground it was necessary to drive short spiling. The corner construction was weak, and the wall plates of the set tended to turn over under the pressure from the jacks.

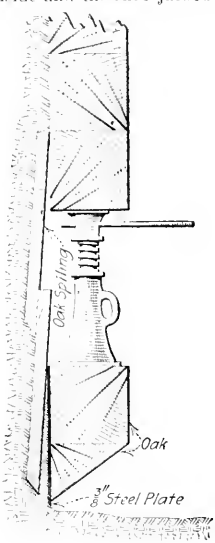


FIG. 1. SECTION THROUGH OLD SHOE

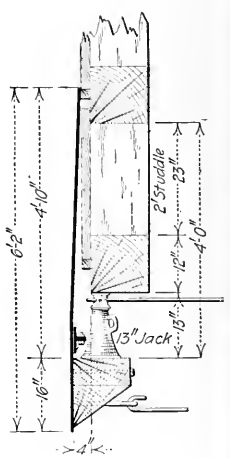


FIG. 2. SECTION THROUGH NEW SHOE

To remedy these defects, an improved sinking shoe was designed, as shown in Figs. 2 and 3. The method of operation is the same, but the set is much heavier; the corner construction has been strengthened; tight rods at

*"The Wisconsin Engineer," April, 1915.

the end correct the tendency to overturn under the jack pressure, and the shoe is 4 in. larger all around than the regulation set, which gives plenty of room for putting in the lagging or lath. Attached to the cutting plate are

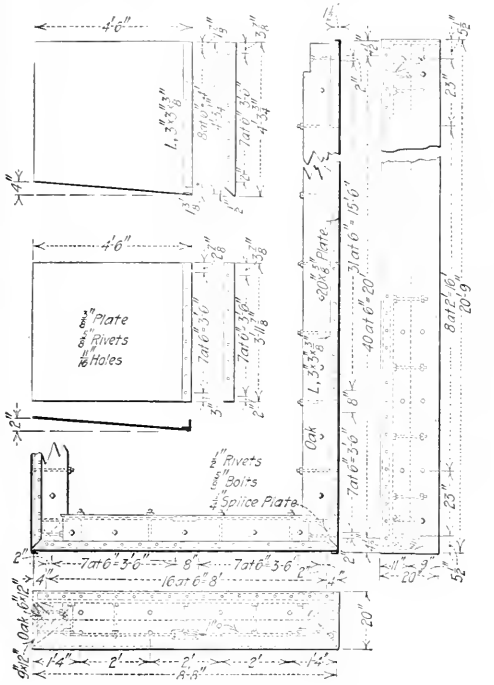


FIG. 3. DETAILS OF NEW STEEL SINKING SHOE

side plates of ⅜-in. steel, long enough to permit installing a full set of timbers with 2-ft. studdles.

This shoe gave perfect satisfaction under the conditions for which it was designed.

Jackhamer Drifting

At the Colby iron mine, Bessemer, Mich., drifting is done by use of Jackhamer auger machines, using two men for one machine. These two men do only the drilling and are followed by a blasting gang and a tramming gang for each drift of the six different headings where this system is used. The size of the drift outside of timber is 8x9 ft. During the period in question 2547 ft. of drifting was accomplished in 112 shifts, which is equivalent to 11.3 ft. per man per shift. The costs per foot are as follows:

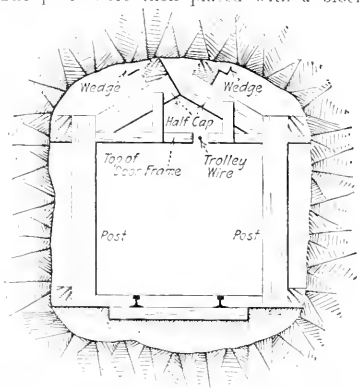
LABOR		
Miners	$0.412	
Trammers	.990	
Timbermen	.360	
Trackmen	.121	
Blasters	.116	
		$1.999
SUPPLIES		
Lagging	$0.094	
Timber	.210	
Explosives	.330	
Light, steel, shop labor, etc.	.060	
		.694
Total		$2.693

The foregoing figures include cost of breaking the ore, tramming it to the chute, timbering the drift, laying track and necessary supplies for the same except the cost of rails.

Timbering for Air-Check Doors in a Motor-Haulage Drift

By Frank S. Crawford*

In the Calumet & Arizona Mining Co.'s mines there are places where the natural air current is so strong that it was decided to place air-check doors to direct the air current into some of the hot, badly ventilated stopes. One of these doors was placed in a motor drift. The frame of the door had to be made so as to allow free passage for the trolley and the trolley wire. To accomplish this the top of the frame was made in two pieces. The posts had to be blocked out securely against the ground, and as it was not desirable to put in an extra cap above, with the necessity of longer posts and the taking down of more ground, the problem was solved by taking two pieces of square timber cut with a bevel on the ends to fit against the tops of the posts and form an arch. The bevel on the ends joining each other was such as to leave a small opening, a couple of inches, on the upper side. The posts were then placed with a block behind



TIMBER SET PLACED FOR AIR-CHECK DOOR

each to hold them in place out from the ground. The two pieces were then set in place and wedges and blocking driven in above to force them down from the roof, causing the gap to close between the ends and forcing the posts tightly against the ground.

These spreaders served to support the top of the door frame rigidly and allowed space for the trolley wire to play up and down.

A "consin-jack" miner ran it and said, "Blawst me, it looks like a bloomin' 'ouse."

Mine Accidents in Arizona

During the year ended Dec. 1, 1914, there were, according to the 1914 annual report of the State Mine Inspector, 62 fatal accidents at the Arizona mines, which is at the rate of 6.6 fatal accidents per 1000 men employed. There were 758 serious and minor accidents, which is at the rate of 80.6 per 1000 men employed.

*Lowell Station, Bisbee, Ariz.

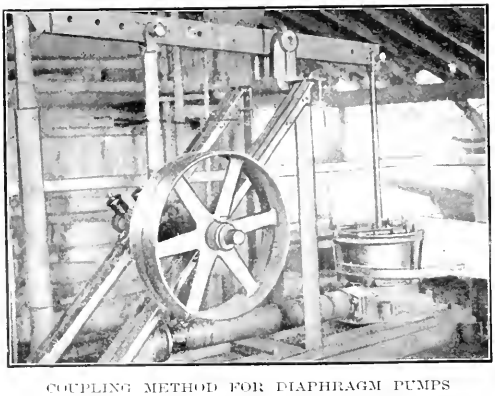
Details of Milling and Smelting

Diaphragm Pumps for Slimes

By Jesse Simmons*

With the adoption of Dorr thickeners and the counter-current system of continuous decantation, mill superintendents were forced to accomplish the economical handling of slimes. At first air lifts were almost universally used. Some installations of centrifugal pumps were made, but most operators now install diaphragm pumps. The chief objection to these pumps seems to be that the manufacturers have not studied the application of their goods to the uses to which they are now put and invariably send out a pump with the drive and gearing close-coupled. Spattering slimes cause excessive wear on the gears and pinions, necessitating large repair bills and entailing a consequent loss of service.

Of many means of overcoming this difficulty, the illustration, which shows the type of drive developed at



COUPLING METHOD FOR DIAPHRAGM PUMPS

the Golden Reward mill, at Deadwood, S. D., is one of the most noteworthy. The frame is made of light angle-iron and I-beams, with a jackshaft at one end about 5 ft. from the pump and far enough away to escape the spatterings of slimes. This shaft is belt-driven. Attached to it is an eccentric which drives a walking-beam that operates the pump. The whole mechanism rests on a bed composed of a rectangular frame of 1x6-in. timbers.

*Mining engineer, Deadwood, S. D.

Potassium Permanganate as a Cyanicide

In some recent tests made on the action of potassium permanganate as a cyanicide (abstracted by the *Journal* of the Society of Chemical Industry from the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa) normal solution from a sand-filling plant, containing 0.0013% of potassium cyanide and 0.0015% of potassium sulphocyanide, was treated, as were also solutions of sodium cyanide (strength equivalent to 0.2% of potassium cyanide), sodium thiocyanate of the same strength, and sodium-zinc cyanide of the same strength. The first three solutions were considerably affected by the permanganate, but the reaction was still incomplete after four days. Sodium-zinc cyanide, which is present in large proportions in working solution, appeared to be only slightly, if at all, affected by the permanganate after four days' contact.

Vogt Process of Recovering Rare Elements

A new process which relates to the recovery of rare elements, particularly radium, uranium and vanadium, from ores such as carnotite ore, is that invented by Louis F. Vogt (U. S. pat. 1,129,029). In following out this process the ore is first concentrated according to any approved manner, or if of a suitable character it may be merely ground. The ground ore is then roasted in the presence of salt and steam, the latter being employed for oxidizing purposes. It is then leached with water to remove the greater part of the vanadium content. A small amount of sodium carbonate is added to the water to convert any possible radium or barium chloride to the carbonate form and prevent the formation of radium or barium in soluble form in the sodium-vanadate solution.

The remaining ore from this leaching treatment is then leached with some acid, principally sulphuric, to recover the uranium and such vanadium as may remain. If other than sulphuric acid is used, sufficient sulphuric acid must be added to form an insoluble radium sulphate, and thus prevent the radium content of the ore from going into the solution. At this stage the remaining solids contain insoluble radium and barium salts and the liquor contains uranium and vanadium salts and impurities in solution.

The liquor is neutralized with sufficient sodium carbonate to precipitate such impurities as iron, alumina, silica, etc., together with most of the uranium and vanadium. If the solution contains impurities in sufficiently large quantity, all of the uranium and vanadium content will be precipitated.

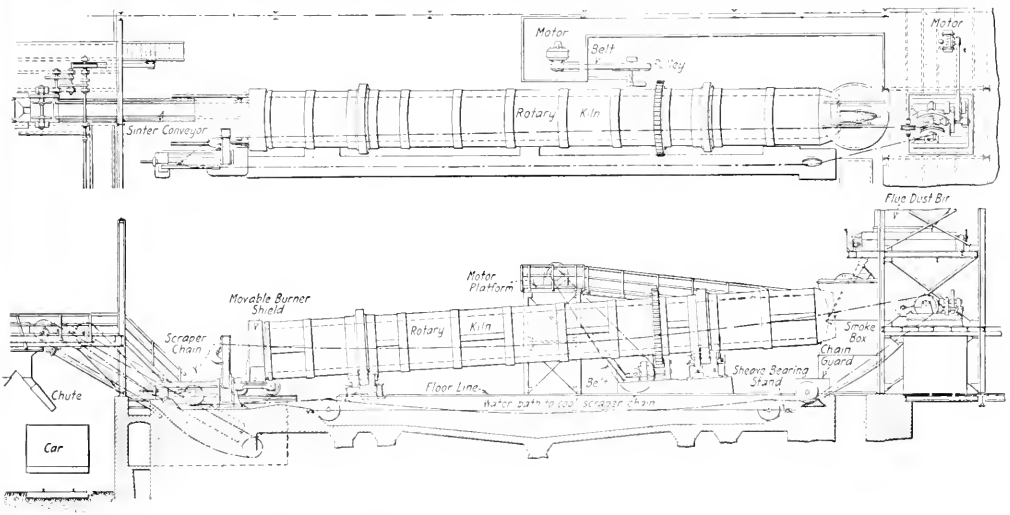
To the solution and precipitate resulting from the neutralizing step an excess of sodium carbonate is added and the mixture boiled, to leach out the uranium and vanadium contained in precipitate, leaving only the impurities. The solution is separated by filtering and is treated to recover the uranium and vanadium. Boiling with a lead salt forms lead vanadate, and the remaining solution is boiled with sufficient sodium hydrate to completely precipitate uranium as sodium uranate.

The solid ore residue is then washed, filtered, dried, mixed with sodium carbonate and fused. The resulting matte, containing carbonate of radium, barium, iron, lime, etc., is treated with water and agitated, taking out the soluble carbonates and leaving the insoluble ones. After filtering, the insoluble carbonates are washed with

water to remove any remaining sodium silicate and free alkali. The carbonate mixture is then treated with a mineral acid, preferably hydrochloric, to dissolve the carbonates, and then by adding sulphuric acid, radium and barium sulphates are precipitated. The dried sulphates of radium and barium are thoroughly mixed with fine coke and a suitable chloride and roasted. The roasted mixture is leached to dissolve the chloride, leaving radium and barium chloride in the solution. Uranium is separated from the barium and impurities by systematic fractional crystallization.

New Sintering Plant at Gary

The new plant for sintering flue dust at Gary, Ind., has a capacity to treat the dust from 12 iron blast furnaces. At present, however, there are only eight stacks at Gary. The sintering plant now comprises two rotary inclined kilns, 90 ft. long by 9 ft. in diameter, a 12-in. brick lining



PLAN AND SECTIONAL ELEVATION OF GARY SINTERING PLANT

reducing the effective inside diameter of the kiln to 7 ft. The accompanying drawing, reproduced from *Iron Age* of May 27, 1915, shows one of the sintering kilns in plan and cross-section. The steel shell is made of $\frac{11}{16}$-in. plate with butt seams, quadruple-riveted. Each kiln is fitted with two annular bearing rings and mounted on idler rollers. The kiln is rotated at about 1 r.p.m. by means of an annular gear near the upper bearing ring, power being supplied from a 60-hp. motor placed on an overhead platform. The motor runs at 715 r.p.m., but this speed is reduced by means of a belt-drive and bevel gears which drive the pinion that engages the annular gear on the kiln.

At the lower end of the kiln is a movable burner shield, mounted on trucks so that it may be drawn back from the mouth of the kiln when not in service. The kiln will be gas-fired, gas being obtained from the nearby coke ovens of the Gary plant.

An interesting feature of the kilns is the drag-scraper chain which passes through the kiln from end to end, returning below the kiln through a bosh, for cooling. The chain has an approximate speed of 70 ft. per min., and is expected to loosen material which may stick or hang in the kiln, keep it moving toward the discharge end and thus prevent the formation of accretions within the kiln.

The flue-dust is frequently handled, owing evidently to the necessity for storage. It is brought to the plant in hopper-bottom cars, and deposited into steel-and-concrete track hoppers. From these hoppers the dust is fed by screw conveyors to a bucket elevator, which carries it up to the overhead hopper at the end of the kiln house. The dust then passes by gravity to a revolving screen having 1-in. mesh and into either of two 230-ton cylindrical bins. From these steel storage bins, another motor-driven screw conveyor feeds the dust directly into the kiln, the speed of the conveyor being under close control.

The flue dust works its way down through the kiln toward the firing end and encounters the zone of greatest heat a short distance in front of the discharge end. The sinter drops through a floor-grating on an inclined conveyor, which elevates it into hoppers immediately above the loading track. Each hopper has two delivery spouts so that the sinter may be discharged into cars on two tracks. Sprays are provided for cooling the sinter as it drops into the cars.

Making Arsenic Compounds

A process for making arsenic acid has been patented by George P. Fuller, of Niagara Falls, assigned to the National Electrolytic Co. This consists of subjecting a suspension of arsenious oxide in an aqueous solution of an alkali-metal halide to electrolysis. The anode must be insoluble and therefore platinum is usually employed. The cathode is best made of copper, although cathodes of other metals may be employed. Since the ordinary form in which arsenic is employed in the arts is as sodium arsenate, it is best to make the alkaline halide a sodium-chloride solution; otherwise the final removal of the arsenic salt will be impracticable, owing to the difficulty of separating sodium from any other base.

The Cost of Doing Things

Drilling Costs in Potash Prospecting

By E. E. Free*

During the summers of 1912, 1913 and 1914 the Railroad Valley Co. of Tonopah, Nev., carried out an extensive prospecting campaign for potash deposits in various parts of the Great Basin and especially in Railroad Valley, Nye County, Nevada. In that vicinity the existence of a buried saline body was suspected, and the prospecting took the form of drill holes designed to reach and explore the supposed saline horizon. Five of these holes were located on the mud flat or *playa* left by the ancient lake which once occupied the valley, and these five holes were sufficiently alike in materials penetrated and in general conditions to be possible of discussion together. Although the general conditions surrounding the work were somewhat unusual, it is possible that the cost data of the accompanying table may have some general interest. The prospecting proved negative, so far as potash is concerned, and has been discontinued.

The work here reported was done between June 20 and Nov. 10, 1913, but during this period there were two shutdowns aggregating 45 days, leaving a total of 99 days' actual work. Field operations were in charge of D. H. Walker, superintendent of the Railroad Valley Co.

Railroad Valley is southeast of the center of Nevada in a sparsely settled desert country without towns, railroads or other facilities. All supplies for the work were hauled by wagon or auto truck from Tonopah, 120 miles west, or from Ely, 75 miles northeast. Drilling was by the rotary jetting method, using an American Well Works rotary attached to a steam-driven Keystone portable rig No. 5. Water circulation was maintained by two American Well Works steam pumps supplied by a separate boiler. The entire outfit was already in the possession of the company and cost approximately $7000, including drill rod, all tools and general equipment, also camp equipment consisting of four tents, boarding house, office, wagons, water tank, etc. No depreciation or interest on this equipment has been included in the costs given. The holes were 5½ in. in diameter and were not cased except for 20 to 50 ft. at the top.

The materials penetrated were essentially the same in all five holes. The upper portions were in smooth clays with little or no sand. The hardness was somewhat variable and a few cemented layers were encountered, but never of such induration as to create serious obstacles to drilling. In their lower portions holes No. 2 and No. 6 encountered beds of solid, crystalline gaylussite[1] alternating with beds of clay. The crystalline material was fairly hard and drilled like soft sandstone or shale. Similar beds were encountered but not entered by hole No. 4. The thicknesses of the beds penetrated by the individual holes are given in the table.

COST DATA OF PROSPECT DRILLING

Hole number.	2	3	4	5	6	Total	Average
Feet in clay.	780	770	762	795	906	4013	803
Feet in gaylussite.	63	none	none	none	84	147	...
Total depth, feet.	843	770	762	795	990	4160	820
Days moving and setting up.	18	13	9	10	13	63	12.6
Days drilling.	6	10	5	5	10	36	7.2
Total time, days.	24	23	14	15	23	99	19.8
Moving costs							
Labor.	$440.60	$340 20	$239 70	$150 75	$292 85	$1464 10	$292.82
Team	633.40	103 90	106 60	16 00	76 92	936 22	187.24
Total.	$1174.00	$444 10	$345 70	$166 75	$369.77	$2400 32	$480.06
Water supply costs							
Labor.	$521 15	$561 02	$284 90	$133 90	$124 45	$1625 42	$325.08
Team	19 50					19.50	3.90
Total.	$540 65	$561 02	$284.90	$133.90	$124 45	$1644 92	$328.98
Drilling costs							
Labor.	$604 10	$747 30	$243 00	$340.70	$540.55	$2475 65	$495.13
Fuel.	537 25	246 25	264 50	214 35	431.75	1694.10	338.82
Casing.	20 70	24 84	27.60	27.60	26.22	126.96	25.39
Total	$1162 05	$1018 39	$535.10	$582.65	$998.52	$4296.71	$859.34
General expense							
Supplies and repairs.	$146 81	$140 70	$85 65	$91 76	$140.70	$605.62	$121.12
Camp maintenance.	163 25	156 45	95 23	102 04	156 45	673.42	134.68
Boarding-house deficit.	95 07	91 11	55 45	59 42	91.11	392 16	78.43
Communications	325 84	312 24	190 06	203 64	312 24	1344.02	268 80
Superintendence.	312 00	299 00	182 00	195 00	299 00	1287 00	257.40
Chemical work.	315 40	300 33	182 81	195 88	300 33	1292 75	258.55
Liability insurance	21.33	20 45	12 44	13 33	20.45	88.00	17.60
Total	$1377.70	$1520 28	$803 64	$861 07	$1320.28	$5682.97	$1136.59
Total costs	$4254 40	$3343 79	$1969 34	$1744 37	$2713.02	$14,024.92	$2864.98
Cost per foot, total	$5 047	$4 343	$2 584	$2 194	$2 740		$3 371
Cost per foot, drilling only.	1.378	1.323	702	.733	1.009		1.033

*Chemical engineer, 1105 Madison Ave., Baltimore, Md.

[1]The mineral gaylussite is the hydrous double carbonate of sodium and calcium ($Na_2CO_3 CaCO_3 5H_2O$). It is a member of the saline series for which search was being made. For details concerning the occurrence see Free, "Min. and Sci. Press," Aug. 2, 1913.

culty. No water was available at or near the drill sites and preliminary 100-ft. holes had proven dry. When a preliminary 250-ft. hole (sunk with hauled water) at the site of hole No. 2 also proved dry, it was decided to bring water by ditch from an artesian well seven miles north. Water supplied by this ditch was used for all subsequent holes. In the table the item of water-supply for hole No. 2 includes the cost of the main ditch and of all preliminary work. For the other holes only the cost of ditch maintenance and of necessary extensions is included. The cost for hole No. 3 is high because the extension of the ditch to it had to be carried through a sand ridge nearly a half-mile wide and several feet high.

The item of drilling includes the actual cost of drilling only. The usual crew was: One driller, one helper, one fireman and one sampler. Occasionally two helpers were needed. Usually there were two drilling shifts of ten hours each, the firemen working three 8-hr. shifts and looking to the pumps during the 4-hr. shutdown. For a part of hole No. 2 three 8-hr. drilling shifts were used. In addition, one or two men were employed on repairs and general mechanical work and one to three teamsters were hauling drinking water and supplies and keeping the ditch in order. The wage scale was $6.50 to $5 for drillers and $5 and $4.50 for helpers, fireman and teamsters, all on the basis of an 8-hr. day with pay for overtime at the same rate. Lodging in tents was furnished free. The boarding house was run by the company and a charge of $1 per day was made for board. The deficit on the boarding house appears under general expense in the table. Teams were hired at $7 per day for team and driver and $5 per day for extra teams, not found. Fuel was wood, no other being available at reasonable cost. It consisted largely of scrub pine and juniper, and was cut and delivered by contract at from $10.50 to $12 per cord.

General expense includes all items which extended over the whole work and cannot be assigned with accuracy to the different holes. These items have been totaled and the total divided between the holes on the basis of the working time for each hole. The item for communications includes the maintenance of the company's automobiles and the hire of other automobiles when necessary. The employer's liability insurance is that required by the law of Nevada. The item for chemical work covers the cost of an accurate chemical control of the drilling, this being necessitated by the object of the work. It includes the salary of a chemist at $7 per day and the expense of the field laboratory. The laboratory equipment was borrowed from the general laboratory of the company and is not charged for. It would have cost about $300 to duplicate it.

*

Smelting Costs at Greenwood, B. C.

In connection with a description of the smelting plant of the British Columbia Copper Co., at Greenwood, B. C., Frederic K. Brunton, who was assistant superintendent prior to the shutdown in 1914, gives[1] some operating costs at this plant which smelted the lowest-grade copper ore of all American works. The plant comprises three blast furnaces—two 51x360 in. at the tuyeres and the other 51x240 in.—and two converting stands using 84x126-in. acid-lined shells. The furnaces smelted daily about 2250 tons (6.62 tons per sq.ft. of hearth area) of ore carrying 0.85% Cu; the coke used varies between 12 and 14% of the charge.

In a month when three furnaces were running and the average smelted daily in the plant was 2224.2 tons, the following operating costs were attained—these do not include overhead, depreciation nor insurance:

COSTS PER TON OF ORE SMELTED TO MATTE*

Coke	$0.851
Flux	.114
Labor	.15
Power	.033
Supplies	.03
	$1.178

Cost of coke per ton f.o.b. works bins	$6.00
Cost of flux per ton f.o.b. works bins	2.75
Cost of power per kilowatt-hour	.0065

*The furnaces were slowed up with an excess of silica on the charge because of shortage of ore, smelting only 6.55 tons per sq.ft. of hearth area as against 6.66 tons per sq.ft. when the cost of smelting was $1.084.

The working costs for turning a ton of ore into blister copper during this month amounted to $1.23. There was an average of 125 men employed and the tons handled per man-day amounted to 17.8. The cost and distribution of labor throughout the plant are shown below. The payroll amounted to $12,496 for the month in question.

LABOR COSTS AT GREENWOOD PLANT

	Labor Cost per Ton of Ore Handled
Sample mill	$ 0.00462
Bins	.01060
Briquette mill*	.00546
Furnaces	.0958
Slag disposal	.0206
Converters	.0147
Linings	.0078
Crane	.00403
Water system	.00326
General surface	.00624
Power house	.00850
Total	$0.18161

*The briquette mill made 398 tons of briquettes at a labor cost of $0.945 per ton.

Converting at this plant cost $9.60 per ton of copper produced, or $0.0048 per lb. The converters were run on two shifts only.

*

Smeltery Brick-Laying Costs

The following interesting figures on the cost of laying brick were obtained from a large amount of construction work at a Salt Lake Valley smeltery:

Buildings. Based on bag-house construction:

Cost of brick per 1000	$5.75
Cost of lime per 1000 brick @ 18c. per bu	0.335
Cost of sand per 1000 brick @ 65c. per yd	0.193
Wages of masons per 1000 brick @ $5 per day	3.205
Wages of helpers per 1000 brick @ $1.75 and $2.25	1.530
Total cost per 1000 brick	$11.013

Average brick laid per 8-hr. day per mason, 1560.2
Average number of helpers per mason, 1.285

Foundations. Based on H. & H. pot foundations:

Cost of brick per 1000	$5.75
Cost of cement per 1000 brick @ $1.64c. per sack	6.625
Cost of sand per 1000 brick @ 65c. per yd	0.495
Wages of masons per 1000 brick @ $5 per day	5.164
Wages of helpers per 1000 brick @ $1.75 and $2.25	3.184
Total cost per 1000 brick	$21.218

Average brick laid per 8-hr. day per mason, 968.3
Average number helpers per mason, 1.877

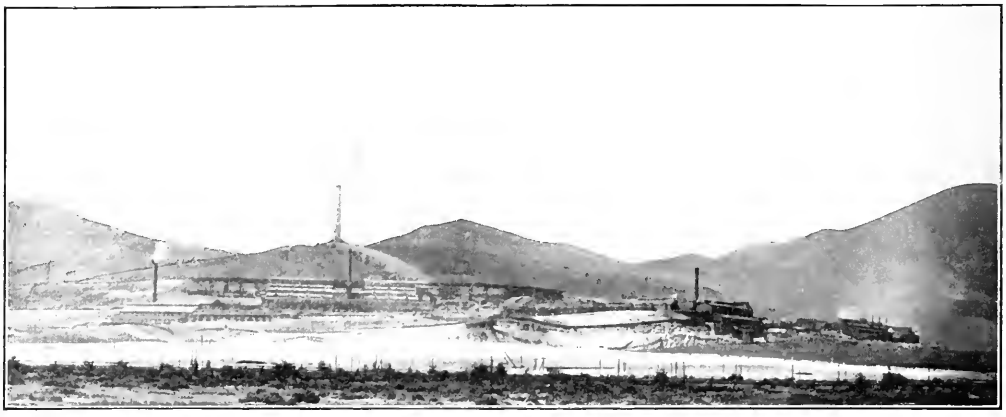
Flue Construction, over forms. Based on section of Fogh catenary flue 21-ft. base:

Cost of brick per 1000	$5.75
Cost of lime per 1000 brick @ 18c. per bu	0.35
Cost of sand per 1000 brick @ 65c. per yd	0.21
Wages of masons per 1000 @ $5 per day	7.353
Wages of helpers per 1000 @ $1.75 and $2.25	6.327
Total cost per 1000 brick	$19.99

The above includes bricklaying, tending and materials only. It does not cover freight, unloading, forms, etc.

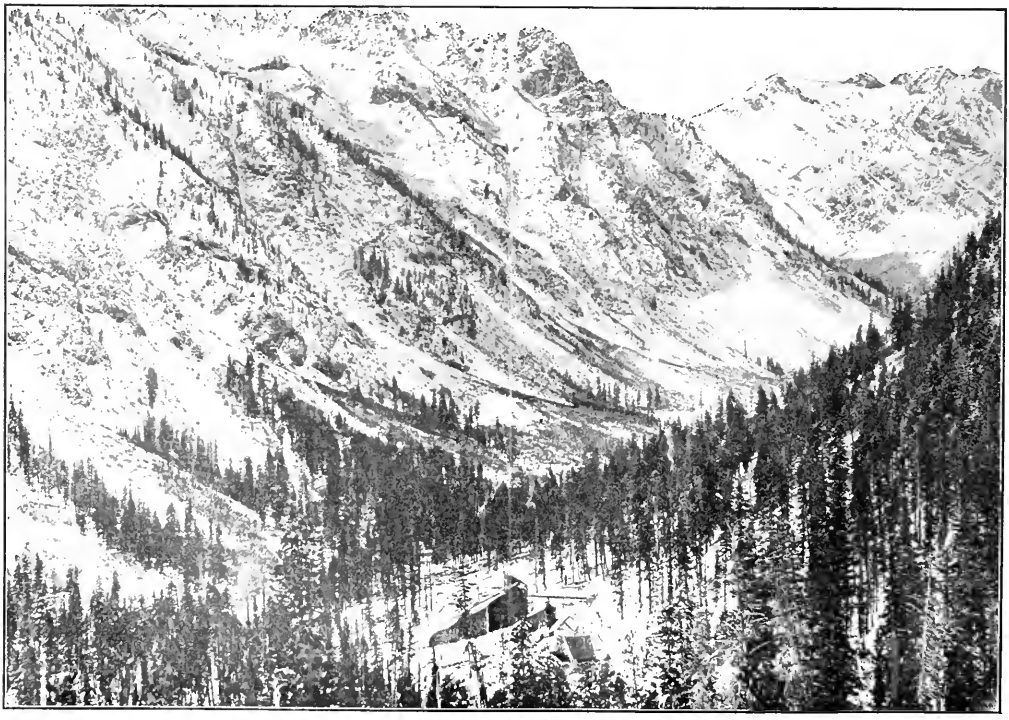
[1]"The British Columbia Copper Co.'s Smelter, Greenwood, B. C.," a paper to be presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

Photographs from the Field

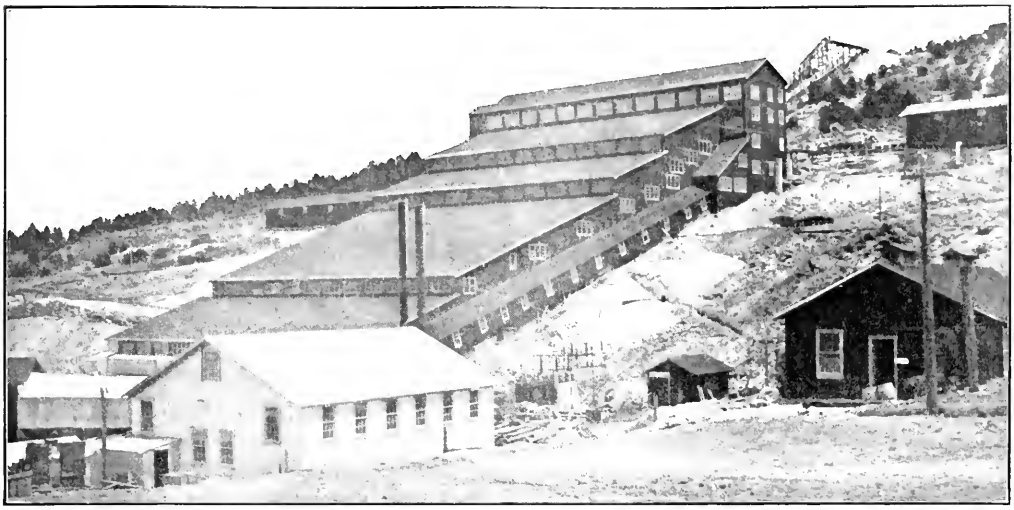


WASHOE REDUCTION WORKS OF ANACONDA COPPER MINING CO., ANACONDA, MONT.

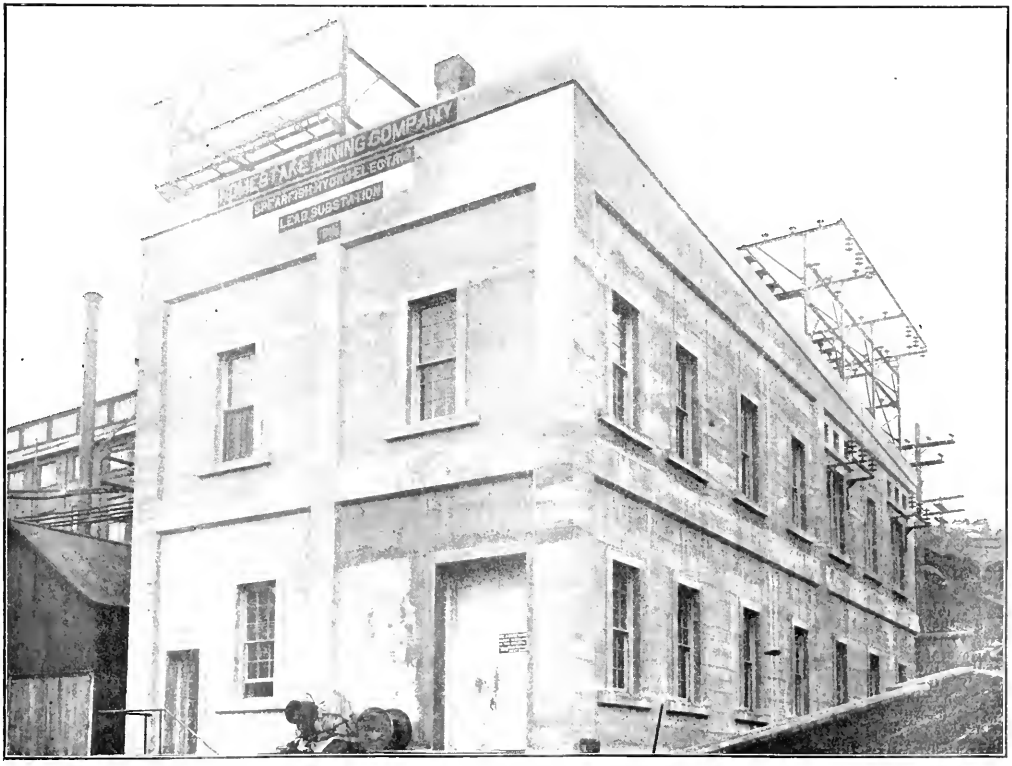
This great works now exemplifies nearly every form of copper-ore reduction, having blast furnaces, reverberatories, converters, jig and table concentration, flotation and leaching



GENERAL VIEW OF BAKER MINES CO.'S TWENTY-STAMP MILL AND CYANIDE PLANT NEAR CORNUCOPIA, ORE.



THE FORTY-STAMP MILL OF THE AURORA CONSOLIDATED MINING CO. AT AURORA, NEV.
A new interest of the Goldfield Consolidated. The mill was built to treat 500 tons daily, and a good many changes were made in it when the ownership changed



LEAD SUBSTATION OF THE HOMESTAKE MINING CO.'S SPEARFISH HYDRO-ELECTRIC DEVELOPMENT

NEW PUBLICATIONS

PURCHASING. By C. S. Rindsfoos. 6x9, pp. 165; $2. McGraw-Hill Book Co., New York.

DIRECT-ACTING STEAM PUMPS. By Frank E. Nickel. 6x9, pp. 258, illus.; $3. McGraw-Hill Book Co., New York.

BULLETIN NO. 59, MISCELLANEOUS REPORTS. Pp. 252, illus. Geological Survey of Western Australia, Perth, W. A.

INDUSTRIAL ACCIDENT STATISTICS. By Frederick L. Hoffman. Pp. 210. U. S. Bureau of Labor Statistics, Washington, D. C.

COAL FIELDS AND COAL RESOURCES OF CANADA. By D. B. Dowling. Pp. 174, illus. Memoir 59, Geological Survey, Canada Dept. of Mines, Ottawa.

ENGINEERING ECONOMICS. First Principles. By John Charles Lounsbury Fish. 6x9, pp. 217, illus.; $2. McGraw-Hill Book Co., New York.

PRACTICAL OIL GEOLOGY. The Application of Geology to Oil-Field Problems. By Dorsey Hager. 5x7¼, pp. 149, illus.; $2. McGraw-Hill Book Co., New York.

THE GEOLOGY OF THE COUNTRY BETWEEN KALGOORLIE AND COOLGARDIE. By C. S. Honman. Pp. 80, illus. Bull. 56, Geological Survey of Western Australia, Perth, W. A.

A GEOLOGICAL RECONNAISSANCE OF A PORTION OF THE MURCHISON GOLDFIELD. By H. P. Woodward. Pp. 103, illus. Bull. 57, Geological Survey of Western Australia, Perth, W. A.

LES MINERAIS DE FER DE LA PROVINCE DE QUEBEC. Gisements et Utilisation. By P. E. Dulieux. 7x9¾, pp. 243, illus. Ministère de la Colonisation, des Mines et des Pecheries, Quebec.

THE SUPPOSED OIL-BEARING AREAS OF SOUTH AUSTRALIA. Investigations by Arthur Wade. 6¼x9½, pp. 54, illus.; paper. Bull. No. 4, Geological Survey of South Australia, Adelaide.

AN INTRODUCTION TO MINING SCIENCE. A Theoretical and Practical Textbook for Mining Students. By John B. Coppock and G. A. Lodge. 4½x6¾, pp. 230, illus. Longmans, Green & Co., New York.

MINERAL RESOURCES OF TENNESSEE, 1914. Twenty-Fourth Annual Report of the Mining Department. By George E. Sylvester. 5¾x8½, pp. 147. Mining Department of Tennessee, Nashville.

THE MINERAL PRODUCTION OF PENNSYLVANIA, 1911. 6x9, pp. 84. Report No. 8 E, Topographic and Geologic Survey Commission of Pennsylvania; Richard R. Hice, State Geologist, Beaver, Penn.

AN OUTLINE OF THE PHYSIOGRAPHICAL GEOLOGY (PHYSIOGRAPHY) OF WESTERN AUSTRALIA. By J. T. Jutson. Pp. 229, illus. Bull. 61, Geological Survey of Western Australia, Perth, W. A.

PRELIMINARY REPORT ON THE CLAY AND SHALE DEPOSITS OF THE PROVINCE OF QUEBEC. By J. Keele. Pp. 280, illus. Memoir 64, Canada Department of Mines, Geological Survey Branch, Ottawa.

SURFACE WATER SUPPLY OF THE YUKON-TANANA REGION, ALASKA, 1907 to 1912. C. E. Ellsworth and R. W. Davenport. Pp. 343, illus. Water-Supply Paper 342, U. S. Geological Survey, Washington.

GEOLOGY AND ORE DEPOSITS OF COPPER MOUNTAIN AND KASAAN PENINSULA, ALASKA. By Charles Will Wright. 9¼x11⅜, pp. 110, illus. Professional Paper 87, U. S. Geological Survey, Washington.

COAL FIELDS OF MANITOBA, SASKATCHEWAN, ALBERTA AND EASTERN BRITISH COLUMBIA. Revised Edition. By D. B. Dowling. Pp. 142, illus. Memoir 53, Geological Survey, Canada Dept. of Mines, Ottawa.

CONTRIBUTIONS TO ECONOMIC GEOLOGY. Short Papers and Preliminary Reports, 1913. Part II—Mineral Fuels. By Marius R. Campbell and David White. Pp. 187, illus. Bull. 581, U. S. Geological Survey, Washington, D. C.

THE NATIONAL DOMAIN IN CANADA AND ITS PROPER CONSERVATION. Presidential Address before the Royal Society of Canada, 1914. By Frank D. Adams. 6¾x9½, pp. 48, illus. Commission of Conservation, Ottawa, Canada.

THE A B C OF IRON AND STEEL. With a Directory of the Iron and Steel Works and Their Products of the United States and Canada. Edited by A. O. Bracket. 7½x10¾, pp. 338, illus.; $5. The Penton Publishing Co., Cleveland, Ohio.

ECONOMICS OF CONTRACTING. A Treatise for Contractors, Engineers, Manufacturers, Superintendents and Foremen Engaged in Engineering Contracting Work. Vol. II. By Daniel J. Hauer. 5¼x8½, pp. 334, illus. E. H. Baumgartner, Chicago, Ill.

THE AMERICAN FERTILIZER HAND BOOK. The Standard Reference Book and Directory of the Commercial Fertilizer Industry and Allied Trades. 7½x10½, pp. 402, illus. $1. Ware Bros. Co., Philadelphia, Penn.

The handbook continues to keep up its reputation as an invaluable guide to anybody in the fertilizer business. It consists, as usual, of a general review of the technical and financial conditions underlying the fertilizer trade, followed by a complete guide to buyers and sellers of all classes of material used in the fertilizer industry.

NEW PATENTS

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

ALKALI COMPOUNDS—Process of Obtaining Alkali Compounds Useful for Fertilizing. Thomas L. Willson and Maximilian Mattheus Haff, Ottawa, Ont., Canada, assignors, by direct and mesne assignments, to Southern Investment Co. of Canada, Ltd., Montreal, Canada. (U. S. No. 1,144,405; June 29, 1915.)

ALLOY-COATING PROCESS. Jay C. Beneker, Cincinnati, Ohio. (U. S. No. 1,144,524; June 29, 1915.)

CLASSIFYING—Process of and Apparatus for Sizing or Classifying Comminuted Materials. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. (U. S. No. 1,141,852; June 1, 1915.)

CONCENTRATOR—Pan-Motion Concentrator. Charles H. Muhleman, Western Springs, Ill., assignor of fifty-five-one-hundredths to Frank Low, St. Louis, Mo. (U. S. No. 1,141,972; June 8, 1915.)

CRUSHING—Ore Grinder. Edward F. McCool, Victor, Colo. (U. S. No. 1,144,305; June 22, 1915.)

ELECTROLYTIC APPARATUS. William E. Greenawalt, Denver, Colo. (U. S. No. 1,144,538; June 29, 1915.)

FILTER. William Poole Lass, Treadwell, Alaska. (U. S. No. 1,144,854; June 29, 1915.)

FLOTATION—Ore-Concentrating Apparatus. John M. Callow, Salt Lake City, Utah, assignor, by mesne assignments, to Metals Recovery Co. (U. S. No. 1,141,377; June 1, 1915.)

JIGGING APPARATUS. James W. Neill, Pasadena, Calif. (U. S. No. 1,144,494; June 29, 1915.)

LAMP—Miner's Acetylene-Gas Lamp. Justus A. Gustafson, Idaho Springs, Colo. (U. S. No. 1,142,699; June 8, 1915.)

MAGNETIC-SEPARATING APPARATUS. Edward H. Rothert, Leavenworth, Wash. (U. S. No. 1,144,383; June 29, 1915.)

METAL-COATING PROCESS. Jay C. Beneker, Cincinnati, Ohio. (U. S. No. 1,144,523; June 29, 1915.)

PULVERIZER. Frederick R. Cornwall, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,144,352; June 29, 1915.)

PURE IRON—Method of Producing Practically Pure Iron. Arthur P. Scott, Brackenridge, Penn., assignor to Allegheny Steel Co., Pittsburgh, Penn. (U. S. No. 1,144,256; June 22, 1915.)

SCREEN—Pulsating Screen. Edgar B. Symons, Milwaukee, Wis. (U. S. No. 1,141,153; June 1, 1915.)

SCREENING CONVEYOR. Thomas F. Webster, Sewickley, Penn., assignor to Link-Belt Co., Chicago, Ill. (U. S. No. 1,142,648; June 8, 1915.)

SEPARATOR—Magnetic Ore Separator. Sven Ragnar Salwén, Grangesberg, Sweden, assignor to American Grondal Co., New York, N. Y. (U. S. No. 1,141,833; June 1, 1915.)

STAMP MILL. Norman Taylor Harrington, Lansing, Mich. (U. S. No. 1,144,126; June 22, 1915.)

STEEL—Process for the Treatment of Steel. Federico Giolitti, Turin, Italy, assignor to Società Anonima Italiana Gio. Ansaldo & C., Genoa, Italy. (U. S. No. 1,144,034; June 22, 1915.)

SULPHIDE ORES—Process for Treating Complex Sulphide Ores. George E. Kingsley, Spokane, Wash. (U. S. No. 1,144,480; June 29, 1915.)

Gold Production in Australia

Official returns of gold production in the Commonwealth of Australia, in fine ounces, for the four months ended Apr. 30, Tasmania being estimated, were as follows:

	1914	1915
Western Australia	406,954	421,951
Victoria	133,425	104,601
Queensland	70,012	76,635
New South Wales	44,250	52,985
Tasmania	10,000	8,500
South Australia	2,500	2,000
Total	667,141	666,672
Total value	$13,789,804	$13,780,110

For the first time in several years the Australian production has held its own. In the period covered by the tabulation the decrease was only 469 oz., or $9694, being only 0.07%. The results in the different states, however, show considerable variation, the gains in Western Australia, Queensland and New South Wales being balanced by decreases in Victoria and in the other states. New Zealand has not reported monthly production this year, so that the official returns are confined to the Commonwealth.

Power Plant of Granby Mining & Smelting Co.

SYNOPSIS—An 800-kw. plant furnishing light, heat and power for the Granby Mining & Smelting Co.'s new zinc-smelting and acid works at Rose Lake, near East St. Louis, Ill.

About two years ago the Granby Mining & Smelting Co. built a large plant at Rose Lake, in East St. Louis, Ill., designed for the manufacture of spelter and acid. In the various processes of manufacture large quantities of steam will be required. Producer gas is to be used for smelting and calcining, and in the making of acid there will be large demand for water. The pumps and various other machines around the works are electrically driven, and current will be furnished from a central power plant. Direct and indirect heating for the various buildings, pottery rooms, etc., and the feed-water heater will take all of the exhaust steam, summer and winter. It is the intention to start manufacturing at an early date, and even now the power plant is running under a light load created by the preparations under way.

A general view of the works is shown in Fig. 1. The power plant appears at the center of the picture. The interior plan dimensions are 89x98 ft. and the height from the floor to the roof trusses, 31 ft. The structure rests on massive concrete foundations designed to bear only two tons per square foot, owing to the presence of quicksand.

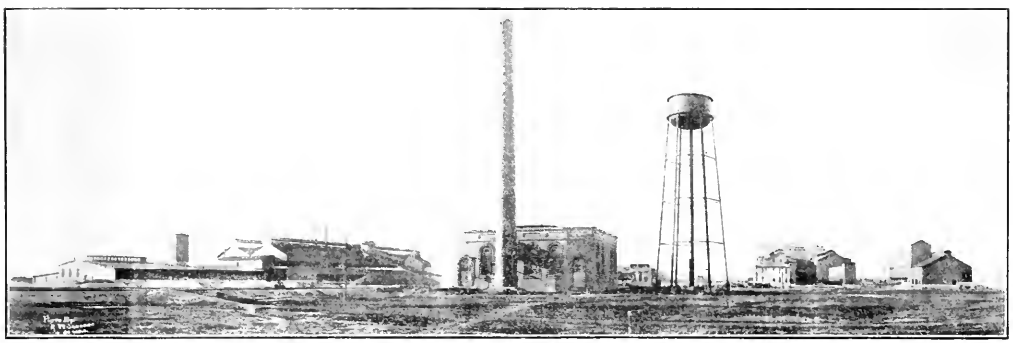


FIG. 1. GENERAL VIEW OF THE GRANBY PLANT AT ROSE LAKE, NEAR EAST ST. LOUIS, ILL.

Liberal Boiler Installation

In the boiler room, shown in Fig. 2, the equipment consists of 1050 hp. in boilers divided into three 350-hp. units of the horizontal water-tube type. The settings are of the marine type, consisting of fire-brick, 3-in. asbestos blocks and a steel-plate covering. Steam at 150-lb. pressure is supplied to 800 kw. in generating capacity, an air compressor and the feed pumps, besides some required in the manufacturing processes. The uses for steam outside of generating electricity and the installation of a spare boiler account for the excess of boiler over generating capacity. The actual ratio is 1050 to 800, or 1.3 boiler horsepower per kilowatt.

Chain-grate stokers having an area of 70 sq.ft. serve the boilers. When compared to the 3500 sq.ft. of heating surface the ratio is standard at 50 to 1. The boilers are vertically baffled for three passes, and between the furnace and the first pass a restricted throat insures the thorough mixture of the gases so necessary for smokeless operation.

Details of Flue Design

The stack rises 185 ft. above the grates, the diameter is 8 ft. and the sectional area of the bore is a trifle more than 50 sq.ft. The ratio of stack to breeching area is thus 10 to 13, or 1 to 1.3. For every square foot of connected grate surface, there is 0.31 sq.ft. of breeching and 0.24 sq.ft. of stack. Per 1000 sq.ft. of boiler-heating surface the areas of breeching and stack are 6.2 and 4.7 sq.ft. respectively. A stack draft of 1.1 in. with a gas temperature of 500 deg. reduces to 0.8 in. at the breeching side of the damper on the boiler farthest from the stack. A drop of 45 to 50 per cent. through the damper and boiler setting gives a draft of approximately 0.4 in. over the fire.

Treating Boiler-Feed Water

Water for boiler feeding is taken from wells on the premises and is high in scale-forming matter. A hot-process system for treating it chemically before passing it along to the boilers was installed.

ANALYSIS OF WELL WATER

Chemical Impurities	Grains per U. S. Gal.
Suspended matter	1.00
Organic and volatile	2.12
Silica	1.45
Calcium carbonate	13.75
Magnesium carbonate	4.04
Magnesium sulphate	0.88
Sodium sulphate	0.35
Sodium chloride	0.29
Total solids	24.18

The apparatus in use at this plant is of the vertical type shown in Fig. 3. While the various parts going to make up the complete outfit are more or less standard, their arrangement and the combinations employed differ for each plant, so that a description of the present system

*Abstract of an article by Thomas Wilson in "Power," July 6, 1915.

may be of interest. The raw water from the service supply enters the heating section, shown at the top, through a balanced regulating valve operated by a float in the float box, which maintains a uniform level in the storage chambers above the filters. Within the heating chamber are trays for breaking the water up into a fine shower in order that the exhaust steam which enters through the separator attached to the heating chamber may heat the water to a point at or near boiling. The hot water set above the treating tank. In these are provided suitable supporting gratings carrying a wood-wool filter bed held in place by grids. The water from the treating tank may contain floating impurities that will not settle. These are caught by the filter and pure water passes up into the storage compartment above, where it is available for boiler purposes.

The filters are arranged in duplicate and so connected that one or both may be cut out of service for cleaning,

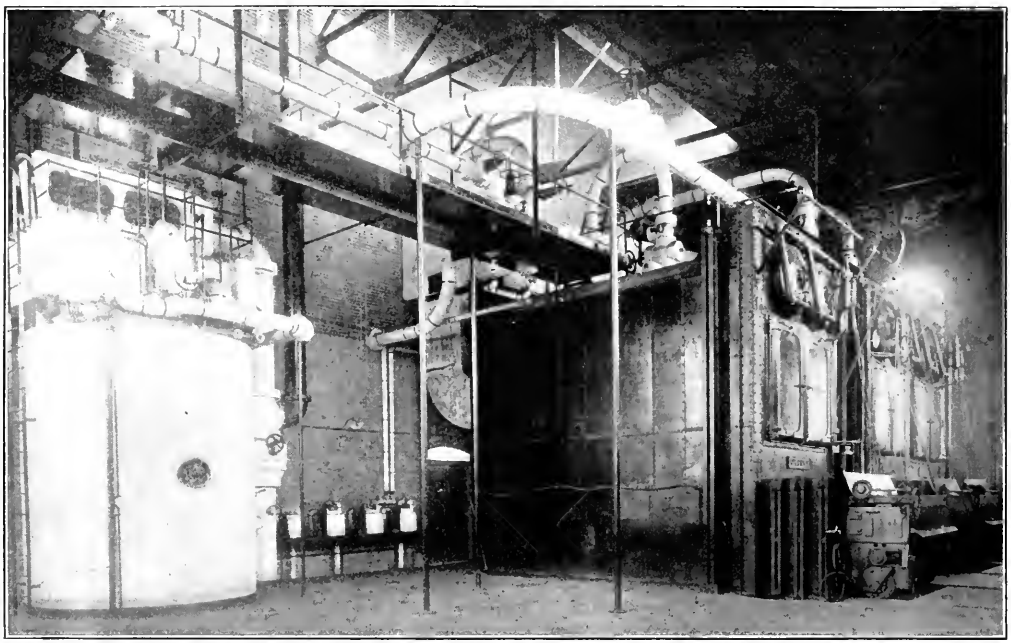


FIG. 2. THE BOILERS AND COMBINATION PURIFIER AND HEATER

then falls by gravity into the treating and sedimentation chamber, striking at the top a baffle which tends to distribute it uniformly and at the same time mix it with the reacting chemical which is fed into the raw water as at the same time leaving the heating section and the treating and sedimentation tank in service.

The amount of chemical to feed is determined by test, a simple equipment for the purpose having been provided.

PRINCIPAL EQUIPMENT UNITS OF GRANBY POWER PLANT

No.	Equipment	Kind	Size	Use	Operating Conditions	Maker
3	Boilers	Horizontal water-tube	550-hp.	Generate steam	150-lb. pressure, stokers, natural draft	Babcock & Wilcox Co.
3	Stokers	Chain grate	70-sq.ft.	Serve boilers		Babcock & Wilcox Co.
1	Stack	Tile and concrete	8x135-ft.	Serve boilers		Wiederholdt Construction Co.
1	Crane	Locomotive	10-ton	Unloading coal, etc.		Brown Hoisting Machinery Co.
1	Heater and purifier	Sorge-Cochrane	5420-gal. per hr.	Heat and purify feed water	Exhaust steam	Harrison Safety Boiler Works
2	Pumps	Duplex	10x6x10-in.	Pump boiler feed water	150-lb. steam	Epping-Carpenter Co.
1	Fire pump	Centrifugal	6-nozzle	Fire protection	Driven by 150-hp. Sprague motor	Alberger Pump & Condenser Co.
2	Engines	Simple Corliss	24x42-in.	Main units	150-lb. steam, 90 r.p.m.	Fulton Iron Works
2	Generators	Direct compound wound	400-kw.	Main units	440 volts, 90 r.p.m.	Sprague Electric Co.
1	Oiling system	Circulating and purifying		Serves main units and air compressor		S. F. Bowser & Co.
3	Oil pumps	Steam-driven	Two and six feed	Oil engines and compressor cylinders		Richardson-Phenix Co.
1	Air Compressor	Duplex	12, 19 and 12x14-in.	Compress air for tools, etc.	700 cu.ft. free air, 100 lb., 152 r.p.m.	Chicago Pneumatic Tool Co.
1	Crane	Traveling	10-ton	Serve engine room		Whiting Foundry Equipment Co.

it passes from the heating chamber to the treating and settling tank. This tank is made large enough to give the chemical time to act and the precipitate to settle to the bottom, where it can be drawn out through a sludge valve and discharged to any convenient point.

During this period the water passes down the outside and up the inside of the cone shown in the tank. At the top it is distributed between the two filter chambers

The proper proportion is then fed automatically into the system, which has a capacity to heat and treat 5420 gal. of water per hour.

When turning out the products for which the works was intended continuous service will be required from the power plant. The load night and day will run about the same, and reliability of service will be of the utmost importance, as discontinuance would entail a

large loss in the product under manufacture. For this reason duplicate generating units were installed, each capable of carrying the load while the other is held ready for service on short notice.

The engines are heavy slow-speed Corliss units, with cylinders 24x42 in., making 90 r.p.m., while the generators to which they are directly connected are really 600-kw. compound-wound direct-current machines, although rated at 400 kw., owing to the low speed. These massive units

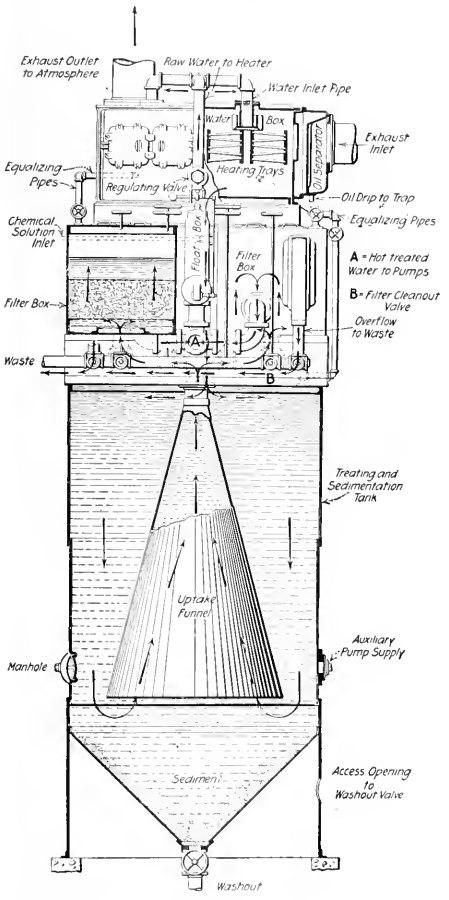


FIG. 3. SECTIONAL VIEW OF PURIFIER AND HEATER

are expected to care for the load with a minimum of upkeep and, above all, to give reliable service. The steam rate, although good for an engine of this type, is not of prime importance, as all of the exhaust steam will be utilized winter and summer.

Steam is supplied to each engine through an 8-in. pipe having a sectional area of 0.3171 sq.ft., or ⅛ sq.in. per kilowatt of rating. At 30 lb. per kw.-hr. the engine, at 50 per cent. overload, would require 18,000 lb. of steam, or 300 lb. per min. At 150 lb., and dividing by the area of the pipe, 0.3174 sq.in., gives for continuous flow a velocity of 2383 ft. per min. At quarter cutoff, however, steam would flow only one-fourth of the time, so that to supply the aforementioned amount of steam would require a velocity close to 9000 ft. per min. A receiver of course tends to equalize the flow. The longer the intervals between steam admissions, the larger this receiver should be. In the present case it was made 2¼ times the volume of the cylinder.

The exhaust piping is 10 in. in diameter, and for each kilowatt of rating it has an area of 0.197 sq.in. For 50 per cent. overload and continuous flow the velocity of the exhaust would be close to 12,000 ft. per min. At normal load this would reduce to 8000 ft.

Including building, chimney and all equipment, the total cost of the plant was $110,000, or $137.50 per kilowatt of rated output.

Granite Mountain Hoist*

The hoist now in course of installation at the Granite Mountain shaft of the North Butte Mining Co. is the largest electrically driven hoist of the Ilgner type on the two American continents. The hoist is designed to handle 7 tons of ore per trip. The ordinary hoisting speed will be 2700 ft. per min., but arrangements are made so that the speed can be increased to 3000 ft. per min. The equipment is designed to hoist from vertical depth down 4000 ft., and the cycles of operations have been chosen to give capacity from various levels approximately as follows:

300 tons per hour from the 2000-ft. level
250 tons per hour from the 3000-ft. level
200 tons per hour from the 4000-ft. level

The hoist has cylindrical drums 12 ft. in diameter and the rope to be used will be of 1⅝ in. plow steel.

The power required for hoisting will average about 1500 hp.; but to accelerate, the peak load will vary from 5500 to 4300 hp.

The direct-current hoist motor has a nominal continuous rating of 1850 hp., and has an intermittent rating of 2750 hp. It is guaranteed to handle 4500 hp. for a short time. The generator of the motor-generator set has a rating of 1500 kw. and can deliver 3750 kw. without trouble. The driving motor is 1400 hp.

The flywheel is 12 ft. in diameter, weighs 50 tons, and will have a speed of 400 to 500 r.p.m. The peripheral speed of the flywheel will be as high as 19,000 ft. per minute. In order to prevent any possibility of a flaw in this large wheel it is assembled out of sheets of rolled steel plate, each sheet being ½ in. in thickness. The total thickness of the combined plates is 21½ in. In designing this wheel the number of rivets was figured so that the plates are held together with sufficient pressure to hold any one plate by friction alone, eliminating any dependence on the shearing stress of the rivets. The entire wheel was carefully cut and finally polished and lacquered, so that it will present as smooth a surface to the air as possible and thus reduce friction. It was considered at one time that it might be advantageous to run the flywheel in a vacuum, but investigation proved that while such operation was feasible the application involved complications without sufficient increase in economy to compensate. The friction and windage losses of running the flywheel in the open air would amount to between 80 and 100 hp. This loss will be

*Abstract of a paper read before the Montana Society of Engineers, Butte, Mont., Apr. 10, 1915, by G. B. Rosenblatt, E. E.

reduced to about 50 hp. by enclosing the flywheel in a sheet-steel case carefully finished on the inside and fitting as closely as possible about the flywheel. Excluding the air from the cover and thereby running the wheel in a vacuum did not seem to reduce the loss by more than 12 or 15 hp., which would not justify the expense and complication of the necessary water-sealed glands, etc.

British Columbia Copper Co.

The report of the British Columbia Copper Co., Greenwood, B. C., for 1914 shows ore shipments from the company's mines tributary to the Greenwood smeltery amounting to 193,289 tons, of which 178,049 tons came from the Motherlode mine, 5332 tons from the Napoleon mine, 7920 tons from the Queen Victoria mine and 1988 tons from the Lone Star mine. No mention is made of the amount of metal produced or the average contents of the ore treated. The following statement of profit and loss is given:

Operating Disbursements	
Mining, smelting, freight, refining and selling charges, general office and administration expenses, maintenance and fixed charges and expenses incurred during the period the plant was closed down	$788,684.64
Custom ore purchased	162,434.84
Total	$951,119.48
Receipts	
Proceeds from metal shipments	$899,851.17
Miscellaneous earnings	11,503.76
Total	$911,354.93
Loss for year	39,764.55
	$951,119.48

A detailed analysis of the financial operations of this company is not possible from the condensed statements given by it, but it appears to us that, while a loss of only $39,765 is reported in the profit and loss statement just given, the company spent $540,330 more than it took in from operations. For example: At the end of 1913 it had a balance of quick assets of $122,406, and at the end of 1914 this balance had been spent, with an additional $417,925, this representing the excess of current liabilities over quick assets. This can be made clearer by the following figures as of Dec. 31, 1914:

Current Liabilities		
Accounts payable		$146,704
Amount advanced by Canada Copper Co.		340,000
Interest accrued to Canada Copper Co.		8,160
Loans and advances from banks		58,794
Reserve for sundry liabilities		500
Reserve for employer's liability		5,017
Total		$559,175
Current Assets		
Metals, smelter products, supplies, etc.	$112,801	
Prepaid insurance and taxes	4,693	
Sundry debtors	6,567	
Cash in banks	17,190	
Total		141,251
Current liabilities over current assets		$417,924
Balance of quick assets at Dec. 31, 1913		122,406
Total increase in current liabilities		$540,330
Loss reported in profit and loss statement		39,765
Other expenditures apparent		$500,565

This additional expenditure of $500,565 above those reported has probably been taken care of through the "Properties" account, but this account as given in the statement shows a decrease of $204,090.83 since the 1913 report was issued.

The report states that on account of the unsettled condition of the copper market during the last half of 1914 the company's smelter at Greenwood and operations at the mines from which the ore supply had been drawn were suspended in August. Development work was continued in a restricted way at the Copper Mountain property. It is stated that 6,200,000 tons of reasonably assured and probable ore of an average grade of 1.82% copper has been developed. There is also 750,000 tons of 1.54% ore developed. When this work has further progressed it is intended to arrange for improvements and equipment to treat these ores. The sum of $183,203 was spent in development work during the year. There are options outstanding on 11 claims for $188,000, upon which payments of $52,545 have been made. The amount shown in the financial statements of $3,400,000 for properties is the result of a preliminary valuation by the company's engineers of all its properties.

Extralateral Mining Rights

By A. L. H. Street*

In affirming judgment for defendant in a suit to recover damages for trespass upon a mining claim and wrongful removal of ore, the Supreme Court of Colorado lately decided in favor of the defendant in the case of Esselstyn vs. United States Gold Corporation (149 *Pacific Reporter*, 93). The defendant owned a senior lode mining claim on which a broad vein had its apex, but passed outside the side lines extended and under plaintiff's junior claim, where it was intersected by three veins, each of which had its apex on plaintiff's claim. It was decided that the defendant was entitled to the ore within the intersection by virtue of the provisions of Section 2336 of the United States Revised Statutes.

Anaconda-Amalgamated Distribution

The Amalgamated Copper Co. has issued notice that the statutory proceedings for the dissolution of the company have been completed, and the distribution of the assets can now be made on the basis stated in the company's circular of May 6. Each holder of one share of Amalgamated stock will receive one share of the new issue of the Anaconda stock, par value $50, and a cash distribution of $3. The transfer books of the Amalgamated Copper Co. will be finally closed on July 31 at noon, and the distribution will begin on Aug. 30 at noon on presentation of the certificates of stock at the company's office. Checks and Anaconda stock will be issued only to stockholders of record of July 31.

Costa Rica Production of Precious Metals decreased last year, according to a recent report from the Bureau of Foreign and Domestic Commerce, which says: "The following are the values of gold and silver mined and exported during each of the past five years: 1910, $811,186; 1911, $1,190,406; 1912, $817,565; 1913, $1,021,473; 1914, $888,599. The decrease during 1914 is partly explained by the fact that the Abangarez goldfield, the largest producer in former years, was shut down during nine months of 1914. In the early part of 1915 the Abangarez mines were placed under new management, and at present work is under way toward reopening these properties. The mines owned and operated by the Panama & Costa Rica Mining Co., the Aguacate Mines of Costa Rica, and the Montezuma Mines of Costa Rica were worked throughout the year with generally satisfactory results. These mines are mostly owned by American capital, and the entire product eventually reaches the United States."

*Attorney, St. Paul, Minn.

Editorials

Doctor Holmes

The death of Doctor Holmes on July 12 was not unexpected, inasmuch as he had been in poor health for a good many months and absent from his office in Washington. The latter is not to say that he had relinguished his duties. On the contrary, while he was at Fort Bayard, N. M., he kept a secretary with him and insisted upon directing many of the affairs of his bureau in spite of the solicitation of his friends who knew that he was overtaxing his strength and were apprehensive of what would be the outcome. This persistence on the part of Doctor Holmes was characteristic of him, however, and a fittting epitaph for him would be, "He lived with his work."

Doctor Holmes first attracted general attention by his services as chief of the Department of Mining and Metallurgy at the St. Louis Exposition. He filled that difficult position with an intelligence and suavity that charmed everybody; and he evinced a diplomacy that gave no ground for complaint to any jealous exhibitor. His particular interest, however, was in certain experimental technological work that was conducted at the Exposition, and upon the closing of the latter it was but natural that this work should be conducted by a technologic branch created in the Geological Survey and that Doctor Holmes should continue to direct it. When the Bureau of Mines was established upon the basis of the Technologic Branch it was equally natural that Doctor Holmes should become its first director.

The Bureau of Mines became his child. He practically created it, organized it and laid out its course. There is scarcely anything in it whereof the inception is not owed to him. He was ambitious for it and sometimes was criticized for the vaulting character of his ambition, although everybody recognized that there was never in his mind any thought of personal aggrandizement, but only thoughts for the prestige and public usefulness of his institution. For that institution he worked during every one of the 24 hours of the day except the few hours of sleep, traveling thousands of miles annually—enduring the hardships of railway tedium, poor food and miserable hotels—and holding intercourse with thousands of persons. The ability to get on well with people was one of his happy faculties, as also was his art of surrounding himself with able and loyal assistants.

He was never willing, however, to relieve himself of arduous duties by delegating them to his assistants. Their purpose, in his mind, was solely to enable his bureau to do more work, and he devoted himself indefatigably to finding it for them to do. With all of this he made the Bureau of Mines a great thing in remarkably few years, but in doing it he killed himself, leaving the mining and metallurgical industries of his country his eternal debtors. His special interest was the promotion of safety in mining. With keen perception he singled out the correction of the disgracefully high mortality in American mining as being the first big work that the Bureau ought to do.

Transition in Metallurgy

The present era is one of frequent and rapid changes in metallurgical practice. During the last three years—and this very likely will be repeated during the next three—processes have risen into prominence, enjoyed a superlative day and then begun to wane. If the prognostications of some of the most highly skilled of our metallurgists are to be credited, we shall soon begin to characterize the process of acid leaching of copper as the brightest and most transient of all the metallurgical stars. Because of practical necessity for a treatment system to fill in the bare places left by the better-known ones, leaching seemed to spring full-grown into being. Colossal plants have been built for its practice, but before even the completion of the greater plants a sturdy opponent has appeared to seriously question the economy of their working. Advocates of flotation maintain that there is no place for leaching in the copper field and that all that can be hoped for through leaching can be obtained with less cost, both of operation and of installation, through some flotation system. Whatever may be the truth of the matter, the fact remains that hardly any system of metallurgy—at least so far as wet treatments are concerned—is so firmly founded as to be able to disregard the advances of some other system. In Utah a highly economical system of roasting has made the return of chlorination possible. Even the cyanide process is challenged by flotation, and while not likely to be entirely supplanted, part of its field may easily be preëmpted. As to other processes, they are so many and so varied that it would be difficult to enumerate them, while the various combinations of two or more of them are almost without number.

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Value of Money and Commodities

When the war began, prophecies about its effect upon trade and finance abounded. Some of these were good, but many of them—perhaps the major part of them—have failed of verification just as much as the military prophecies. Consequently it has become the tendency to express forecasts of the future now with a spirit of caution and humility. Yet in the forecasts of last fall there were many things foreseen fairly well. When England was demanding gold from us and sterling exchange was above $5, it was distinctly foretold that the gold would soon come back and that exchange would fall far below par. The enormous cost of the war, the tension in Europe's credit, and the gradual passage of some of the countries of Europe to a paper basis were prophesied and have come, or are coming, to pass. The purchasing of war material in this country is no surprise to us, although the magnitude of the transactions is indeed astonishing. Certainly the fulfillment of prophecies is such that the prophet of today should not be entirely without honor.

We may therefore listen with patience to the pronouncement that the warring nations of Europe, England perhaps excepted, are gradually going upon a paper basis and that a natural consequence thereof will be inflation; that the United States is being flooded with gold and through its new banking system will also possess the means for inflation. Assuming such to happen—and there is considerable evidence pointing toward it—the corollary is a decrease in the purchasing power of money and an increase in commodity prices. The index numbers show that some increase has already been experienced.

If this forecast indicates correctly the general trend of economics the lesson is that bonds will depreciate in value while stocks, especially the stocks of companies producing the staple commodities, will increase in value. In other words, it will be better for investors to own property than to lend upon it.

We have been startled by the extent of the rise in the prices of some of the metals—staple commodities of basic nature—especially spelter and copper; but while they will probably recede from their highest points, it may be that the world is entering upon a period during which the price for them, as well as the prices for all staple commodities, will prevail at a higher level than what we used to consider the normal previous to the war.

Lacing Method of Making Primers

Two methods of securing the cap and fuse in the primer stick of dynamite to obviate the liability of its pulling out were given in the *Journal* of June 19 and July 3. The first of these—lacing the fuse through the stick of dynamite—is so common that it may well be said to be the universal way of making primers. Almost everyone recognizes the danger of the fuse igniting the dynamite, with the resulting burned hole and all its disadvantages, and the likelihood of the powder train in the fuse being broken by the sharp bends where the fuse enters and leaves the stick of dynamite. When the latter is pushed into the hole with the tamping stick, the fuse on both sides of the dynamite is liable to be ground off by contact with the sides of the drill hole, breaking the powder train and causing misfires. However, the handicaps of this course, though commonly recognized, are often considered to be less than the disadvantages of some other method of inserting the cap. A practical miner sends the following brief in favor of lacing:

> About lacing the fuse in the powder, we shoot 30 and 40 holes in the winze and lace them all and never have more than 2 or 3 missed holes. They won't say it is the cap or fuse. I will bet none of them guys who say it makes the powder burn in the holes saw it do it. What do you think?

The writer of this letter makes the strongest argument possible against the method which he is advocating. If he has 2 or 3 burned holes out of a round of 30 or 40, he is losing 8 to 10% of his holes, and when the cost of shooting them over is considered, together with the additional time wasted in waiting for the powder smoke to dissipate, the blasting costs are going to be increased from 12 to 15%. In addition to this, it is obviously impossible to predict which holes are going to misfire, and if these misfires happen to be the cut holes, then the entire round is lost and will have to be shot again. The blasting expense is not only doubled, but the results from a round that is shot over are never so good as would have been obtained had the first shooting not misfired.

Lacing fuse through sticks of dynamite though common, easy and convenient, is bad practice. If other means suggested seem to have disadvantages out of proportion to the benefits they afford, some entirely new way should be sought rather than to stick to the old lacing method with its known faults and dangers. It was for this very purpose that the device described and installed in the later *Journal* article was devised. It is used advantageously in South Africa and could well be adopted in this country. It is simple, cheap and effective.

Charles Hayden, recently returned from an inspection trip through the West, stated that the policy of the copper companies in which he is an important factor would be to distribute in quarterly dividends such profits as the respective companies were earning if copper were figured at 13c. per lb. At the end of the year the surplus would be paid out as an extra dividend, always retaining in the treasury sufficient cash and cash assets to carry on the business of the company in a safe and independent way. This is certainly a very conservative policy. Adherence to it, or something like it, has enabled Utah to escape the necessity of ever having to reduce its dividend. Even during the disastrous second half of 1914 that company maintained its dividend while most of the others had either to cut or to suspend.

A well-known roller of sheet zinc wrote to the *Journal* with reference to an illustration used in an editorial in the issue of June 19 that a zinc stove-board blank would ordinarily be only about 36x42 in. of No. 9 sheet (0.018 in.) and not the larger size and heavier sheet that we stated. We plead guilty to an inadvertence. The instance that we had in mind was an occurrence, but in order to make the illustration more homely the case of a stove-board blank was substituted in rewriting the manuscript and the incongruity of what followed was overlooked. Nevertheless, the ratios remained the same of course; and so does the point that the high price for sheet zinc is seriously curtailing the consumption of it for many ordinary purposes.

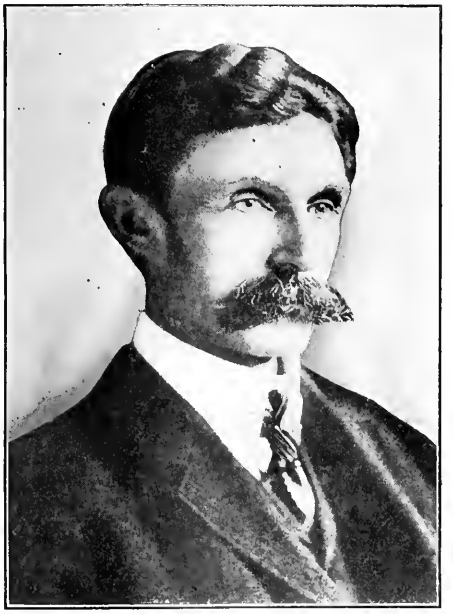
One European and neutral country has benefited by the war. The last report of the Bank of Norway shows the highest gold reserve ever reported by that institution, and the people are said to be unusually prosperous. In part this prosperity has been due to the high rates for ocean freights. Norway is a large vessel owner, and its ships are engaged in commerce all over the world. The boom in the freight business has been helped by an unusually good fishing season, adding to the prosperity of the kingdom.

It is understood that the new 2000-ton leaching plant of the Anaconda Copper Mining Co. is coming fully up to expectation. Since it was put into operation an average upward of 1900 tons of ore per day has been put through it and the tailings have averaged but 0.09% copper. The art of metallurgy appears to be making such progress that mammoth new plants are now put into operation without experiencing any of the infantile troubles that used to be expected.

Joseph Austin Holmes

Dr. Joseph Austin Holmes, chief of the Bureau of Mines for just five years past, or ever since it was organized under its present form, died at Denver, Colo., July 12, aged 55 years. His death was not unexpected by his intimate friends, but it will be the cause of widespread regret among the mining fraternity of all ranks, which he had served well for a number of years, since his work began long before the Bureau of Mines was constituted as a separate body.

Doctor Holmes was born in Laurens, S. C., in 1859. He was educated at local schools and at Chapel Hill, N. C., and graduated from Cornell University at Ithaca, N. Y., in 1880, taking the geological and scientific course. In the following year he was appointed professor



JOSEPH AUSTIN HOLMES

of geology and natural history at the University of North Carolina and remained there for 10 years. In fact, his connection with the university lasted very much longer, for he continued to lecture there for a number of years after he had given up the active duties of his professorship. In 1891 he was appointed state geologist of North Carolina and for three years devoted his time to the reorganization and improvement of the department. He had taken an active part in the geological exhibit at the Buffalo Exposition in 1901 and this pointed to his selection as head of the Department of Mines and Metallurgy at the St. Louis Exposition in 1904. While there, he originated the idea of a plant for testing fuels and structural materials, in the establishment of which he was ably aided by Messrs. Parker and Campbell. He continued in charge of the Geological Survey laboratories for three years, at first in St. Louis, then in Pittsburgh and finally in Washington. In 1907 he was made chief of the technologic branch of the Geological Survey and held that position until the Bureau of Mines was established by act of Congress on July 1, 1910. There were several candidates for the position of head of that bureau, but when Doctor Holmes was finally appointed, the universal approbation which greeted him in his new position was sufficient evidence of the wisdom of his selection.

Since his appointment, his activities had been incessant, all branches of the work receiving his constant attention and supervision, while at the same time he gave as much as possible of his time to outside societies and to committee work which would aid in the objects of the bureau. Thus he served on the International Mining Commission as representative of the United States to aid in the adoption of safety devices, both in this country and abroad. He was a member of the United States Conservation Commission and of the Mining Investigation Commission of the State of Illinois. The work of accident prevention and rescue, specially interested him, and it was largely owing to his influence that the plan of equipping a number of railroad cars as movable safety stations was adopted. He also used all his influence in favor of the measure for the admission into the United States free of duty of rescue and safety apparatus made abroad, in which he was finally successful. He had been suffering for some time from the disease of which he died, but it was not until the last few months that he allowed this to interfere with his varied activities.

Besides his official position, Doctor Holmes was a fellow of the Geological Society of America, member of the American Institute of Mining Engineers, of the Mining & Metallurgical Society of America, of the American Society of Mechanical Engineers, the American Society for Testing Materials, the Washington Academy of Sciences, the St. Louis Academy of Sciences and many minor scientific associations. He was a great traveler and was known personally to mining men in almost every part of the country. With many of these he first came in contact at the St. Louis Exposition in 1904, where the excellence and thoroughness of his work and his talents as an organizer were first generally recognized. From that time on, it may be said that he took the prominent position to which his ability and devotion to his work entitled him. Naturally, he was an able teacher, and his promotion was a serious loss to the University of North Carolina, which he had served faithfully for more than ten years and to which he continued to be much attached, although he was absorbed in his wider field of action.

Three years ago a friendly critic in *Coal Age* said of him—and his words have been amply justified since:

> Only his force of character, united to dexterity of action and ease of manner, could have secured from Congress the recognition, financial and otherwise, which has so far been accorded the Bureau of Mines. Many men have weight; Doctor Holmes has momentum. Lots of people know what to do; he knows how to do it. His diplomacy is the sort that enables a man, without deception or hypocrisy, to be seemingly the same to all men, yet varying with each, according to his peculiarity and according to the mind of the man at the time.

Doctor Holmes was married in 1887 to Miss Jeanie L. Sprunt, of Wilmington, N. C. He leaves two sons and two daughters.

PERSONALS

Sydney H. Ball is in Tennessee for 10 days on professional business.

H. W. Hardinge has returned to New York from an extended trip through the West

A. M. Plumb of the American Zinc Ore Separating Co., has been in the Silverton district, Colo., on business.

J. B. Tyrrell, of Toronto, Ont., will shortly go to examine some silver properties in the Port Arthur district of Ontario.

G. A. Loomis, representing New York parties, is making an inspection of some of the Big and Little Cottonwood properties in Utah.

R. C. Coffey, formerly superintendent of the Uwarra mill in North Carolina has returned to the Cobalt-Porcupine country in Ontario.

Hennen Jennings has gone to Ruby, Mont., whence he will proceed to San Francisco, where he will spend the remainder of the summer.

Fred H. Nye, of Denver, has been made mine superintendent for the Boulder Tungsten Production Co. with office at Boulder, Colorado.

F. W. Sherman has resigned from his position as superintendent of the Daly West mine, and will leave Park City, Utah, where he has lived for the past 15 years.

Franz Juretzka, of Breslau, a well-known German zinc metallurgist and contributor to the "Journal," is now serving as a volunteer in the Ersatz battalion of Grenadier regiment No. 11.

Walter Harvey Weed is at Butte, Mont., on mining examination work and expects to make a trip to Newfoundland on his return to examine some large copper deposits in that region.

John A. Baker, formerly construction engineer for the Tough Oakes mill in Ontario, has accepted the position of milling superintendent for Moose Mountain, Ltd., at Selwood, Ontario.

Prof. C. L. Crandall, dean emeritus of the College of Engineering of Cornell University was the guest of honor at a banquet given July 6 at the University Club by Cornell alumni of Salt Lake City.

H. M. Montgomery, chairman of the Chicago section of the American Society of Mechanical Engineers, has been elected vice-president and director of the Powdered Coal Engineering & Equipment Co., Chicago.

N. L. Heinz, who designed the Langeloth plant of the American Zinc & Chemical Co., completed the first unit of it and made provisions for the remainder, is now engaged with the American Steel & Wire Co. in the designing and building of the new zinc and acid plant at Donora, Pennsylvania.

The gold medal awarded by the British Institution of Mining and Metallurgy to Dr. Willett G. Miller, provincial geologist of Ontario, was formally presented to him on July 7 by Hon. W. J. Hanna, acting premier of the province. This is the first time that the medal has been given to a Canadian.

Dr. Bailey Willis has been appointed professor of geology at Leland Stanford University in California, taking the place of Dr. J. C. Branner, who is now president. Dr. Willis was for a number of years on the U. S. Geological Survey; more recently he has been consulting geologist and has conducted explorations in China and for the Government of Argentina.

Dr. Rukard Hurd, secretary of the Minnesota State Tax Commission, will resign July 15 to devote his time to iron-ore assessments and kindred subjects. Doctor Hurd is an authority on valuation of iron ores and has guided the Minnesota Tax Commission in the adoption of taxation methods on unmined tonnages on the Mesabi, Vermilion and Cuyuna ranges. He will be succeeded by Henry A. S. Ives, a St. Paul newspaper man.

OBITUARY

William C. Squier died at Rahway, N. J., July 7, aged 70 years. He was concerned with his father in the establishment of the New Jersey Zinc Works, and was connected with them for many years, retiring 15 years ago.

P. J. Tallon, assistant secretary of the Silver King Coalition Mining Co. died at Park City, Utah, July 4, aged 40 years. He was born in New York and had lived in Utah since 1884. He was elected mayor of Park City last year.

William H. Gorman died at Bedford Springs, Penn., July 7, after a stroke of paralysis. He lived at Oak Forest Park, near Catonsville, Md., and was President of the Gorman Coal & Coke Co., the Cumberland Coal Co., and the Piedmont Mining Co. He was also a director of several banks.

T. J. Vandergrift died at Columbus, Ohio, July 3, aged 52 years. He was born in Pittsburgh, and his first work was in transporting oil down the Allegheny River. Later he became an oil operator and was prominent for many years in Pennsylvania, West Virginia, Ohio, in the West and in Mexico. He was the first to introduce the use of natural gas in Pittsburgh. He was one of the first to study the relation of petroleum to geology and also one of the first to follow out the theory of anticlinals and synclinals. He was foremost in discovering oil territory in Pennsylvania, New York, Ohio and West Virginia and took first rank as a prospector, or "wildcatter." For many years he was one of the most progressive and successful oil producers and his judgment was considered excellent by many of the most prominent operators. In fact, wherever it was known that "T. J." had started a well or was about to start a well, leasing in the vicinity at once became active.

SOCIETIES

American Mining Congress—Directors of the Utah chapter at a meeting held July 7 decided on a campaign for increased membership. It is planned to give all persons interested an opportunity to join in the chapter's organized efforts to develop and aid the mining industry of the state. Accurate local mining information will be collected and compiled, and will be available to those interested. A. G. MacKenzie of Salt Lake has been selected as secretary by the executive committee.

Colorado School of Mines—On July 8, the board of trustees appointed as president William Battle Phillips, director of the Bureau of Economic Geology in the University of Texas. Prof. Phillips graduated from the University of North Carolina in 1877, subsequently spending two years at Freiberg and obtaining a mining degree. He is a member of the American Institute of Mining Engineers. He has been connected with numerous mining enterprises in the Southwest and is endorsed by officials of the U. S. Geological Survey and the U. S. Bureau of Mines. His duties will commence Aug. 1. Prof. William G. Haldane, who has been acting president of the school for the past two years will resume duties on the faculty as associate professor of metallurgy.

TRADE CATALOGS

The National Tube Co. has issued a bulletin, No. 20, which carries an index to all the bulletins preceding it.

Locomobile Co. of America, Bridgeport, Conn. Catalog. Locomobile Worm Drive Motor Trucks. 43 pp., illus., 8½x11 inches.

Sanford-Day Iron Works, Knoxville, Tenn. Sectional Catalog No. 25. Mine Wheels, Mine Trucks, Cars, etc. Illus., 8½x 11½ inches.

The Esterline Co., Indianapolis, Ind. Catalog No. 364. Golden Glow Incandescent Headlights for Mine, Railway and Industrial Service. 32 pp., illus., 6x9 inches.

The H. K. Porter Co. has just issued the eleventh edition of its catalog, which is really a textbook on locomotives. Because of the expense of preparation this book cannot be sent out indiscriminately, but will be mailed to those not in the market for locomotives on receipt of $1, a low price considering the excellence of the book.

Multi-Metal Separating Screen Co., 68 East 131st St., New York. Catalog: Pulmosan Respirator. 8 pp., illus., 9x6 inches.

This company has for years been manufacturing fine wire screens, as fine as 100,000 meshes per square inch, hence they could logically undertake the problem of devising a respirator to fill the needs brought to the company's attention by Dr. Otto Glogan, oto-laryngologist, delegated by New York State to make research along these lines. The Pulmosan Respirator devised consists of a combination of screening materials supplementing each other to form a perfect air filter which keeps out the finest dust particles.

Editorial Correspondence

SAN FRANCISCO—July 7

Natomas Consolidated Deeds conveying properties to Natomas Company of California were executed June 15. On June 17 delivery of Natomas securities in exchange for interim certificates representing first mortgage bonds of Natomas Consolidated was begun by the Mercantile Trust Co. at San Francisco. Natomas Co. will begin operations with the following capital obligations: Five-year 6% notes (estimated) $2,500,000; general and refunding mortgage 6% bonds $8,398,200; preferred stock (68,363 shares) $6,836,300; common stock (92,405 shares) $9,248,500. Total $26,983,000. Organization of the Natomas Co. authorized $3,000,000 of five-year notes but improvement in operating conditions diminished the amount by $500,000. None of the common stock will be in the hands of the public. This issue will be held by a British holding corporation which will issue its ordinary shares to former holders of second mortgage bonds and common stock in the Natomas Consolidated. The old second mortgage bondholders will receive approximately 25% or 50 shares for each $1000 bond. The old common stock holders will receive one share for $100 share formerly held in Natomas Consolidated. There will be some ordinary shares to cover a bonus arrangement. The trust company will be unable to distribute securities to holders of second interim certificates for several weeks owing to the fact that the British end of the transaction is not entirely completed. Also the capital liabilities of the holding company, for the same reason, cannot be given out for two or three weeks.

Revision of Tentative Mine Safety Rules was begun at a public hearing provided by the California Industrial Accident Commission. The hearing was attended by members of the California Metal Producers Association and operators and managers of a number of the large productive deep mines. Changes agreed upon at the meeting and suggestions or tentative changes from the text will be prepared by the committee who formulated the initial rules and the corrected form will be submitted to another public hearing. The most important change insisted upon at the meetings was a revision of Sec. 41, providing for the elimination of dust. The section was amended so that "inhalation of dust" will be substituted for "escape of dust." This permits the use of respirators instead of requiring the use of spray and water drills. The use of "T" rails in place of strap iron was also objected to; and some other changes asked. Until the rules are satisfactory to a majority of the attendants upon these public hearings they will not be adopted by the commission. There is no danger of the present mining engineer of the commission, or the commission itself, nor the committee of mine superintendents and mine workers who formulated the rules endeavoring to accomplish anything to the detriment of mine operation or to the workmen. The rules in some respects appear to be rather drastic and it is natural that some of the mine operators object to such rules as will require considerable expenditure of money to insure the safety of men, when they believe that less drastic measures may be adopted with equal success. But there is no reason for anyone to grow restive or belligerent respecting the outcome.

SMARTSVILLE, CALIF.—July 3

Renewed Activity In Smartsville, Yuba County, is attracting attention. Johnson, Hite, and Kibbe have leased from the Excelsior Water Co. what is known as the Lone Tree Hill quartz ground and are sinking on a 20-in. vein of gold bearing quartz. They have some good rock in sight. This ground was worked a little about 35 years ago. Some of the rock was very rich and some was hauled to Grass Valley and milled returning about $35 per ton. It is a free milling ore. A. McRae and A. Spencer have reached bed rock and are drifting for pay on their lease from the Excelsior Water Co. at Smartsville. There are some good streaks in these old channels. The gravel is hard and has to be blasted and then ground in some kind of mill to get the gold which is mostly small and flakey and rather hard to save as "quick" does not take hold readily.

BUTTE—July 7

Workmens' Compensation—When the state compensation law went into effect July 1, it placed 32,000 employees in Montana under the protection of the provisions of the law. These 32,000 workers will be paid for accidents that may befall them while in the line of their employment; about 25,000 of the men are insured under plan No. 1 in which the companies carry their own insurance. The liability companies have taken the risk for 5000 employees and 2000 are insured under plan No. 3 directly by the state, the money coming from employers. The 9 Anaconda Copper Mining companies, the 10 W. A. Clark companies and other big concerns carry their own insurance, having produced satisfactory proof of their solvency. The first employee to receive the benefits of the new law is Samuel Shepardson, of Butte who on July 1 had his leg sprained while in the employ of the Jones Transfer company. During first two weeks insurance company will pay his doctor and medicine bills, after that he will receive $10 per week as long as he is incapacitated. Had he been killed his family would have received $4000.

DENVER—July 8

Thirty Tons of Titanium Ore have been shipped from the northern New York mining field to the Colorado School of Mines, Golden, to be tested in the metallurgical plant by several flotation, electrostatic and magnetic separation processes.

Highgrading in the Cripple Creek District continues under rigid ban. In the district court last week, Judge Sheafor sentenced Thomas Moynahan, an assayer, to a term of from 2 to 4 years in the penitentiary. Another assayer is awaiting similar trial.

Standard Chemical Company has suspended operations in its reduction plant, in the Paradox valley southwest of Grand Junction, until the close of the European war. This policy throws about 180 men out of employment since the vanadium mines supplying this mill with ore were also shut down. But there is a healthy condition in the tungsten camps of Boulder county and it is estimated that the daily production of WO_3 has a value of about $8250.

Recent Transfer of the Independence Mine to the Portland Gold Mining Co. created a stir in the Cripple Creek district. Citizens believe that the deal will prove advantageous to the district as a whole in that operations will require more men than heretofore. The Independence mill was closed down preceding the transfer, the dump material having practically all been treated. There is a scramble for leases in the Independence ground and it is probable that the new owners will grant such privileges upon the same terms as prevail in Portland leases. The deed making transfer of ownership states the total consideration as $325,000.

The Mineral Production of Colorado for first half of 1915 shows little change. Gold production has been somewhat greater than for the corresponding half of 1914, this being due to the marked activities in the Cripple Creek district and to an increased dredging business at Breckenridge. Silver output remains nearly constant. Notwithstanding recent high prices for lead and zinc, figures show that the production of neither metal has risen materially up to this time. Tonnage of ore in Cripple Creek has been increasing every month since last fall. The estimated tonnage for June is 81,430 with an average gross value per ton of $16. It is predicted that, before the close of 1915, the district will be producing 100,000 tons per month.

To Comply with the Workmen's Compensation Law passed by the last session of the legislature, employers of Colorado, especially those engaged in mining and metallurgy, have negotiated with insurance companies for rates. On June 29, thirty managers of metal mines met at the Capitol building to discuss their findings in this matter and they arrived at the conclusion that they would either organize a mutual insurance company or secure their insurance directly from the state compensation fund, if the old-line companies that had attempted to force high rates did not recede from their octopus-like attitude. A committee, consisting of Fred Carroll, state commissioner of mines, D. W. Strickland, attorney, Ex-Gov. Jesse F. McDonald, Leadville, R. M. Henderson, manager of Wellington Mines Co., Breckenridge, and C. E. Anderson, Aspen, was selected to conduct final negotiations with the insurance concerns or to proceed with other schemes. Subsequently to conferring with this committee, the state industrial commission announced that it would approve a rate

$3.73 for all underground workers and a rate of $2.39 for all surface workmen, this amounting to a reduction of practically 10% from rates that had previously been insisted upon by the insurance concerns. Where medical treatment is not included in indemnities, the above rates will be further reduced 25%. Now the coal-mine operators are busy along similar lines. Insurance companies insist upon a premium of $7.49 per hundred dollars of payroll in coal mines. Appeal to the state industrial commission by the coal operators resulted in a statement from the commission that it would approve a minimum rate of $6 per $100 of payroll. The operators believe they can form a mutual insurance fund and make money at the $6 premium rate.

SALT LAKE CITY—July 9

The Utah Copper Co.'s Output for the first five months of 1915 amounts to 52,183,908 lb. copper. Production has increased from 8,009,646 lb. in January to 14,053,765 lb. in May, which is the largest month's production in the history of the company. This is an increase of about 75%. The June output was larger, exact figures are not yet available. There are at present 1500 men on the payroll at the mine, 1500 men at the mills, and 250 in the employ of the Bingham & Garfield railroad—all told 3240 employees, who are paid over $200,000 a month in wages. The production in April and May amounted to 26,168,913 lb. copper as compared to 26,415,995 lb. during the first quarter.

Enterprising Park City Men have erected on Lincoln highway parting of roads east of camp a big sign reading: "Only seven miles to Park City, Utah's greatest silver-lead mining camp, elevation 7000 feet. Population 4500. Total mineral production $150,000,000. Dividends paid to stockholders over $45,000,000. See the wonderful mines, big reduction mills and a modern city." The sign has already brought scores of transcontinental autoists to camp. Many are attracted by the wonders of mining on a big scale and they are stopping over and visiting the mines, and incidentally leaving a little money at the hotels and restaurants. But better still, they are carrying away good words for the old camp, which is considered incalculable in dollars and cents.

GOLDFIELD—July 6

The Goldfield First-Aid Society has been organized with 16 charter members, all miners employed in the local mines. These men have been under instruction of C. S. Arthurs of the U. S. Bureau of Mines, for several weeks, in first-aid and mine-rescue work, and it was upon his suggestion that the organization was formed. The men have made excellent progress and have now two efficient teams capable of performing first-aid and mine-rescue work for the Goldfield district.

SEATTLE—July 6

Large Cleanup on Tolovana has recently been brought into Fairbanks by Harry Patterson operating a lay in deep channel claims on the third tier of the right limit, opposite claim No. 5 Above Discovery, a claim on Livengood Creek. It amounted to about $2500 in coarse gold. There are many nuggets weighing from $5 to $10. It is estimated that he has taken out about three fourths of the gold from his dump, the remainder of which cannot be sluiced on account of the lack of water. The largest previous cleanup was $180.

The Output of the Fairbanks Placer Mines for the first six months of 1915 was $300,000 greater than for the corresponding period last year. This was due almost entirely to the earlier season and the abundance of water. The greatest benefit of the lengthened operating season is to the opencut mines, which were handicapped by the backward season and the cold, wet weather last summer. Harry Atwood, on 5 Below Discovery, Pedro Creek, and Wm. Goodrich, on 3 Below, started sluicing in the latter part of May, whereas it has rarely been possible in the past to start before the first of July. Unless dry weather interferes by cutting off the supply of sluice water during mid-summer, the opencut mines should have the best season in the history of the camp.

Broad Pass Country Is Showing Well under prospecting, according to many who have come out for new supplies. Highly encouraging results have been obtained by practically all operators now working in the district on lode claims on the mineralized zone which penetrates the district for an unknown length. The indications are that the camp will be one of the richest in the north. The gold occurs with arsenides. W. E. Dunkle, a mining engineer representing the Guggenheims, is developing a group of claims which the big syndicate has taken under option to purchase at a large figure. The Guggenheims have options on some 20 other claims in the Broad Pass country. There are about 50 prospectors in that district now.

WALLACE—July 7

Cœur d'Alene Mines Cut in on Power from Thompson Falls Plant—The Frisco mine and mill, the Morning mine and mill, the Greenhill-Cleveland mine and mill, and the Tamarack mine and mill began to use power from the Thompson Falls plant July 1. The first three properties belong to the Federal Mining & Smelting Co. The litigation which preceded the use of the Montana current has attracted widespread attention but it was not generally known that the power line had been constructed. This work has been going on for the past year. The use of the Montana power is the direct result of the excessive rates charged by the Washington Water Power Co., which has had a monopoly on the power throughout the Cœur d'Alene district. Repeated efforts on the part of the mining companies to obtain a lower schedule always met with failure. Litigation in the state courts and before the State Public Utilities Commission was won by the mining companies and the state legislature enacted a provision to meet the situation in this district whereby the mining companies could build power lines to the state line to receive outside power providing that they would not become selling agents for the power. The defense of the power company was that they could not sell their current at a lower rate and operate at a profit. Since the new power is being used however new contracts are being offered at greatly reduced rates by the Washington Water Power Co.

The Continued Idleness of the Hercules Mine since the departure from the district of the representatives of the A. S. & R. Co. is regarded as an indication that the efforts to settle upon a new smelting contract for the Hercules ore have been abandoned. The old contract for the Hercules ore was at $14 for freight and treatment and, the lead content to be settled for at the full New York price for lead. This netted the Hercules company about $12 per ton more than the other companies for the same grade of ore. The Bunker Hill company has a long time contract but the terms are to be revised every five years and the revision to be based on the average of all contracts in the district. If the Hercules was given the same contract as they had had before it would have meant a material reduction by the smelting company on the Bunker Hill ore. It is believed that if the negotiations have been abandoned, the Day interests who control the Hercules will construct a smeltery in the Cœur d'Alene or might reconstruct the old Northport smeltery. They have holdings of several thousand acres near Osburn which were acquired recently. It is hardly possible that the Hercules mine would remain closed during the construction of a smeltery. In case the mine were operated the ore would have to be stockpiled unless some temporary smelting facilities could be obtained. The Northport smeltery might possibly be utilized in this case or the old Panhandle smeltery at Ponderay, four miles from Sandpoint, might be rehabilitated and the plant operated until the plant at Osburn could be constructed. There is a good water supply, and lime and coke are all that would have to be shipped in. There would only be a 2-mile haul for the concentrates from the mill and a 10-mile haul for the crude ore from the mine, both hauls would be downgrade.

JOPLIN—July 10

Strike Situation—East of the Missouri-Kansas state line the ore production this week did not exceed 800 tons, the strike extending to all the mines of Oronogo, Duenweg, Webb City, Alba-Neck and Joplin. In Kansas and Oklahoma no effort was made to extend the strike. Mines were started Thursday, Friday and today on the old scale of wages, and there are more than enough of the striking miners ready to go to work. It is estimated that 75% to 80% of the strikers will return to their old jobs Monday morning, and some of them are sore enough to cause trouble if any strikers attempt to interfere with their going to work. Representatives of the Metal Mine Workers Union were haranguing the men today, with the assertion that they can get $100,000 to back them up in their strike. It is asserted that all but the floating element are ready to return to work. The operators have made arrangements for a sliding scale of wages, based on the average base price of ore the preceding month, this rate to hold for one month. No trouble is anticipated.

TORONTO—July 9

Bees and Smeltery Smoke—Ten farmers in the neighborhood of Thorold, Ont., have brought actions against the Coniagas Reduction Co., for amounts varying from $950 to $10,000, on the ground that gas from the company's smeltery at Thorold has killed all the bees within a radius of several miles. They also allege that the poisonous vapors kill vegetation, rendering farming or fruit-growing in the vicinity of the smeltery practically impossible.

The Mining News

ALASKA

KENNECOTT COPPER (Kennecott)—Copper production in June was approximately 9,000,000 pounds.

HUBBARD ELLIOTT COPPER (Strelna)—A. G. Elliott on way to property, where he will plan installation of new equipment at Strelna on Copper River.

ALASKA COPPER CORPORATION (Strelna)—H. W. Du Bois, consulting engineer, of Philadelphia, is at property to go over ground in preparing plans for production on larger scale.

ALASKA-JUNEAU (Juneau)—J. H. McKenzie announces that 9000-ft. adit tunnel now being used to deliver ore to company's pilot mill may be double-tracked when new mill is built.

MOTHER LODE COPPER (McCarthy)—Is to drive lower adit tunnel to ore. President Godfrey is at present in New York on business in connection with mine.

PORCUPINE (Porcupine)—Large cleanup, first this year, has been made on this property consisting of $17,000 in gold dust, result of 15 days' labor of 22 men. Some rich ground has been opened up and force is being increased with view of rushing development.

ALASKA GOLD (Juneau)—Manager B. L. Thane announces that work will be continued this year and during winter to prepare Kensington mine for producing ore for 500-ton mill to be started in spring. Mine is situated at Berners Bay, about 60 miles from Juneau. Work being started on transmission line to bring power from new Annex Creek power installation now in process of construction to Thane. Sam Vuch, discharged miner at Perseverance mine, was given one year in jail for assaulting shift boss with candlestick underground.

ARIZONA

Greenlee County

ARIZONA COPPER (Clifton)—According to final court decision company must pay to Greenlee County $40,000 of back taxes.

SHANNON (Clifton)—Copper production in June was 1,018,000 lbs. which was 6000 lbs. less than in May. Average price received for copper sold in June was 19.47c.

Mohave County

LOST BASIN (Kingman)—Recently organized to take over Scanlon mine will immediately build first unit of 100-stamp mill.

UNITED EASTERN (Oatman)—Plans to begin construction of mill within next few weeks. On 565 level free gold has made its appearance in vein material.

ARIZONA SOUTHWESTERN (Yucca)—Shaft at Copperville being unwatered and will be sunk to 500 level. Mill now being overhauled preparatory to resumption of operations.

Pinal County

MAGMA COPPER (Superior)—Ore reserve said to be 95,000 tons, averaging 7.6% copper and $4 to $5 in gold and silver. Company hopes to develop porphyry orebody at depth. Full capacity of plant will not be reached until completion of three-compartment shaft about October.

AMERICAN SMELTING & REFINING CO. (Hayden)—Has taken over Christmas mine near Hayden. Will construct aërial tramway 1½ miles long, a high power transmission line and make other improvements. S. H Sterman is superintendent.

Santa Cruz County

DUQUESNE M. & R. (Duquesne)—Work being rushed on alterations of mill at Washington Camp, installing new flotation machinery. Plant will have 100 tons capacity and will be ready for operation soon.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Reported that new oreshoot in 2300 level is wider and contains more gold than in upper levels.

Eldorado County

MONTEZUMA (Nashville)—Good progress being made in deepening shaft. Property is being developed by owners of Plymouth Consolidated at Plymouth, Amador County. J. F. Parks is superintendent of both mines.

Kern County

ANTIMONY CLAIMS have recently been located in Greenhorn Mountains by Miles R. Martin of White River and Pat McCloskey of Bakersfield. Samples are reported to assay 85%. Property is being prospected.

BUCKBOARD (Randsburg)—Fraser Bros. have purchased lease. Former leasers worked only few weeks and extracted 31 tons of ore that milled $21.75 per ton. Mine contains some good orebodies.

KERN COUNTY LAND CO. (Bakersfield)—Antimony mine in San Emidio mountains being prospected with view to operating during summer time. Mine was located several years ago and is reported to contain valuable deposits of antimony.

Mendocino County

MANGANESE DEPOSITS recently discovered at Potter on Busch ranch will be developed by Eastern men interested through Dr. Lewis Lee.

Mono County

NEYLON (Laws)—Controlling interest taken over by Joseph S. Giroux, of Ely, Nev. New road is being built to mine situated about ten miles northeast of Laws.

MAMMOTH (Mammoth)—Prospective purchasers examining mine which was formerly producer. Ore low-grade but it is reported that it can be worked with profit if it will average $4 per ton.

Placer County

FEDERAL DRIFT MINING CO. (Dutch Flat)—Agreement between surface property owners and mining company has been practically completed for mining operations beneath town. Only three owners have withheld their signatures. It is expected to start this new tunnel immediately. Recent bedrock strike made by company half mile below town added to interest in undertaking. Dutch Flat was, in early days of California mining, one of richest hydraulic camps and it is evident that there is large amount of drift gravel beneath town. Company recently installed 4-stamp mill and an electric device for saving gold.

Siskiyou County

JUDDRIGHT (Fort Jones)—A. H. Lindsay of Sacramento has bonded this property on Indian Creek. Initial work will be driving of 600-ft. tunnel. Mine was rich producer in early days.

Trinity County

GOLDEN JUBILEE (Coffee Creek)—Since reopening mine which closed down several years ago, good grade of milling ore has been disclosed and it is expected to start mill soon. Mine was large producer when in former operation.

Tuolumne County

NYMAN MINES (Jamestown)—Charles E. Schafer, manager, has received authority from owning company at San Francisco to begin unwatering Santa Ysabel mine.

SPRINGFIELD TUNNEL (Sonora)—New tunnel is now in 2400 ft. The last 104 ft. was driven in 19 days. Raise at 2230 ft. mark cut gravel and will be initially used as an airshaft. At 2800-ft. point, another raise will be made.

COLORADO

Boulder County

BOULDER TUNGSTEN PRODUCTION CO. (Boulder)—Development work is in progress in 1905 shaft, under direction of Fred H. Nye, superintendent of mines. Pay ore has been opened on 125 level and crosscutting is in progress to develop Midnight vein. It is company's plan to continue work in shaft and eventually make connection with tunnel driven from Boulder Creek.

Clear Creek County

CLEAR CREEK COUNTY SHIPMENTS during June were 88 cars of crude ore and concentrate. Argo mill purchased ore to value of about $26,000; Chamberlain samplery at Idaho Springs bought ore worth $25,000; and Georgetown sampler paid out $12,000 in settlements, making total of $63,000.

San Juan County

HIGHLAND MARY, SHENANDOAH AND TRILBY, old producers of copper-silver ore, have been consolidated and will hereafter be operated under one management. Shenandoah is under lease to J. B. Houston. Ores from these mines are amenable to flotation and a plant of this sort is contemplated.

SILVER LEDGE (Silverton)—Mill is running steadily concentrating lead-zinc ore accumulated during last winter's operation of mine.

BAGLEY MILL (Animas Forks)—Arrangements are made for starting up this old plant to treat ores from Hermes and other mines. Dan McNaughton will be superintendent.

EMMA (Silverton)—John Mattivi has begun sending out his accumulated winter stock of high-grade lead-silver ore by jack-trains; trails in Ice Lake Basin having been recently opened for season.

MAYFLOWER (Silverton)—American Ore Flotation Co., lessees, has reopened this mine and is exploring it. Body of sulphide ore 9 ft. wide carrying silver and gold is under development. Oil flotation is in continual use at the Silver Lake mill, treating ores mined in Mayflower and other leased mines. D. L. Thomas is metallurgist and Philip M. Collins is mill superintendent.

San Miguel County

TOMBOY (Telluride)—Mill ran 29 days in June; crushed 11,500 tons ore yielding $48,700 bullion and $54,500 concentrates. Operating profit $42,500.

COLORADO MANGANESE MINING & SMELTING CO. owns 10 claims in Dry Creek basin from which it ships very rich ore running less than 1% iron. Ore is hauled 40 miles in wagons to Placerville. Plans are made to maintain shipment of 25 tons daily. This very pure oxide has a ready market with manufacturers of electric batteries.

Summit County

FOUR DREDGES of district are working steadily. Estimated recovery of gold during June was $80,000.

DUNKIN (Breckenridge)—Shipped 50 tons carbonate ore to Chamberlain sampler. Ore runs about 35 to 40% lead, 15 oz. silver and 1 oz. gold. Lessees are O. K. Gaymon, of Denver; J. A. Sumner, of Salt Lake City; and Thomas H. Knorr and W. W. Wharton, of Breckenridge. Lawsuit with Queen Mining Co. over extra-lateral rights has been adjusted out of court and operations will be pushed.

Teller County

STRATTON'S INDEPENDENCE (Cripple Creek)—Cable advices give May production 4743 tons ore averaging 8 dwts., 13 grains; low-grade mine and dump ore milled 9617 tons.

LAST DOLLAR (Altman)—Lessees Crumby and Gibbons, who control ground between 1000 and 1200 levels, have opened vein on 1200 level that is 2 ft. wide and averages $30 per ton.

ORPHA MAY (Victor)—Dump is being worked over by Garstin and associates who have installed screening and washing machinery and are shipping product worth about $20 per ton

MARY McKINNEY (Anaconda)—Mine practically closed down during installation of new electric machinery. Repairs to shaft also being made and it is probable that shipments of ore will be prevented for two months.

AJAX (Victor)—In Worthington lease in Block 13 ore-body has been opened for distance of 50 ft. which has width varying from 2 to 5 ft. and test shipments of higher grade product range from $100 to $200 per ton in gold.

GRANITE (Victor)—Leasers Loss and Kaser are developing block of ground on 1200 level. New ore shoot has been opened which has width of 2 to 4 ft. and assays $30 per ton. Raise in ore shoot indicates that vein is becoming wider toward surface.

UNITED GOLD MINES (Victor)—In the various properties controlled by this company, at least 20 sets of leasers are working and shipments are being made from Trail and Trachite, on Bull Hill, May B on Squaw Mt., and the W. P. H. and Damon on Ironclad Hill.

C. O. D. (Cripple Creek)—This mine produced heavily in former times, but was closed down because of drainage difficulties. It has been secured by parties who have incorporated C. O. D. Consolidated Mining & Development Co. Col. T. B. Burbridge, James E. Hanley, Virgil Mann and Frank Vetters are among incorporators. Five sets of leasers are already working underground, while one set is preparing to handle mine dump.

IDAHO

Custer County

LOST PACKER (Mackay)—Smelting plant on Loon Creek being prepared for blowing in. Apparatus for 50-ton flotation plant is arriving.

EMPIRE COPPER (Mackay)—During June 169 cars, about 8450 tons of ore, were shipped to Utah smelters. On July 5, new record made at mine by shipping 18 cars, about 900 tons. Ralph R. Osborn is superintendent.

Shoshone County

C. & R. MINING (Wallace)—Edward Roberts, manager, will immediately purchase new compressor and other equipment for mine.

HORST-POWELL (Little North Fork)—Crew of 30 men are stoping and developing this copper property. Transportation difficulties have been solved and crude ore shipments will begin at once. Plans for erection of 150-ton mill have been completed.

SNOWSHOE (Mullan)—North-and-south fissure recently encountered has been followed for distance of 160 ft. and drift shows from 8 in. to 2 ft. of high-grade copper ore entire distance. Strike was first made at point 1600 ft. from portal of No. 2 tunnel and has vertical depth of 650 ft.

MICHIGAN

Copper

KEWEENAW (Calumet)—Loading station is being cut in Keweenaw at ninth level. Openings show good copper.

WINONA (Winona)—Is milling 600 tons per day at this time and is adding to milling and mining force daily.

CHEROKEE (Houghton)—Resumption of operations at Cherokee is expected in short time, both drilling and trenching.

FRANKLIN (Houghton)—Large compressor is in commission and production will be increased this week to 1000 tons daily.

MOHAWK (Mohawk)—Mohawk's new shaft rock-house will be in operation within month, if progress in construction continues at present rate.

NEW ARCADIAN (Houghton) — New Arcadian's further development in amygdaloid lode in south drift at 9th level shows as good if not better grade of milling rock than shown anywhere in mine.

ONECO (Hancock)—An assessment is expected on Oneco, if New Arcadian developments continue as sensational as in past few weeks. This company has 70,000 shares upon which $8 per share has been paid in.

AHMEEK (Ahmeek)—Sensational stories of rich strikes in exploratory drilling are untrue. One diamond drill is working. This drill is taking the first step in a cross-section. Yesterday it struck ledge, so utter absurdity of turning out a core from famous Calumet conglomerate is realized.

WYANDOT (Houghton) has unwatered shaft and is continuing drifts on 9th level with fairly good showing. They are making drill tests at present and orders are being placed for new machines. Resumption of sinking in winze will follow shortly. Assessment called last week was generally anticipated by shareholders.

NEW BALTIC (Houghton)—Shareholders of New Baltic are apparently pleased with plans for development of property through New Arcadian, and assessment plan is generally meeting with approval. In meantime development work at Arcadian continues to show most excellent stamp rock with each new blast.

Iron

TRADERS (Iron Mountain)—Mine will not be operated this season. It is an openpit and has shipped for several seasons.

INDIANA (Iron Mountain)—Several small lenses of high-grade ore have recently been found here. Considerable development work is being carried on. Regular shipments are now being made to docks at Escanaba. The inflow of water is greater than it was. About 800 gal. are now being taken care of. Eighty men are employed underground and on surface.

MAAS (Negaunee)—Cleveland-Cliffs Iron Co. has started shipping big stockpile here. Mine has been idle since last fall. There are about 300,000 tons of ore in stock. The bessemer is now being moved. This company has about 3,000,000 tons in stock on Marquette range. The sales for this year are close to 2,000,000 tons. Part of ore in stock runs high in silica and cannot be easily disposed of at this time. Production of the company's mines at present time is at rate of 1,500,000 tons per annum.

CHARCOAL IRON CO. OF AMERICA (Marquette)—This is title of company formed to take over Lake Superior Iron & Chemical Co. This latter company was placed in the hands of a receiver two years ago, when iron market became dull. Holdings were sold in Federal court in Marquette for $4,-000,000. Bondholders bought in property and will issue preferred and common stock to holders of bonds of Lake Superior Iron & Chemical Co. Management will remain the same and general offices will be maintained at Marquette. At present time only two of the company's six furnaces, Boyne City and Newberry plants, are in blast. Other plants are located at Chocolay, Ashland, Manistique and Elk Rapids. Ashland and Manistique furnaces will be blown in as soon as repairs now under way are completed. Concern has large timber holdings in upper Michigan and Wisconsin and owns lease of Yale mine on Gogebic range, which is owned by J. M. Longyear.

MINNESOTA

Duluth

MINNESOTA STEEL—Official announcement made that completion of Minnesota Steel Co.'s plant will be rushed. Already 500 men have been employed. Actual production of steel will begin by November. In addition, erection of 100 more employees' residences is planned.

Cuyuna Range

CUYUNA RANGE—On North Range, Rowe mine still leads in activity, having two hydraulic units at work stripping. Their concentrator will be ready by August 1. Hill Crest and Mahnomen stripping operations are progressing, as is also the stripping of part of Armour No. 1 orebody. Pennington pit is unwatered, although no work is being done. Inland Steel Co. is operating its Thompson pit and Armour No. 2 mine. Concentrator at Thompson is satisfactorily producing 600 tons daily. Circular concrete shaft at Croft mine is down 145 ft., being 40 ft. into ledge. Kennedy, at Cuyuna, is shipping 750 tons from skips, and will ship its 100,000-ton stockpile. On South Range, Wilcox is shipping steadily, and increasing its production. Brainerd-Cuyuna, at Brainerd, hoisted its first ore on Sunday, July 4, on which date the stockholders held a picnic on property.

MONTANA

Fergus County

SPOTTED HORSE (Maiden)—Plans being made for construction of cyanide plant. Property said to have been one of biggest gold producers in state since its discovery in 1881.

Hill County

HAVRE OIL AND NATURAL GAS (Havre)—Reports from Havre indicate that gas was struck June 3 in third well drilled by company, which flows between 7,000,000 and 10,000,000 ft. of gas every 24 hours. All efforts to cap flow failed because of great pressure of gas. Noise of escaping gas is heard mile away and precautions have been taken to prevent fire. Two lengths of casing were extended above ground so as to carry the gas further from danger. Town of Havre wild with excitement over strike.

Lewis and Clark County

SCRATCH GRAVEL DISTRICT NEAR HELENA—Operations in this district, which have been carried on by Helena Mining Bureau, have been discontinued for reason that claims leased by the Bureau have not come up to desired expectations. Machinery which had been installed on these claims is now being moved to near Clancy, where Bureau will start development work on Silver King claim. Of four claims developed by Bureau, Hawkeye mines, within city limits of Helena, is only one which has shown enough promise to warrant continued operations.

RICH STRIKE IN DRY GULCH NEAR HELENA—One of the richest strikes made in recent years in the gold district tributary to Helena is reported from a property a mile and a half south of Helena in Dry Gulch. Property is owned by Peter Rowan. There is a 450-ft. tunnel on the claim, in which a vein was discovered which is believed to be the much-sought-for "mother lode." Vein averages in width from 3 to 5 ft. and average values in previous operations ran from $7 to $8 a ton. Claim adjoins the Jumbo, a famous gold producer a number of years ago.

A. B. MELZNER VS. BRITISH-BUTTE MINING CO (Butte)—June 25 Judge McClernan finished hearing testimony in case of A. B. Melzner against W. E. Ward on injunction to prevent

Ward from interfering with big De Hora dredge at Rocker, which Melzner bought in at sheriff's sale last February, ordered to satisfy a judgment against the defunct British-Butte Mining Co. Judge McClernan granted temporary restraining order to prevent further interference with dredge by Ward, who had started to dismantle with apparent intention of selling it for scrap. Order will hold good until the final trial and determination of case involving ownership.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Will proceed at once with development of Butte-New York properties of which Butte & Superior owns controlling interest. Butte-New York controls Butte-Milwaukee group which lies east and north from Butte & Superior's Black Rock mine. Butte-New York claims are zinc properties. Development will be carried on from 1200 and other levels of Black Rock.

MINING ACTIVITY IN WALKERVILLE DISTRICT—Great deal of work being done in and around Walkerville where some of first mining was done in Butte. Many leasers are busy developing and shipping ore and steps are being taken to unwater the old Lexington mine. Work has been started to repair the shaft and install pumps on the 300 and 500 levels. Contractors have been at work deepening Moose shaft, an auxiliary of Badger State. Work is being done to connect these shafts at a depth of 1300 ft. George Stephens, mayor of Walkerville, is making weekly shipments of gold and silver ore from Moulton. Development work is continued on Home Run mine and Frank Whitman is shipping ore regularly from his lease on Fraction which carries high silver and gold. Sam Hoar has several men working on his lease on Belle of Butte and is making preparations for regular shipments.

NEVADA

Elko County

BLUSTER CONSOLIDATED (Jarbidge)—New mill, started last month, now treating 40 to 45 tons daily; treatment by amalgamation.

ELKO MINING (Jarbidge)—Alpha mill closed down indefinitely. Small amount of development work will be continued in hope of opening more ore.

Nye County

TONOPAH ORE PRODUCTION for week ended July 3 was 10,100 tons valued at $207,760, compared with 10,642 tons week previous. Producers were: Tonopah Belmont, 3547 tons; Tonopah Mining, 2450; Tonopah Extension, 1820; West End, 1002; Jim Butler, 1100; North Star, 107; and miscellaneous leasers 74 tons.

MONITOR-BELMONT (Belmont)—New mill being constructed will have ten 1600 lb. stamps and one 6x10 tubemill. Flotation equipment will also be included. It required 18 horses 8 days to haul tubemill from Tonopah, distance of 50 miles.

Storey County

COMSTOCK PUMPING ASSOCIATION (Virginia)—Repairs finished to east crosscut drain on the 2700 level.

YELLOW JACKET (Gold Hill)—Mill received 1005 tons of dump rock. One bar of bullion shipped to smeltery.

UNION CONSOLIDATED (Virginia)—West crosscut on 2650 level in porphyry and quartz. Reopening north drift on 2500 level.

CONSOLIDATED VIRGINIA (Virginia)—Jointly with Ophir on 2500 level old main north drift reopened to Mexican line. Resumed work in east crosscut to 2700 level winze.

MEXICAN (Virginia)—Important prospecting started in west crosscut on 2700 level. On 2500 level ground in main Comstock reopened. Mill crushed 155 tons, averaging $14.25 per ton.

OPHIR (Virginia)—Saved 323 cars of mill ore from Central tunnel and shipped 250 tons to mill. Central tunnel continues to show large tonnage and 8-ft. body of quartz to be explored to the north. Machine drills are to be installed to continue Andes crosscut.

NEW JERSEY

Sussex County

NEW JERSEY ZINC (Franklin Furnace)—A 250% stock dividend has been declared payable on or after July 21 to stockholders of record at noon July 10. This increases the capital stock to $35,000,000.

NORTH DAKOTA

Mercer County

DRILLERS ENCOUNTERED GAS at depth of 75 ft. 1½ miles west of Expansion.

UTAH

Juab County

TINTIC ORE PRODUCTION during the first half of 1915 amounted to total of 2770 carloads estimated at 138,500 tons, valued at $3,480,000. Total for June was 568 carloads, estimated at 28,400 tons, and valued at $710,000. These figures compare with total yearly shipments from camp in 1914 of 6094 carloads, and fall little below average. Chief and Mammoth in June, exceeded any of their other monthly production so far this year. There were 22 shippers in June and 34 in first half of 1915. The individual productions for first half of 1915 are in carloads: Sioux mill dump, 241; Iron Blossom, 502; Chief Consolidated, 335; Mammoth, 110; Centennial-Eureka, 530; Eagle & Blue Bell, 245; Gemini, 103; Grand Central, 83; Dragon Consolidated, 91; Victoria, 36; Gold Chain, 42; Beck Tunnel, 34; Bullion Beck, 35; May Day, 61; Carisa lease, 16; Sioux Consolidated, 18; Uncle Sam, 12; Opohongo, 9; Colorado, 30; Eureka Hill, 25; Godiva, 9; Yankee Consolidated, 19; Black Jack, 4; Tintic Standard, 9; Lower Mammoth, 62; Ridge & Valley, 1; Utah Ore Sampler, 3; Minnie Moore, 4; Utah Mining-Continental, 3; United Tintic, 1; Clift lease, 1; Dubuc lease, 1; Salvador, 1; Copper Queen, 1.

OHIO COPPER (Bingham)—New leasing company is working at capacity, treating 2400 to 2500 tons of ore daily.

GRAND CENTRAL (Mammoth)—Shipments are being made from nearly all levels between 600 and 2200. Copper ore of good grade is coming from lower workings. June output amounted to 18 cars.

Piute County

MINERAL PRODUCTS (Marysvale)—Construction on the new mill to treat alunite for potash has been started. Work is under contract to Westinghouse, Church, Kerr & Co. Roads in cañon are being put in shape for autotrucks, and tramway mile long is to be built to loading station in Cottonwood Cañon. About 20 men are employed at mine on development. L. K. Kennedy will be mine superintendent.

Summit County

PARK CITY ORE PRODUCTION for month of June shows total of 8759 tons from five principal shippers and approximately 500 tons from others, making total for camp of 9259 tons, estimated at $370,360. Total for first half of 1915 is approximately 50,000 tons. Estimated valuation is $2,000,000 for six months. These figures may be compared with a total for the camp in 1914 of 75,000 tons, and is considerably above half-year average production. Principal producers were: Silver King Coalition, 22,498 tons; Daly-Judge, 11,636; Silver King Consolidated, 4594; Daly West, 7391; Ontario, 521; Daly, 520; D. W. Quincy, 100; American Flag, 25 tons.

WASHINGTON

Okanogan County

ARLINGTON MINING CORPORATION (Okanogan)—H. I. Stolfire states that company plans to install considerable new equipment in Arlington mine.

Stevens County

COPPER KING (Chewelah)—Judge W. H. Jackson, in the Superior Court of Colville, ordered accepted bid of $125,000 for property by J. W. Douglas of Orient. This will net shareholders about 5c. per share. Property was in receiver's hands.

WISCONSIN

Zinc-Lead District

MINERAL POINT ZINC (Mineral Point)—Construction of new sulphuric-acid plant at Mineral Point is under way. New methods will be used to protect surrounding vegetation from gas fumes.

ENTERPRISE (Platteville)—H. E. Stephens and Chas. Kistler are preparing to operate Enterprise roaster for custom work.

NATIONAL SEPARATING CO. (Platteville)—New equipment is being installed which will increase capacity of roasting plant 50 per cent.

VINEGAR HILL ZINC (Platteville)—New milling plant on Kittoe Mine at Lenton has been placed in operation.

FIELD (Scales Mound)—New 400-ton mill has just been completed on Thompson lease at New Diggings.

UTT-THORNE (Platteville)—This company has purchased roasting plant of Wisconsin Separator Co. at Benton and will engage in custom roasting.

CANADA

Alberta

SOUTHERN ALBERTA OIL CO. (Calgary Oil Field)—President Wm. Livingston announces that this company has flowing well. Rising oil burst safety valve at top of hole and is flowing over surrounding area. Depth of well is 3527 ft. and pressure when valve blew off was 350 lb. per sq.in.

British Columbia

BRITISH COLUMBIA COPPER (Greenwood)—After idleness of ten months Greenwood smeltery has resumed operations by blowing in one blast furnace. About 50 men will be employed at plant and 50 more at Mother Lode mine. Operations will be brought up to full normal capacity as rapidly as possible.

Nova Scotia

DOMINION STEEL CORPORATION—No. 7 blast furnace was blown in July 5, making four furnaces now in operation. Production for June: Pig iron, 22,552 tons; steel ingots, 28,680; rails, 13,044; rods, 6435; bars, 797; wire and wire products, 3167 tons.

Ontario

LUMSDEN (Cobalt)—Operations have been resumed on a small scale. Crosscutting will be undertaken on 50-ft. level in hope of cutting Timiskaming vein.

DOME (South Porcupine)—General manager has given out statement to effect that rich ore struck by diamond drilling when opened up by drifts is in richness and extent beyond expectations. He says "The mine-run showed better than 27,000 tons milled yield bullion production of about $121,000," and concludes by saying "we have openings now in the mine in such high-grade ore that we can make almost any production which you might feel justified in wishing to maintain."

SOUTH AMERICA

Chile

BRADEN (Rancagua)—Production for June was 2,542,000 lb.. Treated 91,000 tons ore averaging 2.1% copper. Average extraction was 77.21%.

AFRICA

Rhodesia

TOTAL PRODUCTION OF METALS in Rhodesia for the five months ended May 31, is reported as follows: Gold, 362,471 oz.; silver, 71,397 oz.; copper, 1313 tons; lead 12 tons. The output of other minerals was: Chrome ore, 17,543 tons; asbestos, 231 tons; coal, 151,558 tons. There were also 33 carats of diamonds reported.

The Market Report

Metal Markets

NEW YORK—July 14

All of the principal markets except spelter were dull during the last week, and were inclined to be reactionary, although the recession in quotations was but trifling.

Copper, Tin, Lead and Zinc

Copper—Exactly the same conditions continue to exist as were reported last week, but there was less business done. Such as was done by the principal producers was for special shapes, special brands, special terms or otherwise that were in no way indicative of the market. On regular business they maintained their asking prices of 20@20¼c., regular terms, but it was admitted that the actual market was below that, and, in fact, copper was offered during the week by outsiders as low as 19½c., regular terms. On the whole, however, the market during the last week cannot be characterized as otherwise than merely nominal.

Copper Sheets are understood to have brought 25@26c. per lb. The principal manufacturer makes no base quotations. Wire is quoted at 21½@22c. per lb. at mill.

Copper Imports reported by the Department of Commerce for the month of May included 10,389,201 lb. in ore; 655,041 lb. in matte; 9,495,690 lb. pigs, bars, etc.; 745,867 lb. old, scrap, etc.; total, 21,285,799 lb. Exports for the month included 39,637,810 bars and ingots; 8,623,823 lb. rods and wire; 2,130,402 lb. plates and sheets; 750,906 lb. scrap, etc.; total, 51,202,941 lb. In addition there were exported 2910 tons ore and matte, containing by values approximately 153,220 lb. copper. This brings the total imports for the five months ended May 30 up to 43,929 long tons; exports, 134,405 tons.

Copper Imports for the week ended July 3 are reported by the Department of Commerce as follows: Metal, 5,236,918 lb.; contents of ore and matte, 759,585 lb.; total, 5,996,503 lb. These imports were nearly all from Chile, Peru and Japan. Exports of copper for the week were 7,171,707 lb.; the chief items being 3,859,650 lb. to Great Britain; 2,477,231 lb. to France; 672,000 lb. to Denmark.

The Consolidated Arizona Smelting Co. is reported to be doubling its smelting capacity at Humboldt, Ariz. This company is said to be making money now for the first time in its history.

Tin—Deliveries were rather large and there was some pressure to sell, which caused the price to recede a little, buyers being already well provided.

Exports of tin from the Federated Malay States five months ended May 31 were 20,599 long tons in 1914, and 19,270 in 1915; decrease, 1329 tons.

Lead—The principal producers maintained a price of 5.75c., New York, which was realized on some transactions, but there was a reappearance of lead from second-hands which was offered in considerable quantity at rather large concessions from the producers' price.

Spelter—Relatively little business was reported done by first-hands, but there was rather a large tonnage reported sold in trading business, considerable spelter being offered for resale. The conditions of these transactions were rather curious. A moderate tonnage of spelter was reported sold for export

The London quotation for spelter continues unchanged at £100, but this quotation is purely nominal.

The number of new distillation furnaces being added at the Sand Springs smelting works is two. One furnace is being added at Chanute, and one at Bruce. The old plant at Nevada, Mo., is to be put in operation about the end of August with four Belgian blocks. E. V. Lanyon is building two Belgian blocks in connection with the east plant at Pittsburg, Kan., but on his own account.

The U. S. Steel Corporation is reported to be making good progress at Donora, Penn., with the construction of its new zinc and acid plant.

Exports from Baltimore for the week included 474,874 lb. zinc dross to Liverpool.

Spanish Exports of Metals and Minerals for the four months ended Apr. 30 are reported by the "Revista Minera" as follows in metric tons:

	Metals		Ores etc.	
	1914	1915	1914	1915
Iron	4,027	52,689	2,673,020	1,348,945
Copper	6,391	5,562	48,470	12,811
Copper precipitate	3,720	3,604	....	....
Lead	55,308	45,407	879	274
Zinc	502	1,400	29,958	5,194
Quicksilver	827	699	....	....
Manganese	....	....	5,913	2,326
Pyrites	....	....	1,070,727	461,764
Salt			201,600	144,268

Imports of coal for the four months were 455,159 tons, a decrease of 484,569 tons; of coke, 63,802 tons, a decrease of 62,699 tons.

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Spot, Cts. per Lb.	Lead New York, Cts. per Lb.	Lead St. Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
8	4 7650	47½	*19 15 @19 55	38¾	5.75	5 57½ @5.67½	19.75 @22.25
9	4 7681	47½	*19 30 @19 40	38¾	5.70 @5.75	5 55 @5.65	20.00 @22.50
10	4 7675	47⅞	*19 25 @19 35	38¾	5.70 @5.75	5.55 @5.65	20.00 @22.50
12	4 7650	47⅞	*19 25 @19 35	38¾	5.70 @5.75	5.55 @5.60	19.75 @21.75
13	4 7663	47½	*19 30 @19 40	38¾	5.60 @5.75	5 50 @5 60	19.75 @21.75
14	4 7663	47½	*19 30 @19 40	38	5.60 @5 75	5 50 @5.60	19.75 @21.75

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos.	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts. per Lb.
8	22 15/16	77¼	79	93½	19 32	170	165½	23¾	5.17	100	21.73
9	22½	77⅝	78⅞	94	19 42	172	166¼	24½	5 22	100	21.73
10	22½	....	....	....	....	....	....	....	.....	....	....
12	22½	77⅝	79	93½	19 32	171¾	165½	25½	5 43	100	21.73
13	22½	78¼	79½	93½	19 32	172½	166¼	25 3/16	5 36	100	21 73
14	22 9/16	78	79¼	93½	19 32	171½	165½	25¼	5 35	100	21.73

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—July 14

Aluminum—The market has been fairly active, with some increase in sales. Prices are unchanged and firm, the current quotation being 32@33c. per lb. for No. 1 ingots, New York.

The latest London quotation for No. 1 ingots is £130@140 per long ton; the average being equal to 29.33c. per lb. The price is advancing.

Antimony—Fair sales are reported but the market is nervous and unsettled though there has been no material change in prices. Chinese and other ordinary brands bring 37½@40c. per lb. The special brands are nominal, 50@52½c. per lb. being asked for Cooksons.

Nickel is steady and unchanged at 40@45c. per lb. for ordinary forms, according to size of order. Electrolytic 3c. per lb. higher.

Quicksilver is strong and in good demand, with prices higher. New York quotations are $94 per flask of 75 lb. for large orders; $95@100 for smaller quantities, with sales chiefly at the higher figure. San Francisco price is reported by telegraph at $90@95 per flask, with business fair. London has had a sharp advance and the price is now £18 5s. per flask, with £18 2s. 6d. quoted from second hands.

Minor Metals—Current sales of bismuth are at $2.75@3 per lb. New York. The London price is quoted at 10s., or $2.40 per lb. there—**Cadmium** is quoted at 6s., or $1.44 per lb. in London; $1.50 per lb., New York.—**Tellurium** is reported sold at 80s., or $19.20 per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50@5 for retail lots.

Gold, Silver and Platinum

Gold in the United States July 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,173,799,069; in Treasury current balances, $206,526,508; in banks and circulation, $600,777,874; held by Federal Reserve banks against notes, $12,445,564; total, $1,993,549,015. This is an increase of $78,765,019 over the June report.

Gold production of the Transvaal is reported by cable at 755,280 oz., or $15,611,638, in June. For the half-year ended with June it was $84,475,128 in 1914, and $91,114,352 in 1915; an increase of $6,639,224 this year.

Platinum remains quiet with moderate sales and quite steady. Dealers ask $37@39 per oz. for refined platinum and $41@44 per oz. for hard metal.

Our Russian correspondent writes that the market remains generally unchanged, but a slow decrease in prices is to be noted. The demand in Petrograd is good, but the difficulties in exporting the metal detain the business. At Ekaterinburg the speculators buy voluntarily small portions of platinum from the starateli. The quotations are: at Ekaterinburg, 8.20@8.30 rubles per zolotnik; in Petrograd, 33,000@33,200 rubles per pood, for crude metal, 83% platinum. These prices are equivalent to $31.02 and $32.44 per oz. average, respectively.

Silver continues quiet, with small fluctuations in price. Some silver is going to the East from San Francisco; shipments from New York are only moderate, but seem sufficient at present to satisfy the demand.

Exports of silver from London to the East Jan. 1 to June 30, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£3,863,000	£2,647,000	D. £1,246,000
China	40,000	5,000	D. 35,000
Total	£3,933,000	£2,652,000	D. £1,281,000

Coined silver in the United States July 1 is estimated by the Treasury Department as follows: Standard dollars, $568,272,478; subsidiary coins, $185,293,874; total, $753,566,352. Of the standard dollars $493,459,000 are held in the Treasury against silver certificates outstanding.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 10

The base price paid this week for 60% zinc ore was $100@110 per ton. The base price paid for 80% lead ore was $70 per ton.

SHIPMENTS WEEK ENDED JULY 10

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	2,819,400	371,580	475,380
Year	97,973,430	3,888,470	14,261,270

Shipped during week to separating plants, 3,582,000 lb. zinc ore.

The net shipment of finished ore for the first six months of 1915 showed a gain of 18,513,630 lb. over the corresponding period last year.

JOPLIN, MO.—July 10

Blende, high price $112; base per ton of 60% zinc, premium ore $110, medium to low $105@90, in car lots. Calamine base per ton of 40% zinc, $58; average price, all grades of zinc, $100.01. Lead, high price $72; base $70@60 per ton of 80% metal content; average all grades of lead, $61.47 per ton.

SHIPMENTS WEEK ENDED JULY 10

	Blende	Calamine	Lead	Values
Totals this week	4,814,370	185,580	1,335,420	$291,090
Totals this year	303,970,400	26,144,080	46,101,670	12,667,270

Blende value, the week, $245,030; 28 weeks, $10,905,980
Calamine value, the week, $5030; 28 weeks, $550,310
Lead value, the week, 41,030; 28 weeks, 1,210,980

Production of the Missouri mines in the district was not over 800 tons. The miners are now gradually returning to work and the strike is almost over.

OTHER ORES

Chrome Ore—The latest quotations in London are, per long ton: New Caledonia ore, 50% base, $27.60 per ton, with a scale of 60c. per unit for variations. Rhodesia ore, base 48%, $26.40, variation 48c. per unit. Baluchistan ore, base 50%, $27.60, variation 60c. per unit. New Caledonia and Baluchistan ores generally run over 50%; Rhodesia 2 to 3% below.

Iron Trade Review

NEW YORK—July 14

Activity continues in the iron and steel trades, largely due to the volume of export business placed, but in some degree also to improving consumption at home.

The rate of operations at the steel mills has increased, and some of them are working well up to capacity. The Steel Corporation June report of orders shows that its new business for the month must have exceeded deliveries by a considerable amount. The Corporation is now reported to be buying billets from outside mills to supply some of its plants in the East.

Pig iron seems to linger behind. The increase in production shown this month is mainly from the steel works furnaces, the merchant stacks having only a small gain.

Holding that tariffs filed by 11 railroads proposing charges for hauling slag from furnaces in western Pennsylvania, Ohio and West Virginia, do not conform to the act to regulate commerce, the Interstate Commerce Commission has handed down a decision ordering the tariffs stricken from its files. The commission says, however, it sees no reason why this disposal service must be performed gratuitously by the carriers. It makes it plain that it expects the railroads to file appropriate tariffs conforming with other requirements attending business of common carriers. These tariffs are expected to be regular and be more specific than those which were on file.

Exports from Baltimore for the week included 2,703,610 lb. billets and skelp steel; 3,466,919 lb. bars and wire rods; 2,631,730 lb. wire and 3,330,949 lb. pipe, all to Great Britain.

Pig Iron Production—The reports of the furnaces on July 1, as collected and published by the "Iron Age," show at that date 218 coke and anthracite stacks in blast, having a total daily output of 80,400 tons; an increase of 7800 tons over June 1. Making allowance for the charcoal furnaces the total make of pig iron in the United States in June was 2,408,500 tons; for the six months ended June 30 it was 12,248,400 tons. Of this total 8,960,700 tons, or 73.2%, were made by the furnaces owned and operated by steel companies. Production now is at the rate of about 29,500,000 tons yearly.

Exports of Iron and Steel for which weights are given in the returns amounted during May to 138,514 tons in 1914, and 262,814 in 1915; an increase of 124,330 tons, or 89.8%, this year. The larger gains were in bars and wire rods, billets and ingots, plates and wire.

PITTSBURGH—July 13

Conditions in the steel industry seem to be improving even more rapidly this month than they did in May and June, a remarkable showing considering that July and August are usually dull months in the industry. Bookings by the steel mills have been heavy thus far this month, comparing very favorably with June, and prices are stiffening more or less practically all along the line, even including such items as railroad spikes, chain, shafting, rivets, etc., which are usually slow in showing price advances.

The pig iron and coke markets have become excited and there are predictions of almost sensational price advances. The pig iron market, however, is quite unsettled, on account

of the Lake front furnaces presenting such unusual competition with the Valley furnaces.

The Steel Corporation's contract obligations are reported at 4,678,196 tons at the close of June, showing an increase of 413,598 tons during the month, against a gain of 102,354 tons in May and small losses in April and March. The June increase was equal to about one-third of capacity, while the shipments were about 80% of capacity, so that bookings exceeded capacity by a wide margin.

The bi-monthly wage adjustment at the iron mills showed a realized price on bar iron shipments from the selected mills in May and June above 1.10c., giving the tonnage men in the iron mills 1 to 2% higher wages for July and August.

The steel mills are operating at more than 80% of rated capacity, and openhearth capacity is practically fully engaged, the chief idleness being in bessemer departments, and efforts are being made to divert orders from openhearth to bessemer.

Pig Iron—Two or three Cleveland furnace interests have been selling basic iron over a wider range of territory than formerly, cutting out the Valley and some detached furnaces, and $12 or less at Cleveland furnace has been done. The Youngstown Sheet & Tube Co. is reported to have bought 30,000 to 50,000 tons at a very favorable price. At the same time the Valley furnaces have advanced quotations and are holding basic at $13 and bessemer at $14 at furnace, foundry and malleable remaining at $12.75 and forge at $12.50. The freight to Pittsburgh is 95c. from the Valleys, but on account of the competition of Lake front furnaces foundry and basic seem to be obtainable at about $13.50, delivered Pittsburgh. About 50,000 tons of export bessemer are in the market, 40,000 tons being in one lot, and as copper is barred this seems to shut out eastern bessemer.

Steel—The Pittsburgh mills have been practically out of the billet and sheet bar market for weeks and now the Youngstown mills are withdrawing, being well sold up, at least on openhearth. Consumers in general are well covered by contracts, but odd lots inquired for are drawing higher quotations right along. We quote: Bessemer billets, $20; bessemer sheet bars, $20.50; openhearth billets, $21; openhearth sheet bars, $21.50, f.o.b. maker's mill, Youngstown, the market delivered Pittsburgh being $1 higher.

Ferromanganese—The situation seems to be a shade easier, as contracts are more readily accepted at the regular price, $100, Baltimore, and prompt lots can be picked up at $100@105, Baltimore.

IRON ORE

Lake shipments of iron ore from the Lake Superior region in June were 6,005,091 long tons, an increase of 502,724 tons over June, 1914. From the opening of the season to July 1 the shipments by ports are reported by the Cleveland "Iron Trade Review" as follows:

Port	1914	1915	Changes	
Escanaba	1,076,020	1,248,830	I.	172,810
Marquette	383,948	547,002	I.	163,054
Ashland	883,081	1,161,792	I.	278,711
Superior	3,733,502	1,777,600	D	1,955,902
Duluth	1,779,876	4,295,811	I	2,515,935
Two Harbors	1,767,689	2,490,248	I	722,559
Total	9,621,116	11,521,283	I	1,897,167

The increase from Duluth and the decrease from Superior are due to the termination of the Hill leases.

Sales of local iron ores to Eastern furnace have about reached the capacity of the mines. Foreign ores are nearly cut off by the ocean freight situation. This will probably result in increased sales of Lake ore in the East.

Imports at Baltimore for the week included 6490 tons of manganese ore from Brazil.

SAULT CANAL TRAFFIC

The total tonnage of freight passing through the Sault Ste. Marie Canals in June was 8,360,832 short tons, 7,990,390 tons using the American and 370,442 the Canadian Canal. For the season up to July 1 the total tonnage was in short tons: East bound, 13,006,133; west bound, 4,138,001; total, 17,144,134 short tons, an increase of 299,417 tons over 1914. The total number of vessel passages this year was 2581, showing an average cargo of 3075 tons.

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

	1914	1915	Changes	
Anthracite	702,339	678,852	D	23,487
Bituminous coal	4,038,630	3,022,437	D.	1,016,253
Iron ore	9,112,500	11,072,607	I.	1,960,017
Pig and m'f'd iron	128,388	75,205	D.	53,183
Copper	18,287	41,272	I.	22,985
Salt, bbl.	343,204	232,173	D	111,031

Iron ore was 64.6% and coal 21.6% of the total freight reported this year.

COKE

Coke production of the Connellsville region for the half year to June 30, 1914, is reported by the "Courier" at 7,336,643 short tons; shipments, 7,310,855 tons. Production of the Greensburg and Upper Connellsville district for the half-year was 923,665 tons.

The U. S. Geological Survey estimates the production of bituminous coal in the United States in the first half of 1915 at about 185,000,000 short tons, a decrease of 10% from last year.

Connellsville—Operators have stiffened materially in their views, chiefly on account of better prospects in pig iron and steel, and instead of quoting $1.75 on contract furnace coke for the second half are quoting $1.75 for July or third quarter, and $2 for the half year. On a flurry caused by fear of insufficient supplies over the national holiday spot furnace advanced from $1.50 to $1.75, but has now receded only to $1.60. Foundry remains at $2@2.40 for prompt and $2.20@2.50 for contract, per net ton at ovens.

Anthracite Shipments in June were 5,316,102 long tons, a decrease of 814,084 tons, as compared with June, 1914. For the six months ended June 30 the shipments were 32,945,789 tons in 1914, and 31,595,304 tons in 1915; a decrease of 1,350,485 tons, or 4.1%, this year.

British Fuel Exports, five months ended May 31, in long tons:

	1914	1915	Changes
Coal	28,852,713	18,775,284	D. 10,077,434
Coke	444,446	366,996	D. 77,450
Briquettes	852,326	509,471	D. 342,855
Steamer coal	8,500,680	6,334,542	D. 2,166,138
Total	38,650,170	25,986,293	D. 13,663,877

The total decrease was 35.3%, and was due entirely to war conditions.

Chemicals

NEW YORK—July 14

General market conditions have not materially changed. In some lines there is a good deal of activity, but others remain rather quiet.

Arsenic remains quiet but steady, with supplies sufficient for the demand. Quotations are steady at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—The market shows a good demand and prices are steady at $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda continues in good demand and the market is strong and steady. Current quotations are firm at 2.35c. per lb. for spot and for all positions this year.

Potash Salts—U. S. Consul T. J. Albert at Brunswick, Germany, reports that the German market for potash is weak for this season of the year. It is hoped that the demand for manure salts will be more active in the fall and that difficulties of railroad transport will not again occur. The ocean export to foreign countries has ceased, since the Government issued its decree forbidding such export. Shipments to Austria-Hungary were not affected by the decree, and shipments to the Scandinavian countries and the Netherlands are allowed. On the other hand, shipments to Italy have been limited. The value of the exports of potash for the first four months of the present year amounted to $8,277,650, as compared with $11,840,403 for the same period in 1914. The decrease in the month of April was $1,230,609 as compared with April last year.

Pyrites—Imports at Baltimore for the week included 6887 tons of pyrites from Huelva, Spain.

PETROLEUM

Exports of mineral oils from the United States in May were 225,254,580 gal., or 30,303,984 gal. more than in May, 1914. For the five months ended May 31 the total exports were 803,071,386 gal. in 1914, and 866,456,249 gal. in 1915; a decrease of 36,615,137 gal., or 3.9%, this year.

The London "Petroleum Review" says that the latest information available is that the situation on the Galician oil fields is very serious. The whole of the remaining staffs have hurriedly left the oil-field region, many of them now being in Lwow. According to the "Pester Lloyd," the stocks of oil on the fields and at the refineries have been destroyed, while a fire which has been raging round Boryslaw-Tustanowice for several days has completely destroyed the majority of the derricks. It is reported that practically every operating company in the fields has suffered very considerable damage to its property.

Mining Companies—United States

Name of Company	and Situation	Shares Issued	Par	Dividends Total	Latest	Amt
Acacia, g	Colo	1,454,304	$ 1	$ 122,004	Jan '11	$0 01
Adams, s.l c	Colo	1,438,989	10	778,000	Dec. '09	0 04
Ahmeek, c	Mich	80,000	25	2,550,000	Apr. '15	3 00
Alaska Mexican, g	Alas.	50,000	5	3,489,381	May '15	0 20
Alaska Treadwell, g	Alas	180,000	25	15,285,000	May '15	1 00
Alaska United, g	Alas.	200,000	5	1,865,070	May '15	0 40
Am. Zinc, Lead & Sm.	U. S	180,200	25	983,320	Jan. '14	0 50
Anaconda, c	Mont	168,647	25	95,410,625	Apr. '15	0 25
Argonaut, g	Calif	1,942,50	5	1,660,000	June '15	0 10
Arizona Copper, pf.	Ariz	200,000	20	2,121,274	May '15	
Arizona Copper, com.	Ariz	1,426,120	20	17,092,498	Feb. '15	0.18
Bagdad-Chase, g., pf.	Calif	1,519,890	5	202,391	Jan. '09	0 10
Baltic, c	Mich.	84,819	25	7,950,000	Dec. '13	2 00
Bingham N. H., c	Utah	100,000	5	408,564	Mar. '15	0 10
Bonanza Dev., g	Colo	228,690	1	1,425,000	Oct '11	0 20
Brunswick, g	Calif	395,287	1	179,597	June '15	0.06
Bunker Hill Con., g.	Calif	300,000	1	840,000	June '15	0 02½
Bunker Hill & Sul., l.s.	Ida	200,000	10	16,200,750	June '15	0 25
Butte-Alex Scott, c.	Mont	327,000	10	148,000	Oct. '13	0 50
Butte & Ballaklava, c.	Mont.	74,000	10	125,000	Aug. '10	0 50
Caledonia, l.s.c	Ida	250,000	1	494,900	June '15	0 02
Calumet & Arizona, c.	Ariz	617,385	10	21,559,443	June '15	0 50
Calumet & Hecla, c	Mich	616,758	25	126,250,000	June '15	5 00
Camp Bird, g.s	Colo	100,000	5	10,318,109	Jan. '15	0 08½
Centen'l-Eur., l.s.g.c.	Utah	1,100,051	5	4,050,000	Apr. '14	1 50
Center Creek, l.z.	Mo	100,000	10	526,000	Apr. '15	0 05
Champion, c	Mich	100,000	25	9,500,000	June '15	1.00
Chief Consolidated, s.g.l.	Utah	871,384	1	262,983	Aug '14	0 05
Chino, c	New Mex	777,458	5	5,175,560	June '15	0 75
Cliff, g	Utah	864,820	1	90,000	Jan. '13	0 10
Cliff, g	Alas	300,000	1	210,000	Oct '13	0 01
Colo. Gold Dredging	Colo	100,000	10	650,000	Sept. '14	1 00
Colorado, l.s.g	Utah	100,000	0 20	2,570,000	Dec '12	0 03
Columbus Con., g.s	Utah.	1,000,000	5	226,832	Oct. '07	0 20
Commercial Gold	Ore.	285,540	1	43,750	Dec. '10	0 00½
Con. Mercur, g	Utah.	1,000,000	1	3,445,313	July '13	0 03
Continental, z.l.	Mo	22,000	25	330,000	Jan. '15	0 50
Copper Range Con., c.	Mich	393,692	100	13,986,746	Oct. '13	0 75
Daly Judge, s.l.	Utah	300,000	1	945,000	Apr '15	0 15
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan '13	0 15
Doctor Jackpot, g	Colo	3,000,000	0 10	45,000	Mar '11	0 00½
Doe Run, l	Mo	65,783	100	3,550,969	Dec '13	0 76
Eagle & Blue Bell, g s.l.	Utah.	893,146	1	312,691	Oct. '14	0 05
Elkton Con., g	Colo	2,500,000	1	3,579,460	May '15	0 02
El Paso, g	Colo	490,000	5	1,707,545	Feb. '14	0 10
Ernestine, g.s	N M	300,000	5	120,000	Dec. '12	0 05
Fed. M. & S., com	Idaho.	60,000	100	2,708,750	Jan '09	1 50
Fed. M. & S., pf	Idaho.	120,000	100	9,856,503	June '15	1 00
Florence, g	Nev	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g	Nev.	912,000	1	546,000	Jan. '08	0 05
Free Coinage, g	Colo	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g	Calif.	200,000	2 50	258,000	Oct. '14	0 02
Frontier, z	Wis	1,250	100	146,202	Nov. '13	2 00
Gemini-Key'ne, l.g.s	Utah.	5,000	100	2,305,000	Dec. '14	10 00
Gold Chain, g	Utah	1,000,000	1	130,000	May '13	0 03
Gold Coin of Victor.	Colo	1,000,000	1	1,350,000	Feb. '09	0 02
Gold Dollar Con	Colo	2,500,000	0 10	100,000	Dec. '12	0 00½
Gold King Con., g	Colo	5,750,370	1	1,407,319	Dec '11	0 03
Golden Cycle, g	Colo	1,500,000	5	3,990,000	June '15	0 02
Golden Star, g	Ariz	400,000	5	140,000	Mar '10	0 05
Goldfield Con., g	Nev	3,558,367	10	27,932,086	Feb. '15	0.10
Grand Central, g	Utah.	500,000	1	1,620,750	Sept. '14	0 05
Granite, g	Colo	1,650,000	1	270,000	Nov. '12	0 01
Hazel, g	Cal	900,000	1	971,000	Dec. '13	0 01
Hecla, l.s	Idaho.	1,000,000	0 25	3,280,000	June '15	0 02
Hercules, l.s	Idaho.	1,000,000	1	5,725,000	June '15	
Homestake, g	S D	218,400	100	37,824,478	July '15	0 65
Horn Silver, l.s.z	Utah.	400,000	25	5,642,000	Sept. '07	0 05
Iowa, g.s.l	Colo	1,666,667	1	233,499	Aug '14	0 00½
Iowa-Tiger Leasing g.s.	Colo	12,655	1	9,250	Dec '14	1 00
Iron Blossom, s.l.g.	Utah.	1,000,000	0 10	2,370,000	Apr '15	0 10
Iron Silver, s.l.g	Colo	500,000	20	4,950,000	Dec. '14	0 10
Jamison, g	Cal	390,000	10	378,300	Jan. '11	0 02
Jerry Johnson, g	Colo	2,500,000	0 10	187,500	Nov. '14	0 01
Kendall, g	Mont	500,000	5	1,505,000	July '14	0 06
Kennedy, g	Cal	100,000	100	1,831,001	Apr. '10	0 03
King of Arizona, g	Ariz	200,000	1	396,000	Aug '09	0.12
Klar Piquette, z.l	Wis	20,000	1	259,000	Apr. '13	0.50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct. '13	0 00½
Liberty Bell, g	Colo	133,552	5	1,559,179	Sept. '13	
Little Bell, l.s	Utah	300,000	1	75,000	Mar. '11	0.05
Little Florence, g	Nev	1,000,000	1	430,000	Jan. '08	0 03
Mammoth, g.s.c	Utah	400,000	25	2,300,000	July '13	0 05
Mary McKinney, g	Colo	1,300,252	1	1,169,308	July '14	0.02
May Day, g.s l	Utah.	800,000	0 25	196,000	May '15	0 02
Mexican, g.s	Nev.	201,600	2 50	161,910	June '14	0 75
Miami, c	Ariz	746,759	5	4,085,629	May '15	0 50
Modoc, g s	Colo	500,000	1	275,000	Dec. '11	0 01
Mohawk, c	Mich	100,000	25	3,375,000	Feb. '15	1 00
Monarch-Mad'a, g.s.l	Colo	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev	921,865	1	488,588	Dec. '12	0 10
Mountain, c	Cal	250,000	25	4,216,250	May '08	0 44
National, g	Nev	770,000	1	570,000	May '11	0 10
Nevada Con., c	Nev	1,999,521	5	18,226,345	June '15	0 37½
New Century, z.l	Mo	330,000	1	237,600	Oct. '09	0 01
New Idria, q	Cal	100,000	5	1,680,000	Apr. '14	0 10
North Butte, c	Mont	410,000	15	11,890,000	July '14	0 50
North Star, g.	Cal	250,000	10	4,637,040	June '15	0 20
Old Domin'n, M. & Sm.	Ariz	162,000	25	7,290,000	June '15	0 50
Ophir, s.g	Nev	201,600	3	2,068,360	Jan. '12	0 10
Opohongo, g.s.l.	Utah	898,978	0 25	80,907	Jan. '13	0 02
Oroville Dredging	Cal	700,000	5	1,692,568	June '15	0.12
Osceola, c	Mich	96,150	25	12,371,998	Apr. '15	2.00
Parrot, c	Mont	229,850	10	7,497,189	May '15	0 15
Pearl Con., g	Wash.	1,909,711	0 05	181,422	Dec. '10	0 02
Pharmacist, g	Colo	1,500,000	1	7,500	Feb. '10	0 00½
Pioneer, g	Alas	5,000,000	1	2,041,526	Oct. '11	0 03
Pittsburgh-Idaho, l.	Iad	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g	Nev.	2,790,000	1	771,200	July '14	0 02
Portland, g	Colo	3,000,000	1	9,903,080	Apr. '15	0 02
Quilp	Wash.	1,500,000	1	67,500	Feb. '12	0 01
Quincy, c	Mich	110,000	25	21,227,500	June '15	2 00

Mining Companies—United States—(*Continued*)

Name of Company	and Situation	Shares Issued	Par	Dividends Total	Latest	Amt
Ray, c	Ariz	1,482,436	$ 10	$3,812,160	June '15	$0 37½
Republic, g	Wash.	1,000,000	1	170,000	Nov. '12	0 01½
Rochester, l z	Mo	4,900	100	190,846	July '12	0 50
Round Mountain, g	Nev	866,126	1	363,365	Aug. '13	0 04
Seven Troughs Coal., g	Nev	1,500,000	1	75,000	Mar. '15	0 02½
St Joseph, l	Mo	1,472,252	10	9,492,710	Mar '15	0 05
Shannon, c	Ariz	300,000	10	750,000	Jan. '13	0 50
Shattuck-Arizona, c	Ariz	350,000	10	2,275,000	Feb. '15	0 50
Silver King Coal., l s	Utah.	1,250,000	5	2,722,385	Apr '15	0 15
Sioux Con., s l g.	Utah.	745,389	1	872,097	July '11	0 04
Skidoo, g	Cal	1,000,000	5	365,000	Oct '14	0 01
Snowstorm, c g	Ida	1,500,000	1	1,192,103	Oct '13	0 02
South Eureka, g	Calif	249,981	1	391,880	Feb. '15	0 05
Standard Con., g s.	Cal	178,394	10	5,274,407	Nov '13	0 25
Stratton's Ind., g	Colo	1,000,000	0 60	456,625	Dec. '14	0 03
Success, z	Ida	1,500,000	1	600,000	June '15	0 03
Superior & Pitts., c	Ariz	1,499,792	10	8,878,778	Mar '15	0 20
Tamarack, c	Mich	60,000	25	9,420,000	July '07	4 00
Tennessee, c	Tenn.	200,000	25	4,606,250	Apr '15	0 75
Tomboy, g s.	Colo	310,000	4 85	3,634,065	Dec '14	0 48
Tom Reed, g	Ariz	909,555	1	2,443,757	Apr '15	0 06
Tonopah Belm't, s g.	Nev	1,500,000	1	7,268,010	Apr '15	0 12½
Tonopah Ext., g s	Nev	943,433	1	778,331	Apr. '15	0 07½
Tonopah of Nev., s g	Nev	1,000,000	1	12,600,000	Apr. '15	0 25
Tri-Mountain, c	Mich	100,060	25	1,450,000	Dec. '13	2 00
Tuolumne, c	Mont.	800,000	1	520,000	May '13	0 10
Uncle Sam, g s l	Utah	500,000	1	495,000	Sept. '11	0 05
United Cop. Min., c.	Wash	1,000,000	1	40,000	Nov. '12	0 01
United (Crip. Ck.) g	Colo	4,000,100	1	440,435	Jan. '10	0 04
United Globe, c	Ariz	23,000	10	2,127,500	Dec. '14	7 00
United Verde, c.	Ariz	300,000	10	34,822,000	Feb. '15	0 75
Utah, s l	Utah	100,000	10	281,860	Dec. '10	0 02
Utah, c	Utah.	1,624,290	10	27,016,180	Mar. '15	0.75
Utah Con., c	Utah.	300,000	5	8,700,000	Mar. '15	0.50
Valley View, g	Colo	1,000,000	1	210,000	Dec. '10	0.04
Victoria, g.s l	Utah.	250,000	1	207,500	Mar. '10	0 04
Vindicator Con., g	Colo	1,500,000	1	3,172,060	Apr '15	0 03
Wasp No. 2, g	S D	500,000	1	469,466	May '15	0 00½
Wellington Mines, g	Colo	10,000,000	1	350,000	July '13	0 00½
Wolverine, c	Mich	60,000	25	8,220,000	Apr. '14	2 00
Yak, s.l	Colo	1,000,000	1	1,847,685	Dec. '14	0 02
Yankee Con., g.s	Utah.	1,000,000	1	167,500	Jan. '13	0 01
Yellow Aster, g	Cal	100,000	10	1,163,789	May '15	0 02
Yellow Pine, l z s.	Nev.	1,000,000	1	481,008	Mar. '15	0 01
Yukon Gold, g	Alas	3,500,000	5	6,884,500	Mar '15	0 07½

Iron, Industrial and Holding Companies

Amalgamated, c	Mont.	1,538,879	$100	$92,484,306	May '15	$0.50
Am. Sm. & Ref., com	U. S.	500,000	100	28,333,333	June '15	1 00
Am. Sm. & Ref., pf	U. S.	500,000	100	52,208,333	June '15	1.75
Am. Smelters, pf. A.	U. S	170,000	100	10,022,350	Apr. '15	1.50
Am. Smelters, pf. B.	U. S	300,000	100	14,750,000	Apr. '15	1.25
Greene Cananea	U. S	450,642	100	4,371,646	June '14	1.00
Guggenheim Expl.	U. S	380,315	25	21,655,763	Jan. '15	0 87½
Inter'l Nickel, com	U. S	115,826	100	17,704,109	June '15	5.00
Inter'l Nickel, pfd	U. S	89,126	100	8,492,180	May '15	1.50
National Lead, com.	N. Y.	206,554	100	8,570,801	Mar. '15	0.75
National Lead, pf	N. Y.	243,676	100	29,693,093	Mar '15	1.75
Old Dominion, c.	Ariz	293,245	25	6,000,390	Mar. '15	0.50
Phelps, Dodge & Co.	U. S	450,000	100	38,234,304	Mar. '15	3.50
U. S. Steel Corp., com	U. S	5,083,025	100	222,360,438	Dec. '14	0.50
U. S. Steel Corp., pf	U. S	3,602,811	100	376,903,174	May '15	1.75
U. S. S., R. & M., com	U. S.-Mex	486,348	50	6,362,188	July '14	0.75
U. S. S., R. & M., pf.	U. S.-Mex	351,114	50	15,518,569	Apr '15	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g s	Mex	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g.s	Mex.	2,000,000	1	1,580,884	Feb. '15	0.03
B. C. Copper	B. C.	591,709	5	615,198	Jan. '13	0 15
Beaver Con., s	Ont	1,996,490	1	529,857	Apr. '15	0.03
Buffalo, s	Ont	1,000,000	1	2,757,000	July '14	0.03
Canadian Goldfields, g	B. C.	600,000	0 10	290,000	July '14	0.001¼
Chontalpan, g s l z	Mex.	7,000	25	59,500	May '14	0.75
Cobalt Townsite, s	Ont	45,000	1	1,042,259	May '14	0.10
Coniagas, s.	Ont	800,000	5	7,480,000	May '15	0.30
Con. M. & S. Co. of Can	B. C	58,052	100	1,942,809	Apr '15	2.00
Crown Reserve, s.	Ont	1,768,814	1	6,031,654	Apr. '15	0 02
Crow's Nest Pass C. Co	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dos Estrellas, g s.	Mex	300,000	0 50	10,335,000	Dec. '13	1.50
El Oro, g s.	Mex.	1,147,500	4 85	8,668,418	July '13	0.24
Esperanza, s g.	Mex.	455,000	4 85	13,162,151	Mar. '15	0.24
Granby, s l c.	B. C.	148,496	100	5,533,457	June '14	1.50
Greene Con., c	Mex.	1,000,000	10	9,544,400	May '14	0.50
Guanajuato D., pf., s	Mex	10,000	1000	274,356	Jan '11	3.00
Hedley Gold.	B. C.	120,000	10	1,644,000	June '15	0 50
Hollinger, g	Ont	600,000	5	3,453,000	July '15	0.20
Kerr Lake s.	Ont	600,000	5	5,670,000	Mar '15	0 25
La Rose Con., s	Ont	1,498,627	5	5,349,656	Apr '15	0 25
Le Roi No. 2, g	B. C.	120,000	24.30	1,501,740	May '15	0 24
Lucky Tiger Com., g.	Mex.	715,337	10	3,069,960	June '15	0.09
McK.-Dar. Sav. s	Ont	2,247,692	1	4,405,471	Feb. '15	0.03
Mines Co. of Am. (new)	Mex.	1,700,000	10	*1,215,000	July '13	0 12½
N. Y. & Hond. Ros., g	C. A.	200,000	10	3,670,000	Apr '15	0 30
Nipissing, s.	Ont	1,200,000	5	12,990,000	Apr '15	0 25
Peñoles, s l g	Mex	80,000	25	6,361,688	June '13	1 25
Peregrina M. & M., pf.	Mex.	10,000	100	328,656	Sept '10	3 50
Pinguico, pf., s.	Mex.	20,000	100	840,000	Oct. '13	3 00
Right of Way Mns†.	Ont	1,685,500	1	219,115	Nov '14	0 02
Rio Plata, s.	Mex.	374,518	5	345,745	Feb. '13	0 05
San Rafael, g s	Mex.	2,400	25	1,442,380	Jan '14	0 50
San Toy, g.s	Mex.	5,750,000	1	530,000	July '13	0 01
Sorpresa, g.s	Mex.	19,200	20	3,979,240	Jan. '11	34 00
Stand'd Silver-Lead	B. C.	2,000,000	1	1,550,000	Sept. '14	0 02½
Temiskaming, s	Ont	2,500,000	1	1,384,155	Apr. '13	0 06
Tem. & Hud. Bay, s	Ont	7,761	1	1,940,250	Nov. '14	3 00
Trethewey, s	Ont	1,000,000	1	1,061,998	July '14	0 05
Wettlaufer-Lorrain, s	Ont	1,416,590	1	637,465	Oct. '13	0 05

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

Assessments

Company	Delinqe	Sale	Amt.
Blue Bell, Ida	July 5	Aug. 4	$0.003
Blue Star, Ida	June 19	July 10	0 01
Carbonate, Ida	June 23	July 23	0 001
Challenge Con., Nev	July 12	Aug. 4	0 05
Con. Virginia, Nev	July 19	Aug. 10	0 05
*Contact Copper, Mich		July 14	0.50
Contact Copper, Mich	May 15		0.50
Four Timbers, Ida	July 28	Aug. 28	0 001
Hancock Cons., Mich.	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1.00
Houghton, Mich	May 25		1.00
Idaho-Nevada, Ida	July 14	Aug. 6	0 001
Iron Mask, Ida	July 1	Aug. 10	0.002
Ivanhoe, Ida	July 12	Aug. 12	0 002
Majestic-Idol, Nev	Dec. 15	July 20	0 005
Mayflower, Ida	June 15	July 17	0 005
Michigan Copper, Mich	July 19		1.00
Mineral Range, Utah	May 24		0 003
Monarch Pitts, Nev	June 14	July 14	0 01
Moonlight, Ida	June 5	July 8	0 005
Nabob, Ida	July 5	Aug. 2	0.005
New Arcadian, Mich	June 1		0 50
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	July 15		0 50
New Baltic, Mich	Jan. 15		0 50
New Yerrington Cop., Nev	July 9	July 27	0 01
Nevada Douglas, Nev	July 21	Aug. 18	0 10
North Bunker Hill, Ida	June 12	July 17	0 002
Old Veteran, Ida	July 5	July 31	0 002
Rainbow, Ida	July 7	Aug. 7	0 002
Rescue-Eula, Nev	July 14	Aug. 19	0 01
Revelator, Utah	Aug. 17	Sept. 3	0 00½
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Rhode Island, Ida	June 24	July 24	0 001
Sierra Nevada, Nev	July 27	Aug. 16	0.05
Silver Pick, Nev	June 5	July 12	0 01
Sonora, Ida	July 23	Aug. 31	0 004
Springfield, Ida	July 30	Aug. 30	0.002
Sunrise, Ida	July 17	Aug. 17	0 002
Sunset Dev., Ida	June 30	July 24	0 0025
Tarbox, Ida	July 17	Aug. 7	0.0025
Umatilla Tonopah, Nev	July 12	Aug. 16	0 01
Virginia, Ida., (post)	July	29	0.02
West Tonopah Con., Nev	July 10	Aug. 10	0.01
Wyandot, Mich	July 28		1.00

*This assessment was levied and payable Apr. 27, '14.

Stock Quotations

Zinc stocks were especially active during the week, American Zinc, Lead & Smelting touching $60 on July 13. Auction sales of securities included: 3000 Princeton Copper M. & S., $1 ea., $4 lot; 2100 Union Canada-Cobalt, Venture Corp., $1 ea., $4 lot; 300 Silver Eagle M., $1 ea., $1 lot; 2900 Sporting Times Ms. Corp., $1 ea., $2 lot.

COLO. SPRINGS	July 13	SALT LAKE	July 13
Name of Comp.	Bid.	Name of Comp	Bid.
Acacia	03½	Beck Tunnel	.04
Cripple Cr'k Con.	007	Black Jack	.09
C. K. & N.	03	Colorado Mining	.10
Doctor Jack Pot	.10½	Crown Point	.01½
Elkton Con	.38½	Daly-Judge	7 25
El Paso	94	Gold Chain	.25
Findlay	.03	Grand Central	.61
Gold Dollar	02	Jim Blossom	70
Gold Sovereign	03½	Little Bell	10
Golden Cycle	1.79½	Lower Mammoth	03½
Isabella	17½	Mason Valley	2 25
Jack Pot	06½	May Day	21
Jennie Sample	‡ 02	Opohongo	00½
Jerry Johnson	04½	Prince Con	.76
Lexington	‡ 005	Seven Troughs	.01
Mary McKinney	.37	Silver King Coal'n	3 52½
Pharmacist	005	Silver King Con	2 17½
Portland	1.40	Sioux Con	.02
Raven B. H.	‡ 02	Uncle Sam	.04
Vindicator	1 74	Yankee	03½

TORONTO	July 13		
Bailey	02	Dome Exten	13
Conlagas	4 75	Foley O'Brien	29
Peterson Lake	22	Hollinger	26 00
Right of Way	03	Imperial	05
Seneca Superior	35	Jupiter	09
Silver Queen	01	McIntyre	51
T. & Hudson Bay	17 00	Pearl Lake	01
Timiskaming	34	Porcu Crown	70
Wettlaufer-Lor	02	Preston E. D	02
Dome Mines	20 37½	Rea	07

SAN FRANCISCO	July 3		
Comstock Stocks		Miscellaneous	
Alta	‡ 04	Belmont	4 00
Andes	08	Jim Butler	96
Belcher	30	Lone Star	05
Best & Belcher	07	MacNamara	02
Caledonia	33	Midway	.16
Challenge Con	07	Mont.-Tonopah	17
Confidence	10	North Star	15
Con. Virginia	09	Rescue Eula	08
Gould & Curry	04	West End Con	80
Hale & Norcross	05	Atlanta	32
Julia	02	Booth	53
Mexican	40	C O D Con	03
Occidental	70	Comb. Frac	08
Ophir	18	Jumbo Extension	1 65
Overman	07	Pitts-Silver Dyke	08
Potosi	02	Round Mountain	52
Savage	04	Sandstorm Kendall	06
Sierra Nevada	07	Silver Pick	10
Union Con	20	Central Eureka	16
Yellow Jacket	30	So. Eureka	1 50

N. Y. EXCH.	July 13	BOSTON EXCH	July 13
Name of Comp.	Clg.	Name of Comp.	Clg.
Amalgamated	73½	Adventure	2
Am.Sm.&Ref.,com	77½	Ahmeek	395
Am. Sm. & Ref., pf.	106½	Alaska Gold M	37½
Am. Sm. Sec., pf. B	79	Algomah	2½
Anaconda	34½	Allouez	54
Batopilas Min	1½	Am. Zinc	58½
Bethlehem Steel	174½	Ariz. Com. cfts.	7 7/8
Bethlehem Steel, pf.	117	Bonanza	37
Chino	46	Butte-Ballaklava	2½
Colo. Fuel & Iron	33	Butte & Superior	71½
Federal M. & S., pf.	48	Calumet & Ariz.	63½
Great Nor., ore., ctf.	35½	Calumet & Hecla	565
Guggen. Exp.	62½	Centennial	18
Homestake	119	Cliff	11½
Inspiration Con.	30½	Copper Range	54½
Mex. Petroleum	71½	Daly West	21
Miami Copper	27½	East Butte	12½
Nat'l Lead, com.	63½	Franklin	9½
National Lead, pf.	107	Granby	86½
Nev. Consol.	14½	Hancock	17½
Ontario Silv.	2½	Hedley	28½
Quicksilver, pf.	3½	Helvetia	40
Ray Con.	23½	Indiana	5
Republic I&S, com.	29½	Island Cr'k, com.	49½
Republic I&S, pf.	90	Island Cr'k, pfd.	89½
Sloss-Sheff'd, com.	35½	Isle Royale	28
Tennessee Copper	37½	Keweenaw	2½
Utah Copper	67½	Lake	13½
U. S. Steel, com	60½	La Salle	6½
U. S. Steel, pf.	109½	Mass	12½
		Mayflower	4½
		Michigan	1½
		Mohawk	72
		New Arcadian	11½
		North Butte	30½
		North Lake	2
		Ojibway	1½
		Old Colony	3½
		Old Dominion	53
		Osceola	84
		Quincy	86
		Santa Fe	2½
		Shannon	8½
		Shattuck-Ariz	27½
		Superior	28
		Superior & Bost	3
		Tamarack	36
		Trinity	4½
		Tuolumne	45
		U. S. Smelting	41½
		U. S. Smelt'g, pf.	45½
		Utah Apex	4½
		Utah Con	13½
		Victoria	2½
		Winona	4
		Wolverine	61
		Wyandot	55

N. Y. CURB	July 13
Name of Comp.	Clg.
Alask a Juneau	13
Alta Con	.89
Beaver Con	31
Big Four	.05
Blue Bell	02
Braden Copper	6½
Buffalo Mines	.50
Can Cop Corpn	1
Can G & S	‡.05
Carlson	‡.50
Cashby	.06
Chambers Ferland	.20
Chile Cop	19½
Con Ariz Sm	1½
Con. Coppermines	‡21
Con. Nev.-Utah	1 7/8
Davis-Daly	11
Dhmchield-Daisy	.04
Dla Black B	.03½
Florence	‡.53
Goldfield Con	1 7/8
Goldfield Merger	24
Greene Cananea	38½
Kennecott Cop	32½
Kerr Lake	4½
La Rose	.50
McKinley-Dar-Sa	23
Majestic	.78
Mines of Am	12½
Nevada Hills	22
New Utah Bingham	3½
Nipissing Mines	5½
Ohio Copper	.20
Oro	.09
South Utah	1½
Standard Oil of N.J.	398
Standard S. L.	11½
Stewart	2 5/8
Tonopah	7 7/8
Tonopah Ex	2 15/16
Tonopah Merger	.40½
Tribullion	5/8
Tularosa	1 7/16
Yukon Gold	‡21

LONDON	July 1
Alaska Treadwell	£7 7s 6d
Cam & Motor	0 14 3
Camp Bird	0 5 0
El Oro	0 7 6
Esperanza	0 8 0
Mexico Mines	3 7 6
Oroville	0 14 0
Santa Gert'dis	0 7 6
Tomboy	1 2 0
Tough Oakes	0 8 6

BOSTON CURB	July 13
Name of Comp.	Bid.
Alvarado	.70
Bingham Mines	8½
Boston Ely	.29
Butte & Lon'n Dev	28
Calaveras	1½
Calumet-Corbin	.04
Chief Con	1 1/2
Corbin	‡.50
Cortez	40
Crown Reserve	.50
Eagle & Blue Bell	1½
First Nat'l Cop	2½
Houghton Copper	3½
Iron Cap Cop., pf	5½
Majestic	81
Mexican Metals	23
Nevada-Douglas	47
New Baltic	3
Oneco	1½
Raven Copper	.09
Smokey Dev	.15
So. Lake	16½
Tonopah Victor	.32
Trethewey	.10
United Verde Ext	41½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.855	28 983	26 553	22.734
February	61 642	57 506	48.477	28 357	26 573	22.753
March	57 870	58 067	50.241	26.669	26 788	23.708
April	59 403	58.519	50.250	27.416	26 958	23.709
May	60 361	58.125	49.915	27 825	26 704	23.570
June	58 980	56.471	49.034	27 199	25 948	23.267
July	58 721	51.678		27 074	25 219	
August	59 293	54 344		27 335	25 979	
September	60 640	53.290		27 986	24 290	
October	60 793	50.654		28 083	23 199	
November	58 905	49 0.2		27.263	22 793	
December	57 760	49 375		26 720	22 900	
Year	59 791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14 223	13.641	64.304	60. 756	69.488	65.719
February	14 49	14 394	65.259	63 494	70.188	*
March	14.131	14.787	64.276	66. 152	69.170	*
April	14.211	16.811	64. 747	75. 069	69.313	*
May	13.99	18. 506	63. 182	77. 600	67.786	*
June	13.603	19 477	61. 336	82 574	66 274	95.333
July	13.223		60. 540		64 955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53. 227		*	
December	12.801		56. 841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34 260	171.905	156.550
February	39.830	37. 415	181. 556	176.925
March	38. 038	48. 426	173. 619	180.141
April	36.154	47 884	163. 963	166.225
May	33.360	38. 790	150. 702	162. 675
June	30. 577	40. 288	138. 321	167. 636
July	31. 707		142. 517	
August	*		‡	
September	32. 675		‡	
October	30. 284		‡	
November	33. 304		1 9. 391	
December	33. 601		147. 102	
Av. year	34 301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4 048	3.827	3 937	3. 718	19.606	19.122
March	3. 970	4.053	3 850	3. 997	19. 651	21.883
April	3.810	4.221	688	4. 142	18. 225	21.094
May	3.900	4.274	3. 808	4. 182	18. 503	20.347
June	3. 900	5. 932	3 810	5. 836	19. 411	25.170
July	3.891		3 738		19. 051	
August	3. 875		3 715		‡	
September	3.828		3 658		‡	
October	3. 528		3 384		‡	
November	3. 683		3. 585		18. 500	
December	3. 800		3. 662		19. 097	
Year	3. 862		3. 737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5. 262	6. 386	5. 112	6. 211	21. 533	30. 844
February	5. 377	8. 436	5. 228	8. 255	21 413	39. 819
March	5 250	8. 541	5. 100	8. 360	21. 460	44. 141
April	5. 113	10. 012	4. 963	9. 837	21. 569	49. 888
May	5 074	14. 781	4. 924	14. 610	21. 393	68. 100
June	5 000	21. 208	4. 850	21. 038	21. 345	100. 614
July	4 920		4. 770		21. 568	
August	5 568		5 418		‡	
September	5. 380		5. 230		‡	
October	4 909		4. 750		‡	
November	5 112		4. 962		25. 016	
December	5. 592		5. 430		27. 369	
Year	5. 213		5 061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.59	$13. 23	$13. 45	$13.99	$13.90
February	15. 06	14. 55	14. 12	13. 45	14. 08	13. 90
March	15 07	14. 55	13. 94	13. 45	14. 10	13. 95
April	14. 90	14. 55	13. 90	13. 45	14. 13	13. 95
May	14. 90	14. 61	13. 90	13. 60	14 27	13. 83
June	14. 90	14. 70	13. 90	13. 67	13. 96	13. 77
July	14 90		13 90		13. 90	
August	14. 90		13 90		14 08	
September	14 90		13 90		14 03	
October	14. 84		13 75		13. 97	
November	14. 59		13. 43		13. 83	
December	14. 70		13. 45		13. 83	
Year	$14 88		$13 78		$14 01	

The Engineering and Mining Journal

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Arizona Copper Co.'s Dorr Thickener

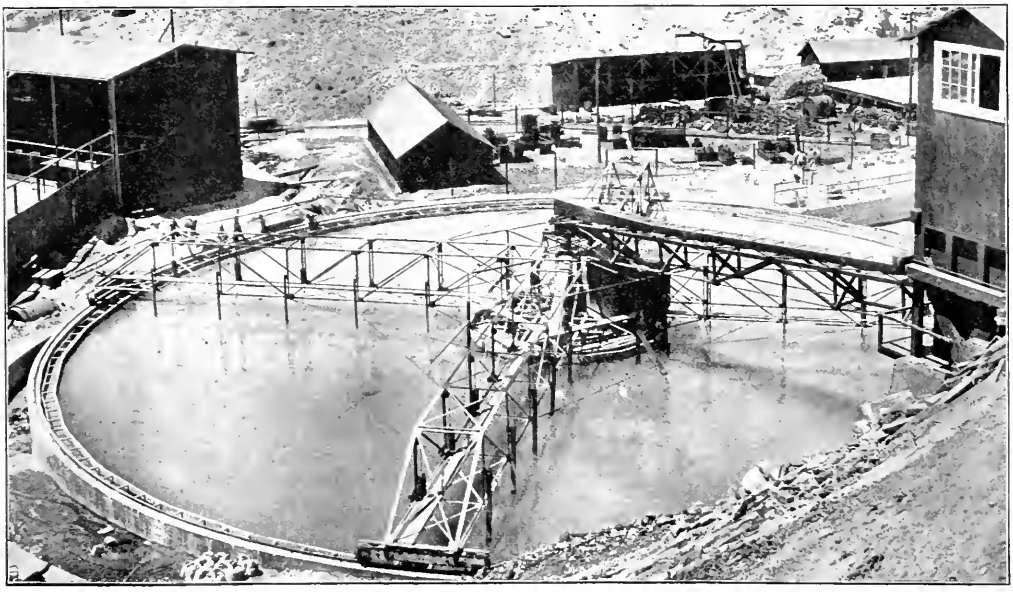
By David Cole*

SYNOPSIS—The largest Dorr thickener ever constructed, 130 ft. in diameter, is used to recover water from the tailings of the concentrating mill. The tank is built of concrete, with a central pier and a peripheral track for sustaining the trusses which carry the scrapers. The operation of the machine has been entirely successful.

All of the milling in the Clifton-Morenci district was primarily done in the drainage area of Chase Creek on rough ground so situated that the tailings would gravitate into the San Francisco River, which empties into the Gila within a few miles of Clifton.

On the Gila, below the mouth of the Frisco, a prosperous farming community has grown up, using the river water for irrigation purposes, and as the irrigation system became more fully developed and all of the low-stage water of the Gila used, the tailings became a menace to the operations of the farmers. Realizing this, the mining companies constructed impounding dams, but on account of the long drainage areas above them, and the precipitous ground upon which they were built, these dams could not be sufficiently protected against floods. A serious break in 1906 brought the matter into the courts and the companies were forever enjoined from allowing any of the tailings to enter the streams.

The Detroit Copper Mining Co. found it feasible to tunnel a small divide and, by using a long flume suspended on the sides of a cliff, reach suitable ground in the drainage area of Morenci Cañon, upon which the tailings could be successfully impounded; but the Arizona Copper Co.'s No. 5 mill was not so favorably situated and this company found it necessary, in order to reach suitable ground upon which to deposit tailings, to move its milling operation to Morenci. Since the mill and mine would then be close together it was decided to fill the square-set stopes of the



ARIZONA COPPER CO.'S DORR THICKENER
A view of the machine from above, showing the trusses which carry the rakes

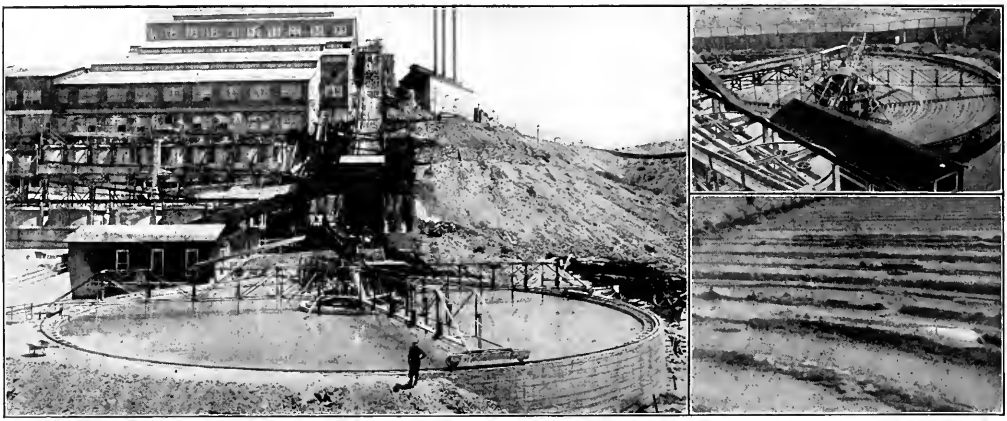
*Consulting engineer, Arizona Copper Co., Morenci, Ariz.

Longfellow mines with the coarsest part of the sand tailings made at the mill, and the large circular tank, which has now been transformed into the largest Dorr thickener and is the subject of the following remarks, was constructed as part of the apparatus devised for reclaiming the sands.

The tank is 130 ft. in diameter and 10 ft. deep, and is divided into several compartments so that one can be emptied while the others are filling. A hollow pier 21 ft. in diameter was constructed in the center of the tank, and a powerful revolving electric crane with long boom and grab bucket was put upon this pier and used for dipping out the sands and delivering them to the skips provided for hoisting the product to the mine level. It was soon discovered that the wet tailings were not good in the mine, and that earth embankments on the tailings ground made poor as well as expensive dams in which to impound slimes, and that the value of the sands in the construction of the tailings dams outweighed their value as filling material. So the electric hoist was removed from the pier and the round tank was arranged with a bottom as illustrated by the accompanying photographs, which show clearly the method of construction and how the thickener appears when in operation.

No trouble has been experienced with it, and although it has been in steady operation for more than a year, the repairs have been exceedingly small. The valves were originally made 8 in. in diameter, with a 3-in. plug opening in each. It was found advantageous to change these valves so as to make the openings 3 in. and dispense with the continuously spouting plug. The new 3-in. valves were arranged to have ball instead of flat seats, and bronze is used instead of old belting for the contact parts. These valves are opened intermittently and are controlled by cams which are adjustable as to number and period. The drive was originally by chain, but this was noisy and otherwise undesirable, and since it developed that a belt would have ample traction, the chain was changed to belt drive.

The rabbles are carried on 3x10-in. fir stringers and these are suspended from the bottom of vertical members hinged at their top ends as shown in drawings, and are

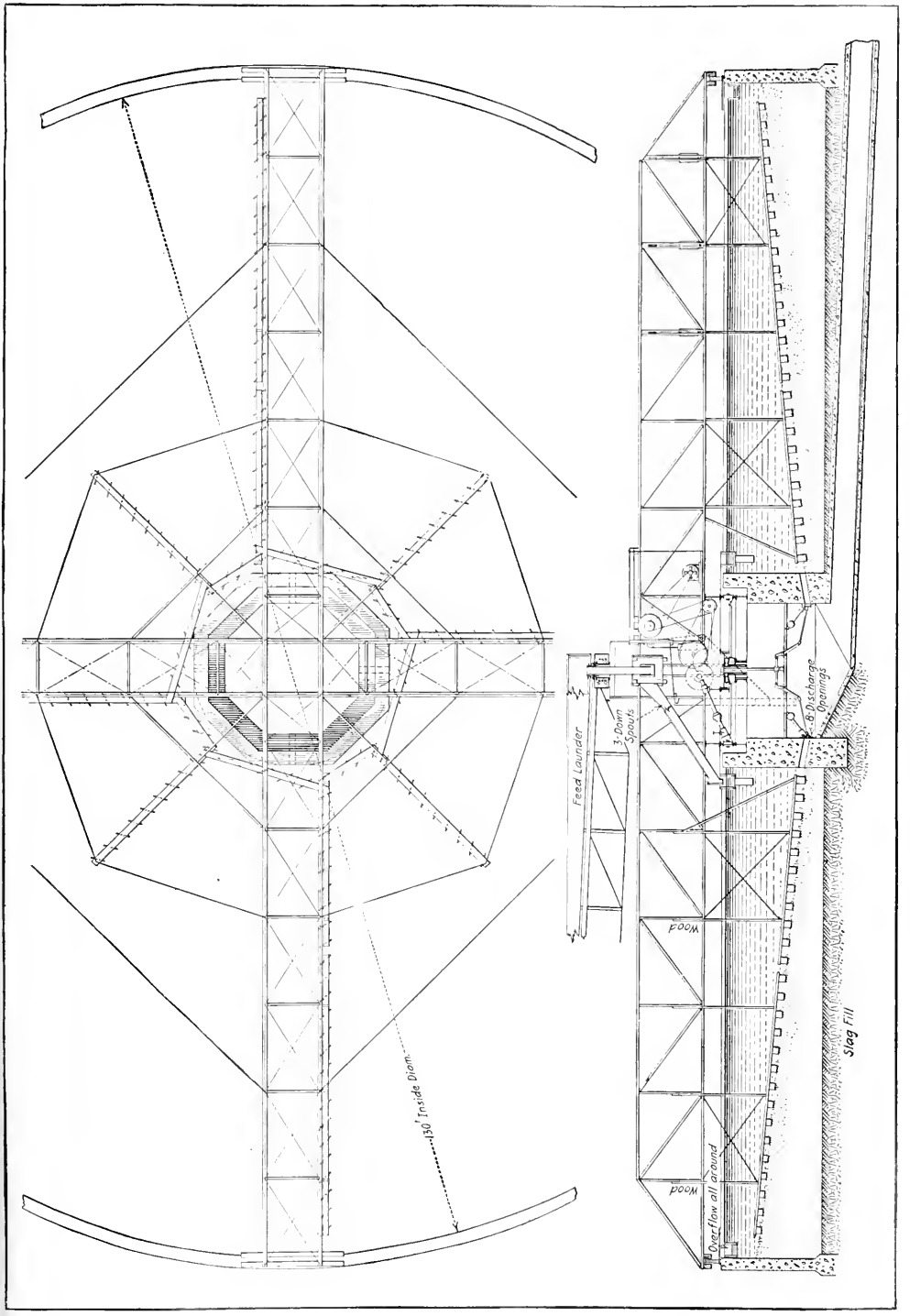


SITUATION OF THE THICKENER WITH REGARD TO THE MILL
The two smaller views show the thickener empty and illustrate the rake action

cut up into V-sections with a multitude of valves communicating with a drainage-pipe system, which did not meet expectations for reasons that are now entirely obvious.

In the work of remodeling and enlarging the milling plant, recently completed, I decided that the large circular tank could be made most useful by converting it into a Dorr thickener. It seemed rather bold to attempt one so much larger than had previously been tried, but conditions were favorable. It would be possible to use the central pier to advantage; the machinery provided for carrying the crane would carry the mechanism of the thickener; and much of the old crane framework and gearing could be used. There was a good T-rail around the rim of the tank to support the outer ends of the cruciform bridge required, etc., so the plans were drawn and the matter laid before Mr. Dorr, who was inclined to hesitate a little at first, but on further study decided that it was a splendid chance to try out the new questions involved, so we bought a nameplate of him, conditioned on the success of the "leviathan," and carried out our plans held back by using copper guy-lines with weights so that in case a rabble-arm should be caught or offer too much resistance, the weight would be raised and the arm would pass the obstruction through the operation of the hinge provided. This now appears to be unnecessary, for, in our experience, the vertical members have never moved from their seats against the trusses. A Reeves variable-speed countershaft was made part of the driving mechanism and experiments were made with several speeds. They all worked satisfactorily, but we finally settled upon one revolution in 30 min. as best for our work. There is little difference between two and three revolutions per hour in the results obtained.

The heavily reinforced-concrete wall of the tank was built upon a slag dump, which is substantial but notoriously porous. Sand tailings quickly sealed the bottom and the hardening slimes finished the job, so that there is no loss of water through seepage. It will be noted that since the bottom of the old tank is flat and the bottom maintained by the rabbles in the thickener is sloping, there is a deep deposit of slime near the outer wall afford-



DETAILS OF ARIZONA COPPER CO.'S DORR THICKENER AT MORENCI, ARIZ.

ing a good surface sloping toward the center with about 2 ft. of hardened deposit on top of the slag around the central pier. So it is at once suggested that these lines might be extended; the upper end of the slope of the cone rim could be extended to where it would be within one foot of the surface, and the central hollow pier could be decreased in size to, say, 10 ft. inside diameter, equipped to discharge the tank in the same way. Then a circular track supported by a small circular wall at the water's edge on the outer rim would support the light truss members of the cruciform bridge. The trusses would be tied together so as to move in unison and the tractive force would be applied on the outer circular track through wheel friction, the same as in railroad practice. The hollow central pier would be connected by large tile or reinforced-concrete conduit to a point of discharge outside of the rim. This may be a pit fitted with centrifugal pump or elevator for raising the discharge to sufficient height so that it may be handled to its destination by gravity. In this way Dorr thickeners up to 200 ft.

STATISTICAL DATA OF THE DORR THICKENER

Diameter of settling pond	130 ft.
Outer depth	4 ft.
Inner depth	8 ft. 6 in.
Diameter of pier (octagon)	21 ft.
Revolutions per hour	2-3
Number of 3-in. discharge valves	8
Number of rabble arms (4 long and 4 short)	8
Size of motor	5 hp.
Size of discharge conduit (to allow man to go in.)	2 ft. 6 in. by 2 ft. 6 in.
Settling area	13,000 sq.ft.
Average feed (tons dry colloidal slime per 24 hr.)	700
Average per cent. solids in feed	5.93
Average per cent. solids in discharge	30.65
Water recovery	85.75%
Gal. recovered per min. (approximately)	1,700
Power required (motor input)	4.7 hp.

Moisture in the discharge can be reduced to 50%, but the tailings are flumed two miles, for which reason the discharge is not made thicker.

in diameter or more can be installed on suitable ground at relatively small construction expense, and such machines should have large capacity, require little power and be cheaply maintained, thus giving the maximum results with the minimum expense.

It is, of course, much more expensive to house the large-diameter machines than the multiple units, but I believe that the large units consisting of relatively shallow ponds with conical bottoms built in the earth would be very readily kept from freezing by the application of the heat to the solutions being handled instead of to the air in contact with the solutions. I believe that less heat would be required by applying it in this way, and when so applied I believe that open-air construction and operation would be best, even in the North. Extremely large ponds should be fenced to break the force of the winds, otherwise a wave action is set up which interferes with settling to some extent.

The full capacity of our big thickener has not been determined. It discharges as much water as the electric pumps provided will handle, and if more feed is given the thickener, water would run to waste. Since this water has to be pumped seven miles against a pressure of nearly 1800 ft., it is expensive, and therefore carefully husbanded.

I have every reason to believe that with tailings as coarse as 40-mesh sand—when the coarse sand is not in larger volume than, say, 30% of the whole—the capacity in terms of tons handled would be found to be greatly augmented, nearly doubled, in fact. The amount of water clarified is, of course, dependent upon the percentage of colloidal material in the feed to the machine. Thus, much additional solids in the form of sands could be added to the present tonnage of real slime without changing any of the prevailing conditions except to greatly augment the tonnage handled.

In our case the man in charge of the pumping station oils the thickener and adjusts the cams controlling the discharge valves occasionally. Practically no labor is required.

Low Cost of Maintenance

The repairs required for 14 months' operations, including the changes mentioned above, are represented in a total sum of $682, which is 0.2c. per ton of dry solids handled in the period. Most of this expense is for valves destroyed by the water handled.

When the war broke out milling was reduced to six days a week and the thickener was stopped on Saturday night and started again Monday morning, and on one or two occasions the machine has stood idle for 48 hr., but it has always started again without difficulty of any kind and without lifting the weights which hold the rabble stringers against their seats.

There has been much interest manifested in the big thickener, and I had hoped to arrange temporarily feed- and water-handling facilities so that tests could be made definitely to determine the capacity, or range of capacities with different classes of feed, before writing a description of the apparatus; but this has not been possible. The extra recovery of water resulting from the use of the large thickener returned its cost in less than two months. It has therefore been highly successful and advantageous.

Dimensions, Weights and Costs of Steam Turbines*

Tables 1 and 2 were compiled from data supplied by manufacturers and should prove of value in connection with preliminary estimates. The dimensions, weights and cost data are for condensing units and include the turbines and alternating-current generators.

The values in Table 2 were plotted and the following equations were deduced, giving the cost in dollars (C) of the turbine and generator, in terms of the capacity in kilowatts:

Impulse types, C = 5040 + 9.2 kw. (Dollars)
Reaction types, C = 7400 + 8.26 kw. (Dollars)

TABLE 1. DIMENSIONS AND WEIGHTS OF CONDENSING STEAM TURBINES, INCLUDING GENERATORS

	Impulse Type							Reaction Type						
Size Kw	Length, ft.	in.	Width, ft.	in.	Height, ft.	in.	Weight, lb.	Length, ft.	in.	Width, ft.	in.	Height, ft.	in.	Weight, lb.
300	15	10	5	0	5	4	18,500	16	0	6	0	..	..	24,000
300								20	0	6	0	5	10	37,900
500								18	0	6	0	..	..	30,000
500	16	1	7	3	6	6	34,800	20	9	6	0	5	10	42,600
1,000								24	0	6	0	..	..	60,000
1,000	16	0	6	10	7	6	45,000	18	4	6	9	6	8	52,250
2,000	20	6	9	0	7	9	75,000	25	6	9	4	7	9	105,000
2,000								26	0	7	0	..	..	90,000
5,000	25	1	10	7	9	8	175,000	34	9	11	5	9	1	236,000
5,000								34	0	8	0	..	..	190,000
10,000	32	5	12	9	12	0	310,000	45	0	10	0	..	..	320,000

TABLE 2. COST OF CONDENSING STEAM TURBINES AND GENERATORS

	Impulse Type		Reaction Type	
Size, Kw.	R.p.m.	Cost	R.p.m.	Cost
300	3600	$8,000	3600	$7,650
500	3600	9,600	3600	9,550
1,000	3600	14,000	3600	13,750
2,000	3600	23,000	3600	22,800
5,000	1800	55,000	3600	48,700
10,000	1800	95,000	1800	90,000

Orebodies of the Mesabi Range—II

By J. E. Wolff*

SYNOPSIS—Vertical sections through developed orebodies from different parts of the range illustrate relations existing between orebody and unaltered iron formation; rock walls; "horses" and "islands"; faults; folds; the slump and other structural features. Western Mesabi orebodies differ in some points of structure, notably in the absence of slump.

Following the discussion of typical structure in Part I, there may be taken up some actual illustrative examples in the form of vertical sections through orebodies from various parts of the Mesabi range, including the sandy ores of the western end.

Figs. 11 to 16 inclusive show sections of orebodies actually developed in different parts of the range by drilling and mine workings. Some of the bodies are nearly worked out at the present time. The sections taken transverse to the long axis of the orebody, that is, across the trough, show the slump markedly; those taken along the axis of the trough do not show it. All of the sections show the typical structure illustrated in Figs. 6 and 7 (Part I).

Fig. 11 shows the cross-section of an orebody now partly worked out. The marked slump and sharp rock walls are features actually observed in the mine. Some idea of preglacial erosion of the taconite, and of ore also, can be formed by comparing this section with Fig. 6. A thickness of 350 ft. to 500 ft. of taconite has been eroded.

Fig. 12 shows two troughs separated by taconite. West of this cross-section these two troughs connect into a larger orebody. An anticline and syncline in the quartzite are shown. This was worked out from drill holes not occurring on the cross-section. Close study of drill records has disclosed many such minor flexures of the formations. Attention is called to the lower nonbessemer ore extending to the south under taconite. This is a characteristic flat-layered body, mentioned before. More frequently the ore occurs immediately below the Intermediate slate layer (Fig. 20).

Fig. 13 shows a cross-section of an orebody now nearly mined out. Notable features are the sharp rock walls, as actually defined by mine workings, and rock layers and horses or pillars in the lower blue orebody. Preglacial

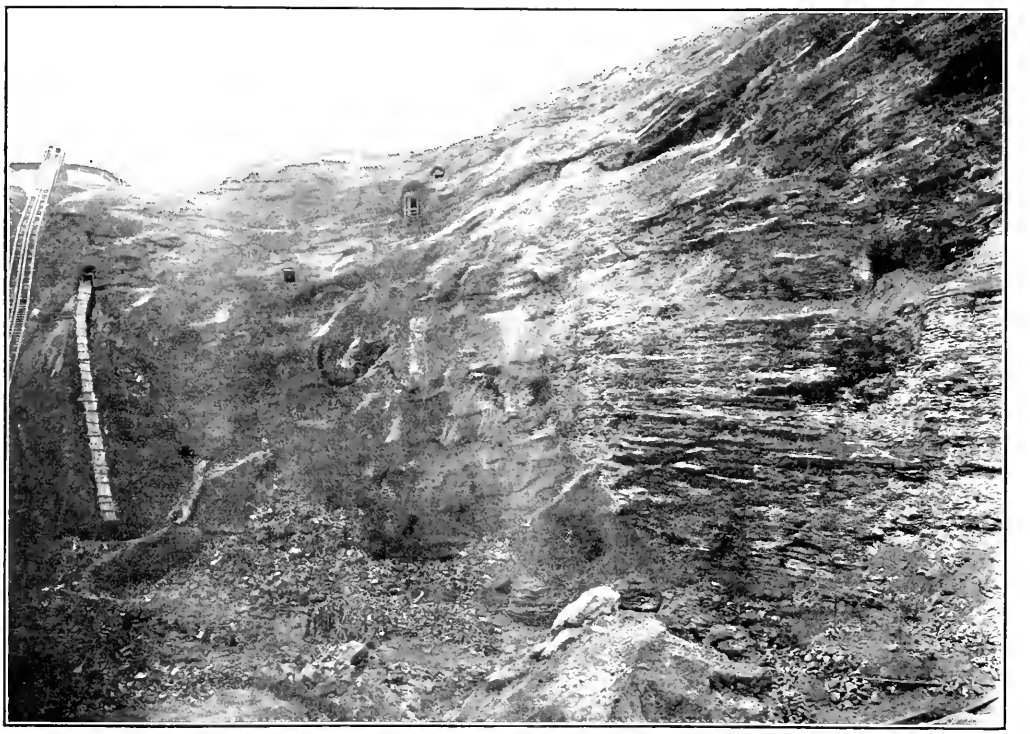


FIG. 8. SHARP ROCK-WALL OF A DEEP TROUGH OREBODY ON THE EAST CENTRAL PART OF THE RANGE
Note face of wall. Left half of picture shows ore

*Mining engineer, Oliver Iron Mining Co., Duluth, Minn.

erosion is marked here also. Note the slump at the rock walls and on both sides of the "taconite island." In connection with this compare Figs. 8 and 10.

Fig. 14 is a cross-section of an orebody of which the east wall is an altered granite dike. In places some concentration was found by mine workings east of the dike also. Samples of the dike assayed 3.65% titanium, which is practically unknown in the iron formation proper.

Fig. 15 is a section transverse to the length of an orebody but does not show the slumping feature except at its south rock wall, because of the steep dip of the formation. Attention is called to the ore "making" under the Virginia slate. This orebody with its eastern continuation is one of the few in which this condition is known to exist. In this body one drill hole showed ore to a depth of 900 ft., the deepest known on the range. This cross-section will be referred to later in connection with the fault shown by Fig. 17.

Fig. 16 shows a longitudinal section of a typical Western Mesabi washable orebody. A comparison of this section with any of the foregoing shows their analogous structure. A transverse section of a Western Mesabi orebody but does not show the sharp rock walls or marked slumping observed in bodies in the central and eastern part of the range. The western bodies are shallower than the central and eastern. In the western bodies the silica has been leached out of the taconite and the iron well oxidized and concentrated into seams and layers; the silica, however, has not been transported but remains as extremely fine, almost impalpable, white powder. This is the condition in both upper and lower blue orebodies. The upper slaty taconite becomes altered in a washable orebody to decomposed taconite which yields a fairly good product after being washed. The lower yellow taconite alters to an extremely sandy washable ore. The upper 10 ft. of this layer contains so much silica and so little ore as to be worthless by itself as washable ore; it resembles common building sand. The upper and lower blue ores in a washable orebody are known as typical washable ores. The silica separates easily from the pieces of hard hematite and the problem of concentration is a simple one.

From the sections presented, covering all parts of the range, it is evident that the same structure exists from one end to the other. Structurally the range and its orebodies are remarkably uniform. The same structure as here shown can be worked out for any orebody if drill and mine exploratory work and records are complete enough. This matter will be discussed more in detail in Part III.

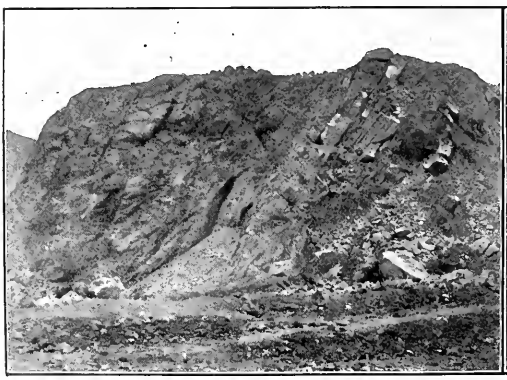


FIG. 9. SOUTH END OF TACONITE ISLAND IN ALPENA PIT

FIG. 10. ANOTHER VIEW OF THE MINE SHOWN IN FIG. 8

Fig. 9—Note steep west dip of rock and ore layers. Fig. 10—Looking northwest, showing south and part of north rock walls. Note taconite horse and pillars and large amount of rock sorted from lower orebody. Orebody nearly mined out. Old steam-shovel approach in ore shown in distance. Same orebody as shown in Fig. 13

LEGEND OF FORMATIONS OF OREBODY CROSS-SECTIONS

B.O.	Blue ore	O.	Ore
B.T.	Broken taconite	P.Q.	Pokegama quartzite
C.	Conglomerate	P.R.	Paint-rock
Cret.	Cretaceous	P.R.L.	Paint-rock layer
C.S.	Cretaceous shale	P.R.O.	Paint-rock ore
C.T.	Cherty taconite	Q.	Quartzite
D.S.	Decomposed slate	S.	Slate
D.T.	Decomposed taconite	S.T.	Slaty taconite
G.	Greenstone	T.	Taconite
G.D.	Glacial drift	T. & O.	Taconite and ore
H.G.O.	High-grade ore	U.H.G.O.	Upper high-grade ore
I.P.R.L.	Intermediate paint-rock layer	U.N.L.	Upper nonbessemer layer
		U.N.O.	Upper nonbessemer ore
I.S.L.	Intermediate slate layer	U.S. & C.T.	Upper slaty and cherty taconite
L.B.O.	Lower blue ore	U.S.T.	Upper slaty taconite
L.C.T.	Lower cherty taconite	U.Y.O.	Upper yellow ore
L.H.G.O.	Lower high-grade ore	U.Y.T.	Upper yellow taconite
L.H.S.	Lower huronian slate	V.S.	Virginia slate
L.N.O.	Lower nonbessemer ore	W.O.	Wash ore
L.O.	Lean ore (40%-49% iron)	Y.O.	Yellow ore
L.Y.O.	Lower yellow ore	Y.T.	Yellow taconite
L.Y.T.	Lower yellow taconite	U.B.O.	Upper blue ore

Fig. 17 shows a normal fault with a throw of 200 ft. or more in which the quartzite and underlying greenstone have been faulted up against the orebody. This fault is the eastern continuation of the Biwabik mine fault, the throw of which is probably 300 ft. or more. It goes off west into the underlying rocks just north of the Duluth mine (NW ¼ of NE ¼, Sec. 3, T. 58 N, R. 16 W). Eastward it dies out before it reaches Embarrass River and gives way to a steep inclination of the formation, as shown by Fig. 15, a cross-section east of this river. Thus it is a fault of the hinge type. This fault and the steep dip are the cause of the quartzite tongue on the geological map in Secs. 33 and 34, T. 59 N, R. 15 W, and the sharp bend in the formation at this place. The deformation produced an anticline in the iron formation and the quartzite. Erosion truncated the series, exposing the tongue of underlying quartzite and the bend in the formations.

Fig. 18 shows a thrust fault in the Alpena mine, a mile north of the city of Virginia. This is the greatest known fault of the Mesabi range. The stratigraphic

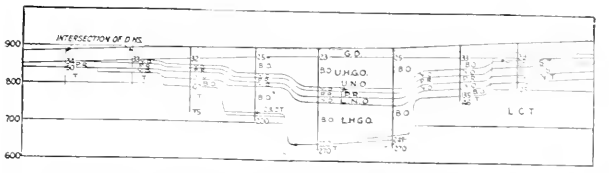


FIG. 11. CROSS-SECTION OF OREBODY IN T. 58 N, R. 20 W, LOOKING WEST. MARKED SLUMP AND SHARP ROCK-WALLS OBSERVABLE IN THIS MINE

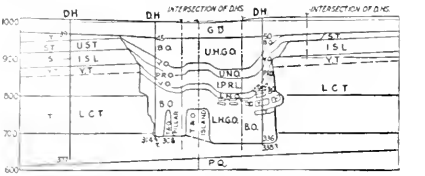


FIG. 13. CROSS-SECTION OF OREBODY IN T. 58 N, R. 17 W, LOOKING NORTHWEST

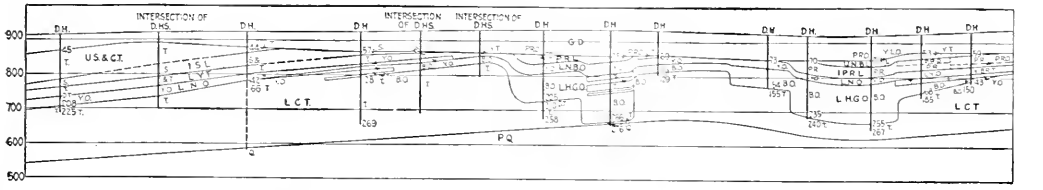


FIG. 12. CROSS-SECTION OF OREBODY IN T. 58 N, R. 20 W, LOOKING WEST

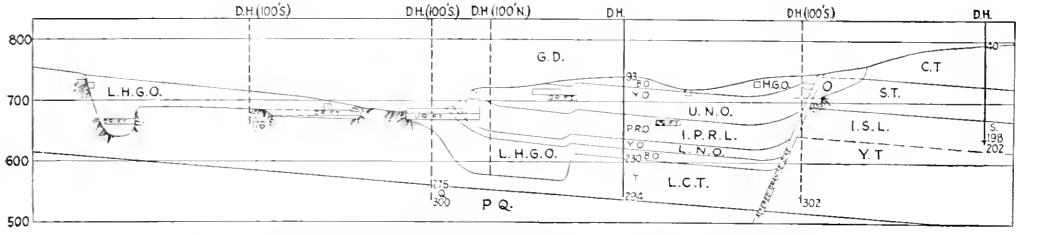


FIG. 14. CROSS-SECTION OF OREBODY IN T. 58 N, R. 16 W, LOOKING NORTH

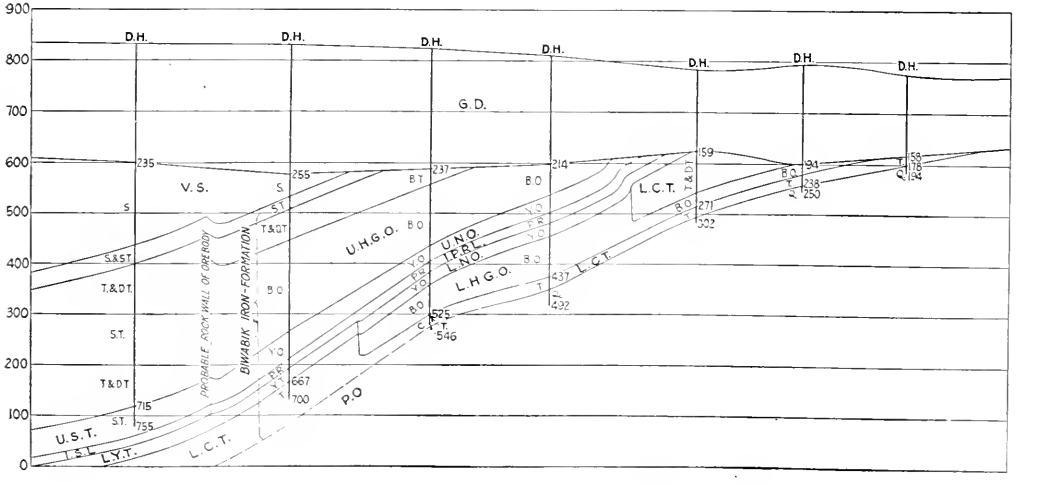


FIG. 15. CROSS-SECTION OF OREBODY IN T. 58 N, R. 15 W, LOOKING WEST

throw is 350 ft., and the vertical throw at least 600 and possibly 1000 ft. This fault is visible in the Sliver mine, north of the Alpena, and has been traced by explorations a half mile south of the Alpena. Fig. 19 shows the probable development of this fault. Its development is directly related to the folding or deformation which produced the large bend in the iron formation between Virginia and Eveleth, known as the "Virginia horn." This deformation is a big drag-fold. The sharp bend in the iron formation northeast of Virginia caused compression and consequent crumpling in the layers of the formation, and necessitated shortening somewhere. The shortening took place in this fault. Diagrams *A*, *B* and *C*, of Fig. 19, show the development of this fault. As the deformation started to develop the Virginia horn, a small drag fold developed as shown in *B*, thus shortening the layers in response to the compression in them. (It is a well established fact in structural geology that in a folded formation the small folds are of the same type as the large folds upon which they are superimposed.) As the deformation increased, the brittle quartzite and iron formation faulted on a plane through the axis of the small drag fold, into the position shown by *C*. Erosion has since cut the top of the fold as shown. Without doubt the fault continues down into the underlying rocks, slates and greenstone. The fault occurred prior to the formation of the orebody, as along the fault plane there is no evidence of movement in the layers of ore. Along the east side of the taconite island (Fig. 18), at the contact of rock and ore, is found a layer of powdered silica several inches thick. This was the fault plane and this powdered silica was produced by the rubbing of the broken taconite in the faulting process. Some slipping within the beds of iron formation undoubtedly occurred also. The fault probably occurred during Upper Huronian or not later than Keweenawan time. It is a fair assumption that the deformation which caused the Virginia horn, the Alpena fault, the Biwabik fault and the steep dip of the formation east of it, was contemporaneous with the intrusion of

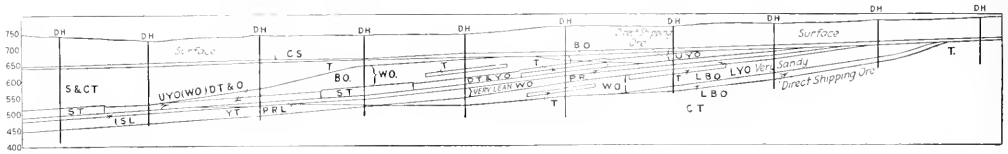


FIG. 16. TYPICAL CROSS-SECTION OF WESTERN MESABI OREBODY

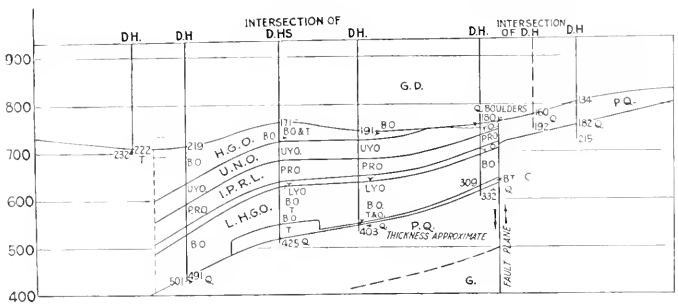


FIG. 17. CROSS-SECTION LOOKING WEST OF OREBODY IN T. 58 N., R. 15 W., SHOWING NORMAL FAULT, WITH THROW OF 200 FT.

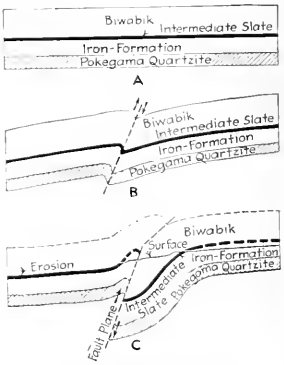


FIG. 19. FAULT DEVELOPMENT

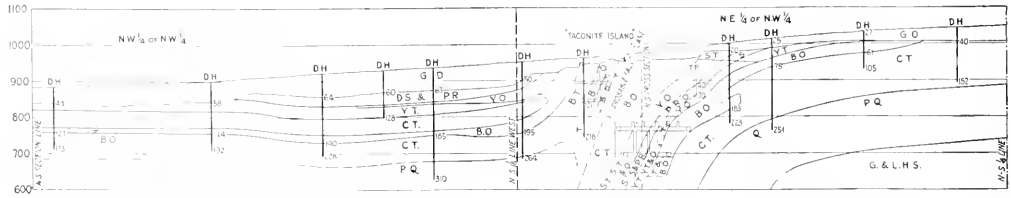


FIG. 18. SECTION LOOKING NORTH, SHOWING FAULT IN ALPENA MINE. N. ½ OF N.W. ¼, SEC. 5-58-17

Keweenawan time. It is a fair assumption that the deformation which caused the Virginia horn, the Alpena fault, the Biwabik fault and the steep dip of the formation east of it, was contemporaneous with the intrusion of the Embarrass (Keweenawan) granite and the Duluth (Keweenawan) gabbro.

Fig. 20 shows a cross-section of an orebody in which the whole formation is bent into a sharp monoclinal fold. This fold was worked out entirely from the drill records; it was followed for a half mile each way from the cross-section. The orebody beneath the Intermediate slate, or paint-rock layer, is a typical example of a flat-layered orebody. A thousand feet north this ore connects with a large trough orebody similar to that shown by Fig. 12. The ore above the Intermediate slate connects each side of the cross-section with elongated bodies of ore. The conglomerate at the top of the iron formation is not Cre-

taceous; it is later in age and the pebbles are not cemented together as in a Cretaceous conglomerate. It is probably a bed of iron pebbles deposited in a local, preglacial lake on top of the iron formation. Numerous occurrences of the kind have been found in drilling and mine operations.

Other exceptional structural features are known in different parts of the range. In the Hawkins and La Rue orebodies at Nashwauk in T. 57 N. R. 22 W. there is a marked faulted fold, which, by means of drilling, has been followed in the taconite between the two orebodies. At the north end of the Agnew mine (NE ¼ of NE ¼, Sec. 11, T. 57 N. R. 21 W), the face of the ore on the Hull forty shows a small faulted drag-fold in the middle of the trough of the orebody (Fig. 3, p. 91). In the Graham mine (Sec. 21 T. 59 N. R. 14 W) on the eastern end of the range, a fold extends the length of the orebody. It is a thrust fold, the south side being thrust up undoubtedly by the great gabbro intrusion 1¾ miles southeast. As the top of the fold is eroded it is not possible to tell how close the fold was.

(To be continued)

Domestic Sulphur Consumption

The sales or marketed production of sulphur in the United States in 1914, according to the Geological Survey, was 327,634 long tons, valued at $5,954,236. These sales were the largest in the history of the industry and 16,044 long tons greater than those of 1913. The sulphur mined in 1914 but stocked at the mines is not included in these figures. In 1914 four states produced sulphur, namely, Louisiana, Texas, Nevada and Wyoming. [One company in Louisiana alone produced more than the total consumption in the United States, as it has done for several years past.—Editor.]

The total imports for 1914, entered for consumption, were 26,135 long tons, valued at $477,937, of which 23,610 tons, valued at $398,984, were crude sulphur. Corresponding figures for 1913 were 22,605 long tons, of which 15,122 tons were crude sulphur. In 1914 the great bulk of the imports was, as usual, from Japan.

In 1914 the exports were 98,153 long tons, and would probably have been considerably greater but for the disturbed conditions in Europe. Even with such adverse conditions the excess of exports over imports amounted to 72,018 long tons, the balance of trade in favor of the United States being $1,329,397.

Ore Reserves of the Rand

By A. Cooper Key*

The table presented herewith shows the quantities of payable ore reserves at the principal Rand mines at the end of last year, or the latest figures available in certain instances where the company's year does not correspond with the calendar period, as well as at the end of 1913. The method of expressing ore reserves varies somewhat among different groups and engineers. For instance, there are stoping tons and milling tons, the latter not frequently. There is considerable difference between the two, and sometimes insufficient information is afforded to enable the comparative significance to be grasped. It is necessary to know the average percentage of waste rock discarded. In spite of many difficulties, the ore-reserve position has been well maintained. The feature of the

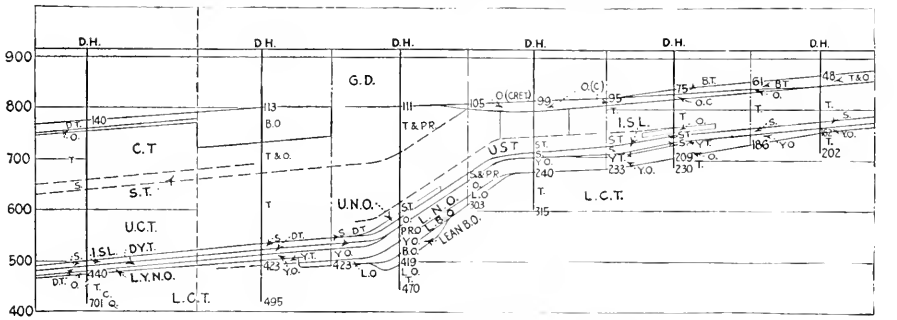


FIG. 20. CROSS-SECTION OF OREBODY IN T. 57 N, R. 21 W

table, however, is the increase which has taken place in the two mines of the far East Rand which have recently joined the ranks of producers. We have the Modder Deep and the Government Areas, each with 2,450,000 tons in sight, but the former has 8 dwt. rock against 5.8 dwt. in the latter, besides an advantage of 9 in. in the thickness of the reef. Springs Mines for the first time commits itself to an ore reserve estimate—550,000 tons of 10 dwt. rock over 52 inches.

Alone among the three big consolidations has the Randfontein Central been able to maintain its reserve aggregate. The Crown Mines' is less by 427,000 and the East Rand's by half that quantity. More serious, however, is the drop of 3s. 6d. on the valuation at the Crown Mines. Brakpan has increased its aggregate by 266,000 tons and maintained the value. City Deep has added 343,000 tons; the value is 0.3 dwt. lower, but still 1 dwt. higher than at the end of 1912. Modder B.'s value has improved by 0.3 dwt. In 1912 the New Modderfontein had 3,900,000 tons exposed; in 1913, 4,547,000; and in 1914, no less than 6,334,500 tons, the value having improved from 8.1 to 8.4 dwt. Kleinfontein gains 1,100,000 tons from the amalgamation with the Apex and Benoni, but the value is 0.7 dwt. less than that of the Kleinfontein alone a year ago. Taking Kleinfontein section by itself, the drop in value is rather greater.

Nourse Mines, Wolhuter and Village Deep are conspicuous for substantial increases, while at the City & Suburban and the New Heriot position is well maintained.

*Editor, "South African Mining Review," Johannesburg

On the west, the West Rand Consolidated has 1,800,000 tons in sight, some partially developed, which compares with 1,445,000 tons of two years ago.

The Meyer & Charlton and the Robinson share the distinction of being mines with reserves exceeding 10 dwt. The former is in the stronger position, having 105,000 tons more of definitely valued ore; moreover, the value is 59s. compared with 45s. 6d. Of course, the Charlton has a considerable life, whereas the Robinson is nearing the close of its remarkable career. By June next it will have produced £20,000,000 worth of gold, of which about £13,000,000 constitutes profit. For the first seven years of its existence the recovery was more than an ounce, sometimes more than two ounces. For the last three years it has been under 10 dwt. But working costs are now 14s. per ton against 25s. in 1898 and 35s. to 40s. in the earliest years of crushing.

RAND ORE RESERVES IN 1913 AND 1914

Producing Cos.:	—As at December, 1913*— Tons	Dwts.	In.	—As at December, 1914*— Tons	Dwts.	In.
Aurora West	554,909	5 7		614,610	5 26	44
Bantjes Con.	974,700b	6 3	42	800,400b	6 1	41
Brakpan	2,224,000	6 7	61	2,490,000	6 73	62
City Deep	2,167,950b	10		2,510,800b	9 7	55
City and Suburban	786,500	8 3		758,700	8 5	..
Con. Langlaagte	2,194,400	6 4a		2,220,707	6 9	..
Cons. Main Reef	614,470	7 32	48	693,460	7 3	49
Crown Mines	10,449,000b	6 82	63	10,022,000b	6 0	66
Durban Rood. Deep	1,312,700b	6 7	47	1,303,400b	6 7	47
East Rand Prop.	5,600,000	6 7	54	5,400,000	5 8	55
Ferreira Deep	1,974,400b	8 7	68	1,893,100b	8 5	68
Geduld Proprietary	1,757,000	6 9	58	1,900,000	7 1	59 5
	106,000	6 3	59			
Geldenhuis Deep	1,669,500b	6 4	49	1,613,000b	6 4	..
Ginsberg	312,540	6 0a		278,213	6 7	..
Glencairn	587,920	3 6a		440,520	3 3a	..
Govt. G.M. Areas (M)	559,500	6 6	50	2,455,583	5 8	60
Knights Central	539,400	6 0	60	430,500	5 7	63
Knights Deep	2,777,000e	4 3	.	2,480,000e	4 2	..
	259,000g	3 7	.	200,000g	3 9	..
Langlaagte Estate	1,512,360d	..	..	886,396	5 97	50
				187,221h		..
Luipaardsvlei Estate	581,800	5 5	..	660,365	5 5	..
Main Reef West	501,830	6 02	55	526,440	5 7	53
Meyer & Charlton	471,844	11 7		469,839	13 9	55
Modder B.	2,800,400	8 3	55	2,772,540	8 6	55
Modder Deep	982,000	7	75	2,450,000	8	69
	191,000g	10 5	62			
New Goch	917,088	5 16		825,900	5 27	81
New Heriot	581,124	8 1	46	588,315	8 1	..
New Kleinfontein	1,658,481e	6 3	59	2,890,731e f	5 6	58
New Modderfontein	4,547,000b	8 1	62	6,334,500b	8 4	63
New Primrose	401,045	6 2a	..	335,463	6 8	..
New Rietfontein	51,737	7 55	..	31,131	..	..
New Unified	387,500	5 9a	..	371,037	5 5a	..
Nourse Mines	1,795,600b	6 6		2,473,700b	6 4	..
Princess Estate	614,600	7 2	28.6	553,000	7 1	28.2
Randfontein Central	6,818,929	6 5	..	6,826,644	6 6	..
Robinson, Leader & S. Reef	358,500	10 4	..	364,700	10 7	..
Robinson Reclaimable	469,100	.	..	330,100		..
Robinson Main R.	772,900	4 3	..	534,300	4 4	..
Robinson Deep	1,538,000e	6 0	..	1,533,000e	5 9	..
	346,000g	5 8S	..	407,000g	5 8	..
Roodepoort United	370,732	5 3	45	590,000	5 9	45
	189,000c	5 4	45	227,000	5 9	45
Rose Deep	3,828,400	5 8	56	3,957,100b	5 5	..
Simmer & Jack	2,524,000e	5 4	..	2,320,000e	5 4	..
	406,700g	4 7	..	348,000g	4 6	..
Simmer Deep	1,670,000	4 3	.	1,429,000	4 3	..
				302,000g	4 6	..
Van Ryn	2,064,500	6 5		1,973,312	6 5	53
Van Ryn Deep	1,953,845	8 6	55	1,692,349e	8 5a	..
Village Deep	2,662,600b	6 6	60	2,853,470b	6 8	60
West Rand Cons.	1,364,956	6 16	.	1,453,000	6 05	49
	213,360g	.		340,000g	7	..
Witwatersrand	1,225,688	6 4a		1,221,876e	6 6a	..
Witwatersrand Deep	1,666,000	6 8	50	1,707,400	6 2	50
Wolhuter	784,100	6 1	51	999,400	5 9	53
Non-Crushing Cos.:						
Cinderella Cons	613,000	6 35	.		i	..
	231,000g					
Jupiter	1,274,000	4 5	..		i	
	161,000g	4 1				
Developing Cos.:						
Springs Mines				553,000	10 3	52

*Or latest date in respective years. a Estimated recovery value. b Includes shaft and boundary pillars, and also valued ore to be rendered available for stoping by current development. c Mining tons. d Payable and unpayable. e Milling tons. f Includes Apex and Benoni, Kleinfontein Section alone, 1,781,231 tons, 5 47 dwts, over 59 6 in. g Partial. h Probable. i Unchanged.

Mica of Good Quality, according to U. S. Consul E. C. Baker at Chungking, is found near Shunpan, in the Szechwan Province, and one of the large Chinese firms at Chungking with a branch office in Shanghai is prepared to export this product. The price delivered at Shanghai is between 9 and 10c. U. S. cy. per lb. About 15,000 lb. can be delivered every year.

New Sampling Plant at Hamburg

A new and unique sampling plant was erected last year at Hamburg, Germany. There is a large tonnage of pyrites imported, and the plant has been erected primarily for the purpose of sampling it. The pyrites consists of hard lumps so that substantial crushing machinery is required.

The ore is imported in large steamers which discharge into lighters in one of the main harbors, whence it is conveyed inland. A certain portion of the ore is discharged from the ship into special lighters for sampling. These special sample lighters are towed to the sampling plant, which is shown in the illustration. The ore to be sampled is discharged from the lighter by means of a jib crane, as shown. The crane is provided with a self-discharging bucket which empties the ore through a trap-door in the roof of the building into a bin.

The progress of the ore may now be followed by referring to Fig. 2 which shows the layout of the plant inside the sampling building. The ore passes from the bin into a jaw crusher, which reduces it to 2-in. lumps.

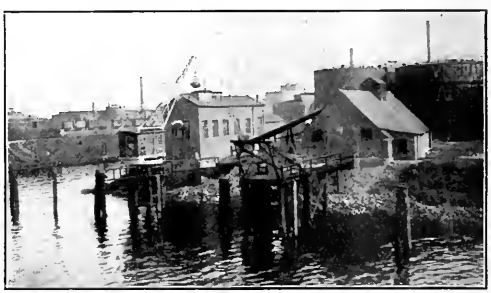


FIG. 1. SAMPLING PLANT AT HAMBURG

It then travels up a bucket elevator and through a Brunton sampler, where four-fifths of the stream is rejected. The remaining fifth goes through the gyratory crusher, which brings it down to 5/8-in. lumps; thence up a second inclined elevator to the top of a special automatic sampling machine.

It is at this point that the unique and especially interesting part of the process begins. This sampling machine consists of a large steel frame about 14 ft. high, in which are arranged three pairs of rolls. The largest, at the top, are 20 in. in diameter and the other two pairs are 16 in. and 12 in. respectively. Above the top pair of rolls and intermediate between the different sets there are three flat reciprocating vanes, or dividers, connected together and arranged to flap from side to side, so that during a portion of the time the ore striking them is diverted in one direction and during the remainder of the time in another. These reciprocating vanes will be called flaps.

The first thing that happens to the stream of ore entering the top of the machine is that four-fifths of it is rejected by the reciprocating flap *A* (Fig. 3) in the drawing. All three of these flaps are driven by cams connecting rods in such a way that during one-fifth of the time they are deflecting the stream of ore into the rolls and during the remaining time they are diverting

it out of the left-hand side of the machine. The first pair of rolls crushes the ore down to about $\frac{3}{4}$-in. lumps. This crushed product then passes over the second flap, the sample going through the second pair of rolls. After another reduction it is finally crushed to the desired degree of fineness by the last pair of rolls, when it goes through the shaking screen *B* and thence to the bottle filler *C*. If there are any particles of ore which have not been sufficiently reduced in size by the last pair of rolls, they slide off the side of the shaking screen upon a little rubber-belt elevator, which carries them up and again passes them through the final pair of rolls. In this way the whole of the final sample is crushed to any requisite fineness for the sample bottles.

One of the most interesting features of the machine is the bottle filler. This consists of a revolving table on which the bottles are placed and over them an annular hopper divided into compartments so arranged that a certain portion of the final sample is diverted and fed into the bottle in such a way that a definite quantity goes into the bottles and each bottle gets its correct proportion. Another feature of the machine is the provision of automatic adjustable feeders between the sets of rolls for keeping the stream of ore practically uniform. When each set of bottles is filled it is immediately removed, corked and sealed by the representatives of both parties.

The rejects from the plant are all discharged on an inclined belt conveyor, which carries them out through the side of the building and up to the top of an adjacent one, shown at the right of Fig. 1, the left-hand structure in that photograph being the sampling building proper. Probably this is the first time that a machine combining in itself complete crushing and sampling-plant functions has been built. The building containing it is of simple construction, carries only one line shaft and does not have to support any machinery whatever, the latter being set upon foundations on the ground. From careful tests made the results obtained have been extraordinarily accurate, with only a minute difference in the analyses from different bottles filled at the same time by this machine and representing the same parcel of ore.

Before this plant was installed the work in Hamburg was done in a semi-automatic plant consisting of two crushers and a set of rolls, the ore being coned and divided by hand, by the old method, between crushings. One tub in every 15 was taken from the ship and put through this plant, and carrying on the process in this way it took 7 men in the plant working about 14 days to get through the sampling of a 5000-ton cargo. With the new plant the same operation is performed in 3 days by 3 men. The whole plant is driven by a 65-hp. motor, the normal load of which, however, is only about 40 horsepower.

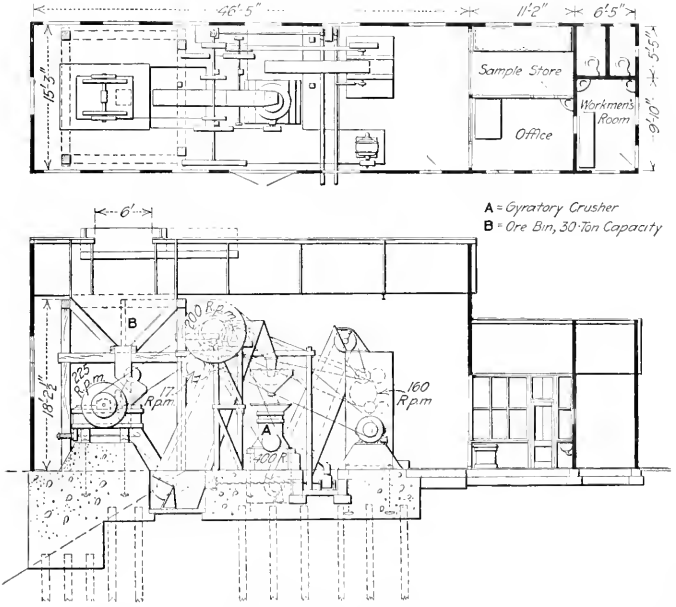


FIG. 2. ARRANGEMENT OF THE SAMPLING PLANT

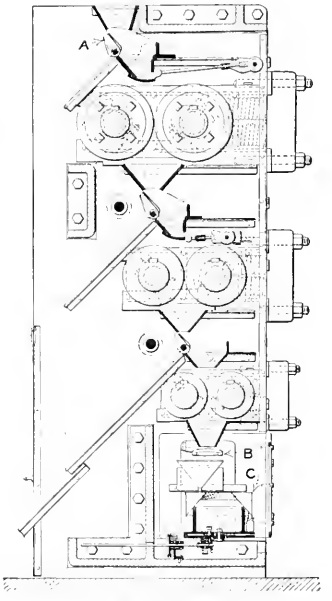


FIG. 3. SAMPLING MACHINE

Negligence of Co-Employees

By A. L. H. Street*

A trammer in a Michigan copper mine having been killed by the rolling of a large rock from a place in a stope where it had been deposited for subsequent loading by him and his crew, his widow brought suit against the mining company. It appears that decedent had been assured by the miners who excavated the rock and passed it down to the level that the rock was safe, and that it would be blasted in a few minutes to facilitate its loading. The accident occurred before blasting.

*Attorney, St. Paul, Minn.

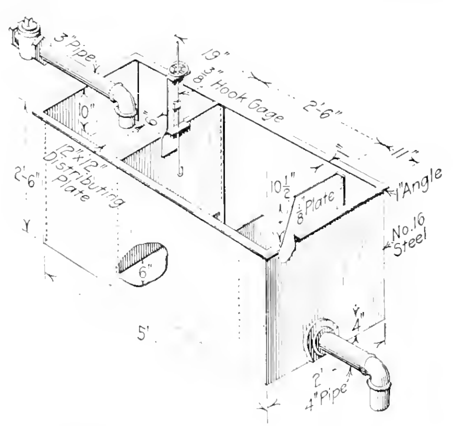
In denying that the mining company was liable for the accident, the Michigan Supreme Court holds that the miners and trammers were fellow-servants in the sense that the company was not liable for negligent failure of the miners to blast immediately. It was further decided that the miners' assurance concerning the safety of the rock could not be deemed to have been given in the capacity of representatives of the company, so as to make it binding upon the company. (Lesh vs. Tamarack Mining Co., 152 Northwestern Reporter, 1021.)

The V-Notch Weir

By John E. Rothwell*

For measuring the continuous flow of water or solution in a concentrating, cyanide or leaching plant, the V-notch weir is probably as simple and accurate a device as can be used. The accompanying isometric drawing shows the general features and dimensions of a measuring box suitable for a flow of 200 gal. per minute, or 1200 tons per day.

The box shown is made of light sheet steel with a 1-in. angle around the top. It can also be built of 1½- or 2-in. plank and made water tight when intended for handling acid solutions or when light sheet steel is not available. The weir partition is made of steel plate for use with water and cyanide solution and is fastened into the box by riveting or bolting, the joint all around being made water-tight. The notch must be carefully and accurately made at an angle of 45° and one side beveled back at an angle of about 60°, the beveled side being placed down stream, or on the overflow side.



CONSTRUCTION OF THE V-NOTCH WEIR

The baffle partition is placed as shown, and has a space of about 6 in. between its bottom edge and the bottom of the box. This, together with the distributing plate, serves to give a quiet surface ahead of the weir to which the measurements can be made.

The hook gage is made of ⅜-in. round iron, steel, copper or bronze as seems necessary, with a hook about 3 in. long and 1½ in. wide, the end of the hook being pointed

*Mining engineer, 850 W. Broadway, Butte, Mont.

THE V-NOTCH WEIR USING 45° NOTCH

Formula: Gal. per min. = 1.11452 [illegible]
Cu.ft. per min = 0.0153 [illegible]
H equals head, vertically above bottom of notch to level of surface of quiet water

Head, In.	0.00 Cu.Ft.	0.00 Gal. per Min.	0.05 Cu.Ft.	0.05 Gal. per Min.	0.1 Cu.Ft.	0.1 Gal. per Min.	0.15 Cu.Ft.	0.15 Gal. per Min.	0.20 Cu.Ft.	0.20 Gal. per Min.	0.25 Cu.Ft.	0.25 Gal. per Min.	0.30 Cu.Ft.	0.30 Gal. per Min.	0.35 Cu.Ft.	0.35 Gal. per Min.	0.40 Cu.Ft.	0.40 Gal. per Min.	0.45 Cu.Ft.	0.45 Gal. per Min.	Head, In.
0											0.0047	0.0355									0
1	0.153	1.141	0.1729	1.292	0.1942	1.452	0.217	1.623	0.2413	1.805	0.2672	2.00	0.2918	2.205	0.324	2.423	0.3548	2.651	0.3873	2.897	1
2	0.865	6.472	0.920	6.885	0.977	7.311	1.037	7.756	1.093	8.22	1.161	8.69	1.227	9.18	1.295	9.68	1.365	10.21	1.437	10.75	2
3	2.385	17.81	2.185	18.59	2.589	19.36	2.694	20.15	2.802	20.96	2.913	21.79	3.027	22.64	3.142	23.51	3.261	24.40	3.382	25.30	3
4	4.896	36.62	5.05	37.77	5.205	38.93	5.365	40.13	5.530	41.36	5.697	42.62	5.865	43.87	6.035	45.11	6.21	46.45	6.39	47.80	4
5	8.557	63.97	8.77	65.60	8.985	67.21	9.21	68.84	9.435	70.57	9.662	72.26	9.895	74.02	10.13	75.77	10.365	77.55	10.61	79.36	5
6	13.496	100.92	13.775	103.03	14.06	105.17	14.35	107.34	14.64	109.51	14.94	111.77	15.24	114.00	15.54	116.27	15.85	118.60	16.17	120.91	6
7	19.83	148.37	20.19	151.02	20.55	153.72	20.91	156.44	21.28	159.18	21.65	161.98	22.03	164.78	22.41	167.62	22.79	170.47	23.18	173.38	7
8	27.69	207.18	28.13	210.41	28.57	213.70	29.02	217.03	29.46	220.36	29.91	223.75	30.46	227.13	30.82	230.56	31.29	234.04	31.75	237.51	8
9	37.18	278.12	37.70	282.00	38.22	285.88	38.74	289.81	39.27	293.80	39.81	297.84	40.35	301.85	40.90	305.93	41.45	310.05	42.00	314.20	9
10	48.38	361.93	48.99	366.45	49.60	371.00	50.22	375.61	50.83	380.25	51.46	384.92	52.09	389.63	52.72	394.38	53.36	399.17	54.01	404.00	10
11	61.40	459.29	62.11	464.55	62.80	469.78	63.51	475.09	64.23	480.40	64.95	485.79	65.67	491.21	66.40	496.67	67.13	502.18	67.87	507.17	11
12	76.32	570.88																			12

Head, In.	0.50 Cu.Ft.	0.50 Gal. per Min.	0.55 Cu.Ft.	0.55 Gal. per Min.	0.60 Cu.Ft.	0.60 Gal. per Min.	0.65 Cu.Ft.	0.65 Gal. per Min.	0.70 Cu.Ft.	0.70 Gal. per Min.	0.75 Cu.Ft.	0.75 Gal. per Min.	0.80 Cu.Ft.	0.80 Gal. per Min.	0.85 Cu.Ft.	0.85 Gal. per Min.	0.90 Cu.Ft.	0.90 Gal. per Min.	0.95 Cu.Ft.	0.95 Gal. per Min.	Head, In.
0	0.0271	0.203									0.0742	0.555									0
1	0.4216	3.153	0.4576	3.423	0.4954	3.705	0.535	4.00	0.5765	4.3	0.62	4.63	0.665	4.975	0.712	5.325	0.761	5.92	0.8125	6.027	1
2	1.512	11.31	1.588	11.88	1.667	12.48	1.719	13.08	1.833	13.71	1.919	14.35	2.007	15.00	2.098	15.69	2.191	16.39	2.287	17.10	2
3	3.506	26.23	3.633	27.17	3.762	28.19	3.894	29.13	4.029	30.14	4.166	31.16	4.306	32.22	4.449	33.28	4.590	34.37	4.744	35.49	3
4	6.572	49.16	6.755	50.52	6.945	51.95	7.135	53.37	7.325	54.79	7.523	56.27	7.72	57.75	7.925	59.26	8.13	60.81	8.34	62.38	4
5	10.85	81.19	11.10	83.03	11.35	84.89	11.61	86.88	11.87	88.88	12.13	90.87	12.395	92.72	12.67	94.73	12.93	96.75	13.21	98.81	5
6	16.48	123.27	16.80	125.66	17.12	128.06	17.44	130.50	17.78	133.00	18.11	135.49	18.44	137.97	18.79	140.51	19.14	143.13	19.48	140.71	6
7	23.57	176.31	23.96	179.22	24.36	182.21	24.76	185.24	25.17	188.27	25.58	191.37	25.99	194.41	26.41	197.58	26.83	200.72	27.26	203.94	7
8	32.23	241.08	32.70	244.63	33.18	248.22	33.67	251.84	34.16	255.50	34.65	259.06	35.15	262.92	35.65	266.66	36.15	270.44	36.66	274.25	8
9	42.56	318.37	43.12	322.54	43.68	326.77	44.26	331.06	44.83	335.37	45.41	339.73	46.00	344.08	46.59	348.57	47.18	352.94	47.78	357.40	9
10	54.65	408.82	55.31	413.72	55.97	418.65	56.63	423.59	57.30	428.60	57.97	433.61	58.64	438.66	59.32	443.75	60.01	448.87	60.70	454.07	10
11	68.62	513.32	69.36	518.85	70.11	524.46	70.87	530.15	71.64	535.87	72.41	511.62	73.18	547.39	73.95	553.18	74.74	559.05	75.52	564.63	11

about as one points a lead pencil. The extreme point is made spherical, about $\frac{1}{2}$ in. diameter. A thread is cut on the long part for about 12 in., and a handwheel, similar to that used on a 1-in. globe valve, is threaded to screw on the rod. A vernier plate of brass is attached to the rod as shown, and a gage plate, also of brass, about 12 in. long by $1\frac{1}{2}$ in. wide, accurately marked in inches, tenths and twentieths, is made and the whole mounted on a bracket as shown attached to the baffle partition.

The box is now ready to be placed in the circuit of the flow to be measured. It is leveled lengthwise, and a vertical line from the apex of the notch should bisect the base or widest part of the notch. Then with a transit or level and a special rod the point of the hook gage is set absolutely level with the apex of the notch, and the gage adjusted to the zero of the vernier. It is now ready for the water or solution to be turned in.

The flow is measured by turning the handwheel, thus raising the hook, until it is observed to form a small "pimple" on the quiet surface of the water just above its point. The reading of the gage is then made and noted. Reference to the table with this reading or its nearest twentieth gives the cubic feet and U. S. gallons per minute with reasonable accuracy.

Then

$$\frac{GPM}{4} = tons\ per\ hour$$

$$GPM \times 6 = tons\ per\ day\ (24\ hr.)$$

If the tonnage flow for 24 hr. to zinc boxes is required—this flow is usually a fairly constant one—take the reading every hour and note it on a record sheet. Then the sum of the cubic feet represented by the individual readings $\times$ 1.875 = tons per 24 hr. The factor used is based on 32 cu.ft. per ton of solids of specific gravity 1.0032 at 60° F.

Having the assay per ton of the solution in Au and Ag entering the boxes and the value per ton in the overflow, which tonnage will be the same, the value deposited in the boxes can be determined and a close check on the mill operation obtained.

It is also possible, when a plant is so arranged to obtain a check on the dry tonnage handled by determining the specific gravity of the pulp in transit. An accurate knowledge of the quantity flow is invaluable in both the "counter-current agitation" system and the "counter-current dilution and washing" systems. In wet concentration the measuring box is valuable in the control of water flow at different points.

Automatic recording devices attached to the box will give a fair check on the work of the mill, and increase the vigilance of the men operating in the department so controlled. The recorder should, however, be used only to supplement the hook-gage measurement when solutions are measured, as the float-operated or pressure-operated recorder results may be vitiated by the accumulation of a deposit on the float, or a condition analogous to adsorption, in which air or gas bubbles attach themselves to the float changing the displacement and thus the record. The same reasons apply to the pressure diaphragm recorder.

A manufacturer in the East makes a "water-flow recorder," using the V-notch weir in connection with an ingenious recording device that has calculation-saving features, which, for such operators as can stand the investment, is probably the most accurate device on the market. For the small milling company whose treasury will not permit such an expense, but whose mill operator is desirous of a better control of the working of his plant, the box described here in connection with the accompanying table offers a simple, accurate and comparatively inexpensive substitute.

Russian Copper Output in 1914*

The report of the Russian Copper Syndicate, "Medj," for 1914 shows that copper smelteries failed to reach their predicted output. Instead of exceeding that of the previous year by about 15,000,000 lb., the production decreased, as is shown in the accompanying table.

STATISTICS OF RUSSIAN COPPER PRODUCTION

1910	49,773,990 lb.	1913	73,967,471 lb.
1911	56,476,401 lb.	1914	71,088,312 lb.
1912	74,485,216 lb.		

The 4% decrease of 2,879,158 lb. last year is attributed by the report to the war, which caused the shutdown of the Dzansul plant of the Caucasus Copper Co., prevented resumption by the Kwarzchana works of Siemens' Successors and reduced the working forces in general. There was a recession in the first half of the year on the part of the smelteries, excepting Kyshtim and Werk-Issetsk.

The production of the smelteries for 1915 is estimated in the report as follows:

ESTIMATED RUSSIAN COPPER PRODUCTION IN 1915

	Lb.	Inc. or Dec.
Demidov Estate	2,708,250	—36,844
Bogoslov Works	7,222,000	—1,279,629
Werk-Issetsk Works	11,555,200	+5,276,682
Kyshtim	24,554,800	+7,360,120
Spassky Copper Mine	10,833,000	+359,402
Siberian Copper Co.	1,444,400	+544,249
Alexejev	1,444,400	+609,789
Caucasus Ind. & Metal Co.	10,110,000	+1,113,235
Siemens' Successors	1,083,300	—695,945
Caucasus Copper Co.	.....	—6,952,547
Various works	7,222,000	+840,424
	78,177,350	+7,089,334

According to the report, 91.8% of the total Russian copper production was by Medj Syndicate works, against 95.7% in 1913. The total Russian copper consumption amounted in 1914 to 74,831,402 lb., which is 383,271 lb. more than in 1913 and 9,956,916 lb. more than in 1912. It appears that the domestic production of smelteries and electrolytic refineries is not sufficient to meet the home demand.

Aluminum and Bauxite in 1914

The Geological Survey reports that the quantity of aluminum consumed in the United States in 1914 was 79,129,000 lb., against 72,379,000 lb. in 1913 and 65,607,000 lb. in 1912. The value of the exports of aluminum and of manufactures of aluminum amounted to $1,546,510 in 1914, as compared with $966,094 in 1913. The quantity of crude and scrap aluminum imported in 1914 was 16,241,340 lb., against 23,185,575 lb. in 1913. In addition manufactures of aluminum valued at $1,308,036 were imported in 1914, an increase of $247,807 over the previous year.

The production of bauxite in 1914 was 219,348 long tons, an increase of 9077 tons over 1913, and the largest quantity ever reported.

*Translated from the German.

Details of Practical Mining

Cheap Method of Transporting Cordwood and Timbers

By J. D. Hubbard*

The cordwood problem at many mines is more or less a serious one in relation to costs. The majority of mines are situated in mountainous regions where steep grades obtain, making hauling of any kind a serious cost factor.

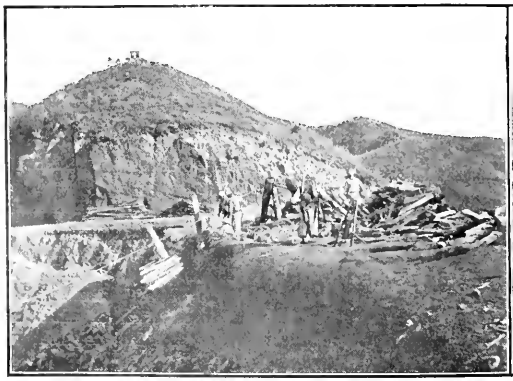
At the Oriental Consolidated mines in Chosen a great amount of cordwood is consumed annually. The cost of hauling cordwood and timbers in carts and on pack trains on the steeper trails became greater as the more available timber was cut off. Finally an employee of the company suggested the present plan, which was adopted and which resulted in a great saving to the company.

A steel cable was swung and well anchord at both ends, with sufficient height above ground to keep the bundles of wood from striking, and with a grade of at least 25°. Spans of 4000 or 5000 ft. are not too long. Old steel cables, after being used to their limits for hoisting, may be used for this work. They are worn out by friction eventually, but greasing the cable from the upper end lessens the wear on the rope.

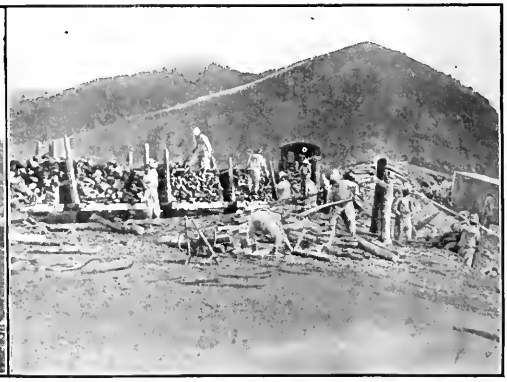
The wood is placed in bundles on a frame, a short length of hemp rope slung around it and fastened to the "rider" by a simple timber hitch. The rider is notched at the proper place to receive the hemp rope, and at another place to ride the cable. The bundle of wood is then tripped and gravity does the rest, the bundle taking care of itself upon striking a bumper at the lower end. The wood is spread over the landscape somewhat upon striking, but is easily gathered up. The amount of splintering depends on the kind of bumper used, and experience shows the best plan.

The hemp ropes are used over and over again, being gathered up and returned to the top landing by the coolie carriers employed for the purpose. Mining timbers of average length are transported the same way. The whole device is simple in the extreme and can be readily installed with a small amount of labor. The illustrations exemplify the simplicity of the operation.

*Mining engineer, 832 Mills Building, San Francisco, Calif.



"TRIPPING" LOAD OF CORDWOOD BY CABLE



UNLOADING WOOD AT UPPER END OF CABLE

Application of Roller Bearings to Mine-Car Haulage

By Phillips N. Case*

A few years ago the average mining operator considered a roller-bearing mine car a luxury to be indulged in only by the most fastidious. Today roller bearings in mine cars are acknowledged to be essentials in obtaining maximum efficiency. In metal mines the use of roller-bearing cars is now felt to be imperative; the reduction of haulage expense also constitutes a vital problem in coal mines on account of the long hauls, heavy tonnage and motor haulage now usually encountered in the large operations. In a recent tour of practically every important Western mining district, I did not find a single locality in which roller-bearing mine cars were not in evidence. As the mining profession has now come to realize that the consideration of roller bearings in connection with haulage problems is of paramount importance in the economy of power, oil, labor and maintenance, an outline of the several standard methods of applying roller bearings to mine cars, together with a brief statement of the conditions under which each is especially applicable, may not be amiss.

The methods of installing roller bearings in mine cars may be classified under three heads—(1) wheel hub, (2) inside box and (3) outside box. The wheel-hub applica-

*Sales engineer, Hyatt Roller Bearing Co., Newark, N. J.

tion (Figs. 1, 2 and 3) is at present in most common use, owing in part to the fact that it is a simple, economical construction that does not materially alter the design of the car boxes and trucks in use previous to the adoption of roller-bearing equipment. Moreover, as the bearing is in the hub, the height of the car body is not necessarily increased over that required with the use of a plain bearing. This point is particularly advantageous in cases where the head room is limited. In addition, this construction does not involve incasing the axle, as in the construction shown in Fig. 4. Where the track gage is wide such casing would prove heavy and cumbersome.

Considerations in Designing Applications of the Wheel-Hub Type

Though the wheel-hub application has in its favor the points enumerated, there are several factors that must be carefully considered when designing a wheel-hub installation in order to obtain a high efficiency. The most important of these is the thrust exerted by the flange when the car is rounding a curve. As the wheel hub is not a rigid box, the thrust that the flange receives from the track on the curve exerts a turning moment against the inside end of the bearing. Therefore, in order that the rollers may not be injured by this thrust, it is essential that the bearing project far enough inside of the load line to take care of this severe duty. To accomplish this, it is best to place the bearing in the hub in such a way that the center line of the bearing coincides with the track gage. Moreover, if this rule be followed, the load is centered, resulting in a uniform distribution of the weight, in the case of flexible bearings affording a full line of contact, when the car is traveling on a straight track. It may be readily understood that because of the resilience inherent in the construction of hollow-spiral rollers, this type of roller bearing is superior to any solid-roller bearing in resisting effectually the severe flange thrust. Another point to be considered is the fact that with a bearing in the hub of a wheel, it is usually difficult to exclude dirt, this being particularly true in cars which are side-dumped. This point should therefore be weighed when designing a wheel with such a bearing. Moreover, with the wheel revolving about the bearings, there is a tendency for the oil to leak out unless well packed. The hollow-spiral rollers of the Hyatt bearings constitute oil reservoirs and as the spirals are alternately right and left hand, a thorough circulation of oil is assured.

Three Wheel-Hub Applications

There are many methods by which bearings may be properly installed in the wheel hub—more, in fact, than I shall attempt to describe here. However, Figs. 1, 2 and 3 illustrate three efficient methods of applying roller bearings, either solid or spiral, in the hub. The cotter-pin application (Fig. 1) presents small opportunity for friction at the outer end of the wheel hub, while the large plate washer at the inside end affords a broad surface for receiving thrusts and in this application is well lubricated by oil from the bearings. At the outer end of the hub, a steel compression ring fits around a leather washer on the axle, thus effectually eliminating leakage of oil at this point.

The application in which the wheel is held on the axle by means of a collar (Fig. 2) is an example of a strong wheel embodying simple construction, with a solid hub at the outer end, affording no opportunity for dirt to enter or oil to leak at this point. In this case the thrust is taken by the collar.

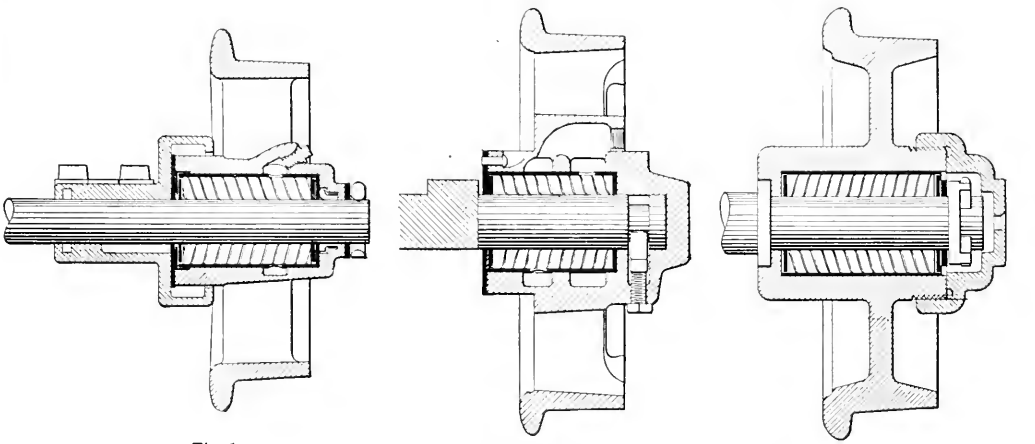


Fig. 1 Fig. 2 Fig. 3

THREE WHEEL-HUB APPLICATIONS OF ROLLER BEARINGS TO MINE CARS

Fig. 3 illustrates a well-designed application of the cap type. Where a cap is employed at the outer end of the hub, it is essential that it be held securely. In this design this is accomplished by threading the cap on the hub, and yet the bearing is readily accessible by simply unscrewing the cap. The end thrust is taken by the collar on the axle.

Selection Depends Upon Operating Conditions

The wheels above described are representative examples of applications in common use, a selection depending upon the conditions at the particular mine in which they are to be used and also upon the ideas of the mine operator. Whatever methods of applying roller bearings in the wheel hub may be favored by any particular mining man, in my opinion it is an advantage to employ a round axle which

is free to turn and thus slips around slightly from time to time, evenly distributing around the axle the load transmitted by the rollers.

Inside-Box Applications

Considering the application of the inside box to the roller bearing, this may be subdivided into two classes—(1) the Anaconda type of wheel and axle shown in Fig. 4, and (2) the angle-iron type shown in Fig. 5, in which the boxes at opposite ends of the axles are braced by angle irons. In the latter type it will be noted that a beveled, self-aligning box is used. This has a decided advantage on uneven tracks, as an opportunity is afforded the box to maintain its alignment. However, except in the case of a wide-gage track, the Anaconda design is undoubtedly preferable, for here the casing affords a rigid box and the whole design is therefore more conducive to stability. In connection with the Anaconda type, the self-aligning box would undoubtedly be an improvement. The thrust in the Anaconda wheel and axle is taken on the heavy flange washers which are threaded over each end of the box protecting the end of the bearings. It should be observed that one wheel is loose on the axle, being held by a cotter pin, while the other is pressed on the axle. The purpose of this is to afford a differential in rounding curves. Owing to the fact that the inside-box applications necessitate slightly greater head room over that required in the case of a plain bearing, there are some instances where they are inapplicable. However, the inside-box type represents in many respects a more efficient application than any wheel-hub type and has become popular in the metal mines in such districts as Montana, Arizona, Idaho, Colorado and Lake Superior.

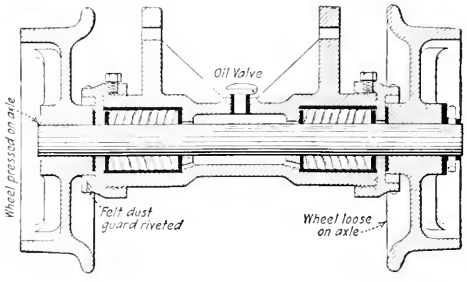


Fig. 4

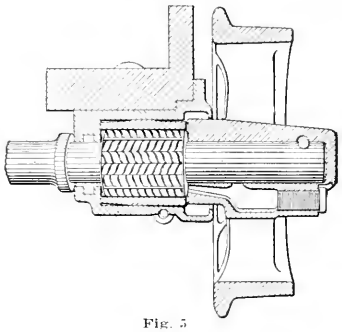


Fig. 5

INSIDE-BOX TYPES OF ROLLER-BEARING WHEELS AND AXLES FOR MINE CARS

Outside-Box Type Most Efficient

In considering the outside-box application (Fig. 6), it may be stated at the outset that where applicable this is the most efficient installation. In the design illustrated, the thrust is taken at the inside end of the box (*A*, Fig. 6). But this point could be easily modified so that the thrust would be taken between the end of the axle and the cap, in which case the surfaces would be well lubricated by oil flowing from the bearings. In regard to the felt packing at the inner end of the box, it may be well to call attention to the method of compressing a square felt packing into a tapered recess.

It will be observed that in the case of the outside-box applications, the bottom of the car body must necessarily be raised above the wheel and the axle must project beyond the wheel, so that this type of equipment is prohibited in narrow or low haulageways. However, many mines employ spacious main-haulage tunnels, through which trains may be hauled by motors at considerable speed, thus affording ideal opportunity for the use of this installation. As an illustration of the efficiency which may be obtained under these conditions, a mine in Idaho may be cited. The entrance is by a tunnel about two miles in length, through which long trains are hauled at a high rate of speed by electric motors. Upon a recent visit to this mine I was informed that the first of these tunnel cars—equipped with Hyatt roller bearings in outside boxes—covered 3000 miles in four months, without any attention and without any ill effects. At present all the cars in this tunnel are equipped with these bearings. The capacity of the cars ranges from 3 to 4 tons of ore, and the service is severe; nevertheless, excellent results are being obtained. Such experiences prove that it is possible in the case of an outside-box application, and to a lesser degree in the case of an inside box, to use with perfect safety bearings of shorter length than would be required were they installed in the wheel hub. With large cars and heavy loads this is a decided advantage.

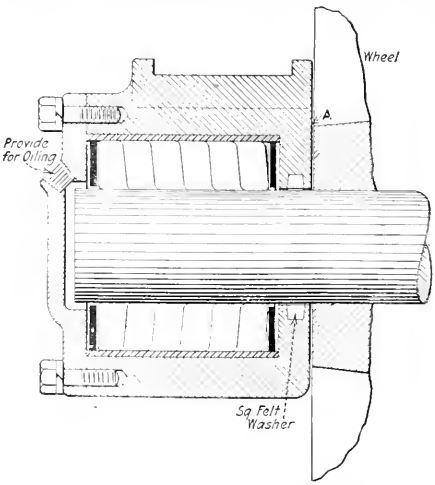


FIG. 6. OUTSIDE-BOX APPLICATION

Details of Milling and Smelting

Marcy Ball Mill Described

Mill operators have been patiently awaiting some technical description of the Marcy ball mill, which has been tried with apparent success and is being installed in some of the larger plants at the present time. No description by the inventor has been forthcoming, because of pending patent applications, but U. S. pat. 1,137,878, granted to F. E. Marcy on May 4, 1915, gives a general description of the mill in question.

The Marcy ball mill is of the drum-type, equipped with the usual spiral feeder and loaded with pebbles or balls as may be required. The drum is divided into two parts—the crushing compartment, equipped with lifters to insure the elevation and dropping of the balls to secure maximum crushing efficiency, and a small compartment at the end of the mill, separated from the crushing space by means of a manganese-steel plate and

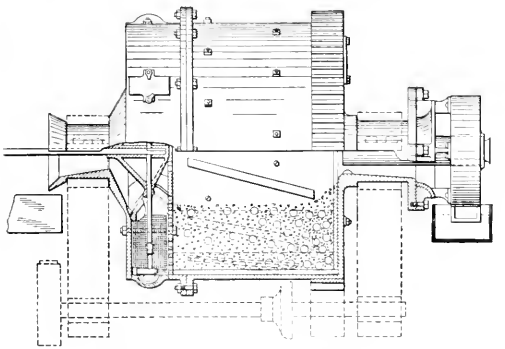


DIAGRAM OF THE MARCY BALL MILL

having perforations about $\frac{1}{8}$-in. wide. In this end compartment there are radial screens and lifters, the lifter forming the bottom of a box the top of which is formed by the screen itself. These are the finishing screens, and material which will pass through them is considered as being of finished size. The material passing through the screens is diverted by arrangement of the compartment so that it will be discharged through the central orifice; while the oversize—material which remains on the screen—is diverted back into the mill through a proper opening. The screens and lifters form a box, as has been stated, and are placed so that they may be removed from the outside of the mill for rearrangement or cleaning. In order to give the screens maximum efficiency and to increase their life, an arrangement of pipe is made so that water or solution under head can be thrown against them while the screen is passing through the upper half of the circle formed by a cross-section of the mill.

The action of the lifters, in addition to forming the bottom of the box and assisting in the screening operation, is to maintain a low pulp level in the mill. It is clear that by constantly removing the solution and pulp from the bottom of the crushing drum, a removal of the material already sufficiently finely ground is accomplished rapidly and no energy is lost in doing work where it is not required. The coarser material is left in a comparatively dry state upon the balls or pebbles, and the crushing and grinding action of the mill can have maximum effect upon it. The accompanying drawing shows a longtitudinal view and partial cross-section of the mill, giving a clear idea of its construction and operation.

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Improvements for Ropp Roasters

By Edgar Hall*

The Ropp roaster although extravagant in fuel has many good points. It can be built cheaply, costs little for repairs and requires no great amount of brains to keep it at work. The use of producer gas reduces the fuel bill, and doubtless it would not be difficult to devise means of conserving heat and lessening the excessive influx of cold air, which would effect further economies. Possibly they have already been introduced, although as yet undescribed in the technical journals. About 10 years ago a Ropp roaster, supplied to the Mount Morgan Gold Mining Co., was purchased by the Silver Spur Mining Co., and has been in use ever since, roasting a complex zinc-lead-copper ore in preparation for matte smelting.

The machine as supplied by the patentees was fed by two Challenge ore feeders—one on each side of the slot—and the four rake carriages had flangeless wheels which were prevented from running off the semi-circular turns in the rails at each end of the furnace by small bogie under-carriages of an elaborate character. Both feeders and rakes had numerous wearing parts requiring constant attention and lubrication, particularly the bogies on which the consumption of oil, owing to the heat in passing through the furnace, was enormous for the work done. It was soon evident that improvement was possible in these parts of the machine.

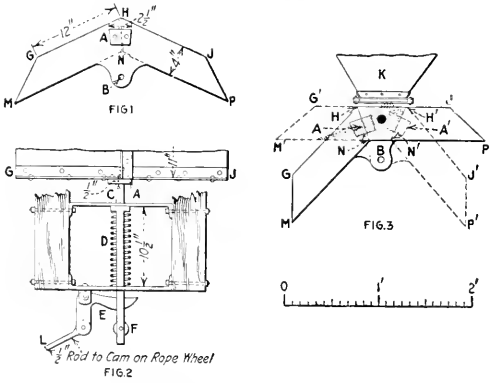
The Challenge feeders were abandoned for the single, overbalanced, tripping type of feeder shown in the accompanying drawings. This is an advantage in every respect. It requires less power, less attention, feeds more evenly on each side of the slot and has cost nothing for repairs and practically nothing for lubrication, only an occasional drop of dirty oil from the engine being required. In first cost the comparison is as great, since only one storage hopper is needed and the feeder itself can be made in a day by a skillful blacksmith, using short ends of plate and rod.

Feeders of this type were in use long ago, in tin-dressing sheds for supplying water to slime tables, but

*Silver Spur Mining Co., Silverspur, Queensland, Australia.

I have not heard of any being used for dry material. There is no reason why they should not be more generally used. For finely crushed ore they work well and probably would be satisfactory on any fairly uniform material of moderate size. At Silverspur the ore was crushed to pass $\frac{5}{16}$-in. square holes, but at times the feed was larger. The feeder consists of two short chutes (*GHNM* and *HJPN*, Fig. 1) of steel plate set together at an angle and placed immediately over the slot and under the mouth of a storage hopper, to the timber frame of which it is fastened. It is free to move on the axle *B*, but is kept in position by the pin *C*, Fig. 2, acting against the shoulder of the block *A*. Figs. 1 and 2, riveted to the outside of the chutes. The pin *C* is held in position by the spring *D* and is moved by the cam *E* acting on a small disk *F*, revolving loosely in a slot in *C*. The cam *E* is attached by a rod *L* to a shoe (not shown) which is struck by a cam on the rope sheave which drives the rakes.

The revolution of the sheave brings the cam over the shoe connected with rod *L*, which pushes the pin *C* out from one side of the block *A*, releasing the chute *GHNM*, which then tips over and is again fixed by the return of pin *C*—through the action of the spring *D* as soon as the



FEEDER FOR ROPP ROASTER

cam on the rope wheel has passed the shoe—to the other side of the block *A*. The next movement of *E* reverses the action. The mouth of the hopper *K*, Fig. 3, is provided with a sliding shutter worked by a screw by which the feed can be adjusted to fill the chute to the amount required for easy working of the feeder.

It is obvious that one side or the other of the chute is always level and parallel with the mouth of the hopper, and that when the slide is open the crushed ore will fall through and pile up on the chute until the opening is blocked by the natural slope of the small pile so formed. Fig. 3 illustrates in diagrammatic form the working of the appliance. The mouth of hopper *K* being open and the chute shown in dotted lines in the position *G'H'N'M'*, a small pile of ore *O* forms and blocks the openings. Presently the revolution of the rakes causes cam *E* to move pin *C*, when the weight of ore on the chute *G'H'N'M'* overbalances the chute and it falls over and discharges its load on the floor of the furnace on the left side of the slot. The chute now has the position *GHJ* and is filled with ore on the side *HJPN* in like manner, and at the next movement of cam *E* falls over and discharges an equal quantity of ore on the floor of the furnace on the right side of the slot. By increasing the number of cams on the rope wheel the quantity fed can be multiplied to any extent, and will remain equally divided between the two sides of the furnace. The feeder of the size shown was equal to 20 tons per day with one cam only on the rope wheel.

I next tackled the rakes which, in spite of the elaborate bogies, would not keep on the rails. The ubiquitous greased flat-sheet of the miners suggested itself. It was easy to try it and I did; the experiment succeeded. The result was that the semicircle of rails at each end of the furnace was taken up and circular tracks of smooth-faced cast iron put in their places. The bogies were removed and the rake carriages placed on fixed axles carrying ordinary mine-truck flanged wheels. The flanged wheels run in the usual manner over the straight lines of rails under the slot and on the return line outside the furnace, but in turning at the ends of the furnace they run on the rims of the flanges over the cast-iron plate tracks, the greased surface of which allows the revolving wheels to perform easily the small slithering movement needed to enable them to follow the rope around the semicircle. Wooden guides fitted at the side of the entrance of the straight lines of rails lead the wheels safely off the plate track to the rails.

The improvement is immense. By dispensing with the bogies the weight of the four rakes is lessened by 1064 lb., nearly half a ton less to be hauled constantly around and through the furnace, and friction is much reduced. There is a great saving of time as the rakes seldom leave the rails and there is no stoppage for oiling the many moving parts of the bogies. The cost for lubricant falls to almost nothing, as waste oil from other machinery can be used for the tracks and the constant renewal bill for bogie parts and rollers disappears.

These alterations have stood the test of years, and are described on the chance that the methods may be applicable to other machines involving similar movements.

Lead Acetate vs. Litharge

By C. R. Morris*

During a series of experiments carried out at the Mexican mill, Virginia City, Nev., it was found that there was not much difference in the mill between using one or two pounds of lead acetate. Our acetate supply

EFFECT OF LITHARGE AND LEAD ACETATE ON EXTRACTION

	Aug.	Sept.	Oct.	Nov.	Dec.
Heads, oz. Ag	629	714	728	661	878
Tails, oz. Ag	108	112	135	65	79
Extraction, per cent	83	84	82	90	91
Lead acetate, lb	1¼	2	..	¼	¼
Litharge, lb	..	..	..	¾	¾
Cost per ton, c	.14	.22	..	.09	.09

failed in October and on this account we were compelled to use litharge, putting it into the tube mill three times a day. The extraction appeared to be as good as with the use of lead acetate. In November we received a supply of lead acetate and used both salts, ¾ lb. of litharge in the tube mill and ¼ lb. of lead acetate in the agitators. This combination of salts gave a better extraction. Results are shown in the accompanying table.

*Superintendent, Mexican mill, Virginia City, Nev.

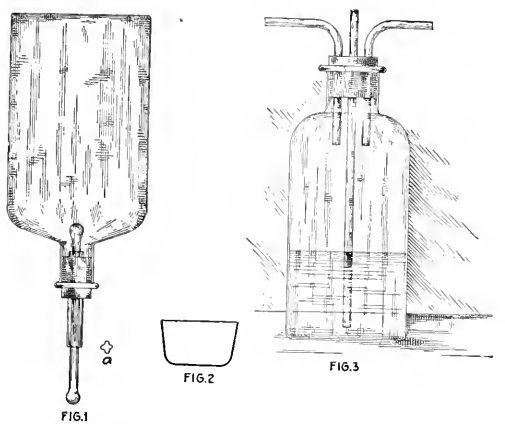
The Assayer and Chemist

A Rapid Method for Washing Gold Beads

By E. J. Hall*

The suggestion by W. S. Black, in the *Journal* of Dec. 26, 1914, for an improvement in the time-honored method of parting and washing gold-silver beads appeared so attractive that I immediately set up his apparatus, except for the interposition of a bottle containing a solution of sodium carbonate between the suction bottle and metal piping to the pump—the fumes from hot acid were strong—and found that the method met all his claims.

I believe, however, that the proposals mentioned below are improvements. As stated by Mr. Black, there is



APPARATUS FOR WASHING GOLD BUTTONS

little trouble from the loss of fine gold, and the saving is closer than by decantation. If the fine gold starts to move across the bottom of the cup, the velocity of the liquid may be retarded or stopped by pinching the rubber tube. Here there may be some trouble with the apparatus as described, with a good head of water, since the Richards pump is capable of giving a vacuum of nearly 30 in. of mercury, and when the pressure on the tubing is released, everything in the cup is likely to disappear if the suction tube is not instantly removed. To overcome this difficulty a vacuum regulator is inserted in the line beyond the suction bottle. This is the common mercury bottle illustrated by Fig. 3, and is frequently used in suction filtration and where such apparatus as pipettes and burettes are filled by suction. The suction is regulated by the height of mercury above the bottom of the relief tube, and will be found satisfactory for this work at one inch.

*Department of Metallurgy, Columbia University, New York City.

The common practice in parting is to add strong acid or wash water as soon as the liquid has been decanted and to put the cups back on the hot plate, or else after decanting to place the cups on a table until this operation is completed. Then the succeeding liquid is added and the cups replaced on the stove. For dispensing the liquid either a beaker or the method suggested by Mr. Black is used, though the latter cannot be successfully employed for strong nitric acid. This procedure is at variance with Mr. Black's treament—where the cups are allowed to dry and bake between applications—and, on the average, will give cleaner gold.

The addition of acid and water from a beaker to the cups without taking them from the stove, immediately following removal of the solution, proved unsatisfactory and therefore the liquid-dispensing bottle illustrated in Fig. 1 was constructed. The bottom of a narrow-mouth glass bottle was cut off. Next a piece of 5-mm. glass tubing was cut true on one end and the edges slightly rounded in a blow-pipe flame. The other end was softened and pressed in with a pointed instrument at four places (*a*, Fig. 1), leaving just sufficient clearance for a 3-mm. glass rod to pass freely. The top of a 3-mm. glass rod was held vertically and rotated in the blow-pipe flame until a ball 6 to 7 mm. in diameter had formed. The rod was inverted and ball heated till it assumed a pear shape and was then allowed to cool. This was inserted into a tube, a paste of 60-mesh emery applied at the point of contact between bulb and tube and ground to a good seat, then polished with a paste of 150-mesh emery, obtaining a perfectly tight valve. Almost any abrasive may be used. A ball formed on the other end of the rod prevents it slipping from the tube. To cement the valve in place it is inserted in the small end of a cork about ⅜ in. and introduced into the neck of the bottle from the inside; the neck is then filled from the mouth with sulphur-sand cement and when set the cork is removed. The dispensing bottle is then set in a wide-mouth bottle, its shoulders resting on the top, and may be filled with any desired liquid.

The details of parting with the apparatus are as follows: After the action of the weak acid on the beads has ceased, the cups are filled with distilled water—to dilute the silver nitrate—by lowering the glass rod of the dispensing bottle into the cup and pressing on the bottom, thereby opening the valve. When a cup is full, the bottle is raised and the valve closed. When the cups are full the water may be changed and strong parting acid used or another dispensing bottle procured.

If 4-cm. Royal Meissen capsules (Fig. 2) are used instead of the customary crucibles, a slight pressure with the suction tube at the point where the bottom curves into the side of the cup will cause the cup to tilt sufficiently to permit complete removal of the liquid. Another advantage of these capsules is their self-righting character, which makes them more convenient to handle. The suction tube is then moved to the next cup, and while

the solution is being removed, strong parting acid is added to the preceding cup from the dispensing bottle, thus preventing premature drying of the gold and enabling the carrying out of two operations at once. After all the cups have been treated in this manner the acid is diluted and the operation repeated, using water instead of acid. If the beads are sufficiently high in silver to part completely or nearly so in the weak acid, one water wash will usually be found sufficient, particularly if the silver is not over 50 mg. We found that the working time of parting had been reduced approximately one-half by the above procedure and its unpleasantness by 90%. Therefore, Mr. Black is to be commended for his suggestion on a process which is so old that no one imagined it could be improved.

*

Assaying Gold-Bearing Cyanide Solutions*

The method here described has been used at the plant of the St. John del Rey Company, at Morro Velho, Brazil, and has proved satisfactory. It is operated by native assistants without any difficulty and yields accurate results which have been carefully checked against the evaporation methods. The method is based on the precipitation of gold by means of zinc shavings, or rather by a zinc-lead couple, from the boiling solution, in the presence of considerable quantities of silver and lead salt. Sufficient silver is introduced to yield with the gold a suitable parting alloy. The presence of lead salts causes the formation of a zinc-lead couple which facilitates the complete liberation of the metallic gold from the solution and yields a bulky precipitate of lead and precious metals which settles easily and thus insures the ready and complete carrying down of the precipitated gold.

The stock solutions consist of a silver solution containing one grain of silver for each 10 c.c. Thirty-six grams of silver-nitrate crystals are dissolved in water, sodium cyanide added in small quantities until the precipitate which first forms is redissolved, and the solution then diluted to $2\frac{1}{2}$ liters. The sodium cyanide solution is a 10% mixture, 250 to 260 grams of sodium cyanide being dissolved in water and diluted to $2\frac{1}{2}$ liters. Sodium-plumbite solution contains 65 grams of lead acetate dissolved in water with sodium-hydrate solution added until the precipitate first formed just redissolves, and the solution diluted to $2\frac{1}{2}$ liters. This solution is preferred to the simple acetate solution usually employed, since it insures the alkalinity of the liquid and the consequent absence of free hydrocyanic acid which might otherwise tend to carry back some gold into the solution.

The procedure is to take one pound, or 7000 grains, or 453.6 c.c. of the solution for assay; this volume is poured into a flask of $1\frac{1}{4}$ liters' capacity and the silver solution added. For rich solutions, 15 c.c. of the silver solution is used, and for the poorer solutions and for wash waters only 5 c.c. Next, 10 c.c. of the sodium cyanide solution is added, then 5 c.c. of the plumbite solution, and the mixture shaken.

Then, 20 grams of zinc shavings is placed in the solution and the contents of the flask gently boiled for half an hour and then filtered at once through a 9-in. filter paper, the clear filtrate being rejected. To the flask containing the solution and shavings, a little water is added, about 20 c.c., only just so much being required as will prevent the cracking of the flask by the drying and heat produced on the subsequent addition of the acid, then 30 c.c. of commercial hydrochloric acid. After the complete solution of the zinc, the contents of the flask are poured on the filter, flask and filter being subsequently well washed with water.

The wet filter is transferred to an assay crucible, dried slowly in the furnace and carbonized at moderate heat. The crucible is withdrawn from the fire and a flux is then added, consisting of this mixture:

FLUX FOR MELTING THE PRECIPITATE

Red lead	$12\frac{1}{2}$ grams	Flour	2 grams
Borax	$22\frac{1}{2}$ grams	Powdered glass	2 grams
Sodium carbonate	$12\frac{1}{2}$ grams	Potassium nitrate	2 grams
Sodium chloride	2 grams		

The crucible is then returned to the furnace and the charge run down in the usual manner, from 20 to 30 minutes being required to complete the fusion, after which the contents of the crucible are poured into a conical mold, the metallic button detached when the mass has cooled, and cupelled in a small magnesite cupel, the resulting beads being parted directly in the usual manner, usual manner.

*

Electrolytic Method for Copper in Nitric-Acid Solution

The following note on copper determination by electrolysis is by H. Clonkey of the Forest Products Laboratory, Madison, Wis. (*Journ. Ind. Eng. Chem.*, March, 1914):

In the electrolytic determination of copper from nitric-acid solutions the deposit is bright and adherent, if the correct acidity-concentration conditions have been maintained. When the acid concentration is too low the film has a dull look and may not be adherent. If the acid concentration is too high a long time will be required completely to deposit the metal, although the deposit will be bright.

In those cases where it is inconvenient to limit the amount of free acid in bringing the copper into solution in preparing for the electrolysis, and where the results of the analysis are needed in the shortest possible time for control work, this excess acidity can be easily controlled by a little powdered sodium acetate.

In preparing the solution for electrolysis all the nitric acid can be used that is necessary to bring quickly into solution the copper, copper salts, or compounds containing copper. Then, after the electrodes have been mounted, the current switched on and current density adjusted, if the copper does not promptly start to plate out, a little sodium acetate dusted into the solution will fix the excess of nitric acid which is dissolving the copper film as fast as formed.

The change in the character and speed of deposition will be almost instantaneous, and the deposit will be bright, adherent, and formed in the minimum of time. The treatment of the solution with an excess of sodium acetate at the end of a deposition in order to change the free nitric acid to sodium nitrate, and thus enable the electrodes to be removed without previous washing, has been recommended often, and the action is the same in both cases, differing only in degree.

*Excerpts from an article by J. M. Levy and Harold Jones, in "Bulletin No. 128" of the Institution of Mining and Metallurgy, May 13, 1915.

Broken Hill Milling Practice*

SYNOPSIS—The Broken Hill lode is not of great extent, but the large variety of ore produced makes necessary a diversity of milling practices. Breaking, crushing, grinding and regrinding are about in conformity to usual practice. Screen sizing is preferred to hydraulic classification. Both jigs and concentrating tables are used.

Although the Broken Hill lode in New South Wales, Australia, is only two miles in extent, the characteristics of the ore in the various mines render the adoption of a standard method of treatment impracticable. The ore consists mainly of lead and zinc sulphides, quartz, rhodonite and garnet sandstone, and it is the varying quantities of the gangue constituents, as well as the variation in degree of crystallization of the mineral contents, which enforce the need of different methods.

Power and Crushing Systems

Some of the mills are driven by steam engines directly connected with the main mill shaft by rope drive. Of late years, however, the general tendency has been toward the installation of three-phase induction motors, each important machine or group of machines being driven by a separate motor. The current for driving the motors in the mill is usually generated at a central power plant. The practice is to run each mill in sections, usually of about 1500 tons per week capacity, so arranged that a breakdown in any section only temporarily stops that section and not the whole mill.

Magnets are used at the head of the crushing system to remove lumps of iron, and grizzlies are in general use. The gyratory crusher is preferred to the jaw type. The present tendency is to crush finer than formerly with the gyratory breaker so as to increase the roll capacity, the size of the product leaving the gyratories being about 1½ in. With an ore such as that in the Junction North mine, containing a high percentage of extremely hard rhodonite, this is particularly desirable. In such a case it is usually necessary to have two gyratory crushers in series, a grizzly at the head of each machine. With a moderately hard ore, a single gyratory will crush 45 tons per hr. from 8 in. down to 1½ in. The average horsepower per machine is about 30, but there is often a peak load as high as 50 hp. A small jaw breaker following the gyratory for intermediate reduction, which used to be a feature of Broken Hill practice, has been dispensed with almost entirely.

Extensive Use of Rolls

The roller system is usually employed for feeding the ore from the bins to shaking screens at the head of the rolls. A flange roller, 10 in. in diameter and 15 in. long, traveling from 4 to 8 r.p.m.—the rate being regulated by a ratchet and pawl—is used. The quantity of feed is regulated by a door worked by a rack-and-pinion over the roller, and in some cases the door is tapped automatically by a rod from the shaking-screen gear so as to keep the ore in motion. Shaking screens at the head of the rolls are now universally used. The importance of efficient screening ahead of the rolls is often overlooked, but bad screening at this point causes undue sliming and is often the cause of low recovery, especially in the case of a hard ore. Shaking screens, suspended from above by hickory springs or eye-bars, are rigidly connected to the eccentrics which drive them.

In the South mill the feed is first treated on a narrow shaking screen and the reground oversize is afterwards separately treated in trommels. In the British mill a corrugated screen is used to keep the ore well agitated in passing over the screen. The average number of bumps given to the shaking screens is 250 per min. The screens are usually lined with steel-slotted material having a 3-mm. aperture, although in the softer types of ores it is screened to 4 mm. for jigging purpose.

Cornish slow-speed rolls, 36 in. by 18 ft., are almost always used on this field. Their speed is 15 to 25 r.p.m. The shells are made of toughened chrome steel and have double-cone centers bolted together, so that when worn they are easily removed. In some cases the rolls are both gear driven. In other cases one of the rolls is driven by friction. The general practice is to have one roll plain and the other flanged, the plain roll working inside the flanged one. Strong rubber or iron springs are used in all cases. Running the rolls fairly wide open, with a large oversize return, is the usual practice. No lateral movement is given, as the shaking screen at their head provides for even wear.

Series Crushing to Reduce Sliming

Series crushing in rolls, theoreticaly supposed to reduce sliming, has been proven by practical tests to be uneconomical. One large Broken Hill mill which for years has been working two sets in series has now gone back to a single set, the feed being crushed finer in the primary reduction of the ore. Experiments with high-speed rolls have demonstrated their inferiority. The average capacity of a set of rolls is 1500 tons per week, crushing from 1½-in. size through a 3-mm. slotted screen; the average horsepower is 30.

From the roll screens the ore goes into the jigging system. It has been found essential to remove fine sand and slime from the jig feed, otherwise it is a matter of difficulty to prevent them passing through the lead hutches and spoiling the final lead product of the jig. Here the practice is divided. Some of the mills use hydraulic classifiers at the head of the jig, a double-cone classifier being preferred. Others use King screens to classify the jig feed, the product screened out being usually 5 to 10% plus 40 mesh. In some isolated cases where screening or classification at the head of the jig is imperfect the jig lead is classified in a hydraulic classifier, but this system is not to be commended.

Characteristics of Jig Practice

Jigging practice has been greatly modified in the last few years. May jigs have now completely supplanted the Hancock machines formerly in use. Jigging has been developed along two entirely different lines, because of the difference in the nature of the ore treated. In the first practice, which is used on most of the mills and is especially adapted for fine-grained ores, the jig

*Excerpts from an article in "Mining and Engineering Review," Melbourne, May 5, 1915.

is used for recovering coarse lead, no attempt being made to produce on the same primary jig a worthless tailing. The whole of the product, except of course the lead, is recrushed for after-treatment in the tabling system. In some cases a middling product is made and returned to the jig. It has been found that by working the jig on these lines five hutches are not required, and only three, or at the most four, are used. In the second practice two sets of jigs are used, the five hutches in each set being employed. On the primary jig, as in the first system, no rejects are made, the tailings produced being reground and treated on tables. Thus the first jig makes the following products: Nos. 1 and 2 hutches, lead; No. 3 hutch, middlings, which are returned; No. 4 hutch, middlings, which are crushed in positive pans and sent to No. 2 jig; No. 5 hutch, tailings, which are recrushed in tube mills. The object of the second, a fine jig, is to make quartz tailings, which are discarded. In the case of a poorer ore this system may be modified, No. 4 hutch going to the tube mills and No. 5 hutch to the positive pans and then after classification to No. 2 jig. This enables a large rejection of quartz tailings to be made.

The advantages of the second practice are the recovery of the maximum amount of lead before undue sliming has taken place and the saving in crushing costs by the rejection of comparatively coarse quartz tailings. The rhodonite being of high specific gravity must be crushed finer to make a saving of further lead values, and also to make a product suitable for flotation treatment of the zinc which cannot be separated from it by mechanical means. It will therefore be realized that this method is not applicable to ores containing a high percentage of rhodonite. The use of the system mentioned has resulted in large capacity increase per jig, and 2000 tons per week of 144 hours is not uncommon. The speed of the May jig is usually 180 strokes per minute, the length of stroke being variable.

Types of Regrinding Machines

Tube mills and grinding pans are used for regrinding. The normal size of the tube mills used at Broken Hill is 10x5 ft., traveling 28 r.p.m. and using 28 to 30 hp. Both trunnion- and roller-type mills are in use. Cast-iron liners are employed, the general size being 20x13x1¼ in. In some cases longtitudinal bars are used to lift the pebbles, while in others the projection forms part of the liner itself and serves the same purpose. Pebbles in the tube mill are usually kept 2 in. below the center at the feed end and 4 in. below the center at the discharge end, the load of flint weighing approximately 4 tons. A coarse screen is used on the discharge end to prevent small pebbles from going out with the crushed product. Moisture in the tube-mill feed varies from 50 to 60%, being higher than in the case of Rand tube mills, which crush finer. Scoop feeds are used satisfactorily. Pebbles are fed in by hand through the manhole door once a day. This method is satisfactory, as pebble consumption is low, 1½ to 2 lb. per ton of ore crushed. Iron consumption is ⅛ to ¼ lb. per ton.

As a rule the ore is ground from jig size to a size suitable for table operation—that is, 5 to 15% plus 40 mesh—in a single tube mill. On some plants tube mills are worked in series with 5-ft. pans. The tonnage treated under these conditions varies from 5 to 8 per hour.

Grinding pans 8 ft. in diameter are used in some mills. They are of two types: Positive pans, in which the feed enters at the center of the pan and passes straight through between shoes and dies and out of the pan, no classification being attempted by raising the overflow of the pan above the level of the shoes and dies; and ordinary pans, in which the feed is not necessarily in the center and where the grade of crushing is regulated by the height of the pan overflow. The stage-grinding system is in use, and it has been found to be much more efficient than a single-step system. The jig-reject product is run, after a classification, into two 8-ft. positive pans, and the classified product from these pans is further crushed in an 8-ft. ordinary pan.

The Forwood-Down Grinding Pan

The pans of the Forwood-Down type have a speed of 32 r.p.m. In the stage-grinding system they crush 2 to 2½ tons per hr. from through 3 mm. to 10% plus 40 mesh. Shoes and dies used are cast iron. As to the 5-ft. grinding pans, both positive and ordinary types are in use. They are used both singly and in series to crush the feed from jigs to the size required for tables. In each case the product is classified on screens before it passes to the pans. The capacity of the Forwood-Down pans is 1½ tons per hr.; speed, 50 r.p.m.; horsepower, 8. Shoes and dies of cast iron last from 6 to 8 weeks, although manganese steel lasts longer. The cost per ton is practically the same in each case. With cast-iron liners 2½ to 3 lb. of metal per ton is usually worn off.

Tube mills are considered preferable to pans. The crushing may be better regulated, as it depends on the load of flint or pebbles and the proportion of water running to the mills, and not, as in the case of pans, on the state of wear of shoes and dies. Costs, while high with tube mills, are much lower than with grinding pans.

The increased capacity of grinding pans while crushing in series leads one to believe that the most efficient crushing system is stage-crushing with tube mills. Two short-tube mills with classified feed supplying a classifier, the underflow of which delivers into a 10x5-ft. tube mill, should give a high capacity and reduced wear with low power consumption.

Necessity for Efficient Classification

A fact that is often lost sight of is the extreme importance of efficient classification at the head of fine-crushing machinery, for tests with grinding pans have proved that it greatly increases the tonnage treated per machine, and also lessens the amount of slime produced. Screening seems preferable to hydraulic classification, as fine lead will pass through the discharge of a classifier and be crushed to slime, whereas this fine lead will be more readily recovered by efficient screening.

The pulp from the fine-grinding section is thickened if necessary and directed to tables without classification, the slime overflow at the top end of each table being separately treated on special machines. The whole feed is split up either by automatic distribution or cut-off gates so as to give an even feed to each table. The tables are all set at a constant slope, having practically a fixed point of cut-off of the lead. These modifications have resulted in the cutting down of labor costs and an increased efficiency of working.

Both riffle and grooved tables are used, and there is still a great difference of opinion as to their relative

merits. Instead of riffles being cut off diagonally across the table, some of them are extended at the far corner of the tables to its full length, the remainder being cut off in the form of a curve. Middlings from the first set of tables are treated on separate ones, and the middlings formed by the latter tables are returned to their own feed. The usual proportion is three primary tables and one table to treat the middlings. The section of a mill crushing 1500 tons per week usually has 12 primary and 4 middling tables. It has been proved that recovery on the table system is proportionate to the area of concentrating surface.

For the settlement of slimes Dorr thickeners and cone settlers are used. The efficiency and regularity in the working of the Dorr thickeners show such a marked improvement over other slime-settling machines on Broken Hill ores that it is doubtful if in future designs of mills any other machine will be thought worthy of consideration.

The enhanced value of the slime product of late years, owing to selective flotation, has turned the attention of some of the managers to the importance of classifying the slimes from all zinc and tailings products. As the slimes are in all cases higher in lead than the coarser product, the thorough removal of slimes results also in a higher grade of zinc being produced from the coarser products. Tailings are either separated in Caldecott diaphragm cones and thickened pulp run out on the dump on a conveyor belt, or the tailings are run into round vats with filter bottoms and bottom-discharge doors which feed a conveyor running under each vat.

The concentrate from each set of machines is, in the most uptodate methods, run to a system of small draining conveyor belts. These all deliver to a main elevator or conveyor, the drained product being discharged into circular or V-shaped concentrate bins with bottoms of coco matting. These bins are elevated along the railway lines, so that on opening the bottom-discharge doors the concentrate may be rapidly loaded in the cars. Future development in lead recovery lies in selective flotation rather than in improved milling methods.

Gypsum Production in 1914

According to the Geological Survey the production of gypsum in the United States in 1914 decreased in tonnage but increased in value. The quantity of crude gypsum mined in 1914 was 2,476,465 short tons compared with 2,599,508 tons in 1913. The gypsum sold without calcining and used principally as land plaster and as an ingredient in portland cement and paint amounted to 113,687 short tons, valued at $646,799. The material marketed as calcined plaster was 1,656,066 short tons, valued at $6,249,190. The total value of all gypsum marketed in 1914 was $6,895,989.

Gypsum was produced in 18 states and in Alaska in 1914, the same states reporting output in that year as in 1913. The relative rank of the three leading states has remained unchanged for the last four years, New York ranking first, Iowa second, and Michigan third in the output of crude gypsum.

There were 78 gypsum mines, including quarries and pits, reported active in the United States in 1914, one of which is in Alaska. These mines supplied 68 domestic mills, of which 61 were calcining plants and 7 produced ground gypsum only. Four new mills were reported in operation last year, three in California and one in New York. One mill was reported under construction in Nevada.

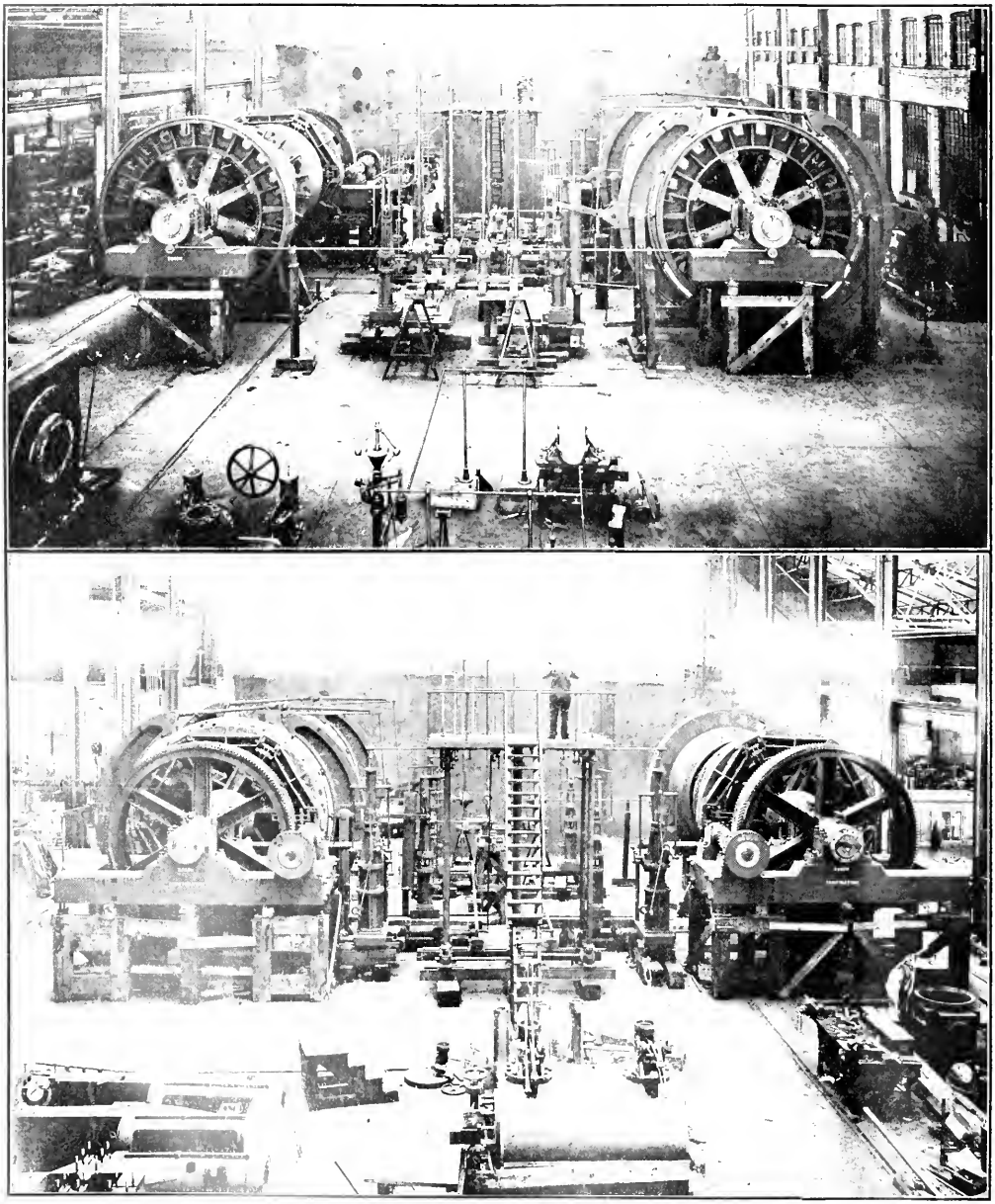
Prospecting Drill for Alaska Placers

The Flume Dredge Co., Mills Building, San Francisco, has designed a portable drill especially to meet the requirements of prospecting dredging ground in Alaska, built for it in the shops of the Straub Manufacturing Co., Third Street, Oakland, Calif. Fifteen of them have been installed in Alaska and the demand for the drills is increased by the simplicity of handling, setting up and operating. The total weight of this drill, including poles, casing, etc., is 1300 lb. The shear legs are 16 ft. long. The hammer weighs 200 lb. Operation of the stroke is caused by winding the drill rope on a gypsy turned by the engine, which is a 4-hp. distillate engine, stationary on the drill. Casing is usually 4 in., which is considered the most practical, but 5-in. casing can be used. The drill is designed to dig 22 ft.; but the essential digging depth in Alaska dredging fields is usually less. The whole is mounted on wheels for moving and the wheels are removed when the drill is set for action. Two men easily wheel the drill about, set it up and operate it, and can put down six holes in a working day. The accompanying photographs show the drill mounted on wheels ready for transporting to the field, and also set up for actual drilling.

PROSPECTING DRILL READY TO BE MOVED

DRILL SET UP FOR OPERATION IN THE FIELD

Photographs from the Field

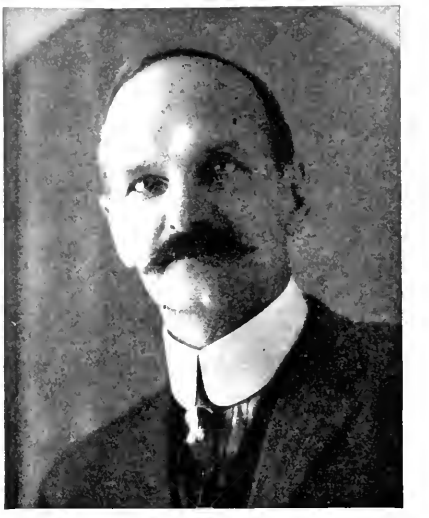


INSPIRATION CONSOLIDATED COPPER CO.'S ELECTRIC HOIST ASSEMBLED IN THE SHOP

This hoist, built by the Nordberg Manufacturing Co., Milwaukee, Wis., has double 10-ft. drums, 65-in. face, and carries on each 100° lay of 1¼-in. rope. Rope pull is 10,850 lb., hoisting normally in balance with a rope speed of 750 ft. per min.

Mining Men in the Public Eye

CHARLES HAYDEN

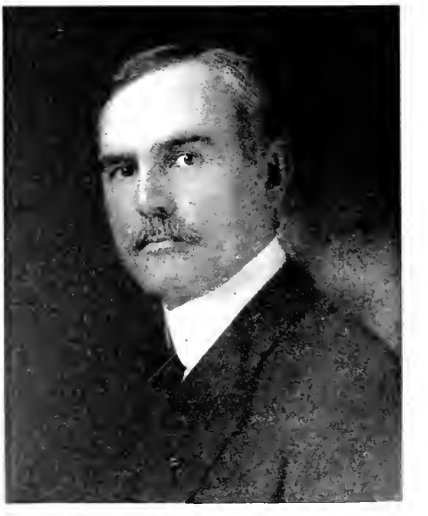


T. COLEMAN DU PONT

Messrs. Hayden and du Pont, together with S. Pierre du Pont, recently gave $250,000 to the Massachusetts Institute of Technology for a mining building, thus contributing to the maintenance of the prestige of the Institute, of which these three men are distinguished alumni

H. M. WILSON

Mr. Wilson recently retired from the position of engineer in charge of the Pittsburgh Station of the United States Bureau of Mines to become director of the department of inspection and safety of the Workmen's Compensation Insurance for Coal Mines



JOHN D. RYAN

Mr. Ryan lately became president of the [illegible] company, which displaces Amalgamated, and is the leader of Montana's industries. Indeed, it would be no stretch of the truth to characterize him as the leader of the copper-producing industry of the United States

Zinc and Lead Imports

An advance report from the Department of Commerce gives the imports and exports of zinc for the United States in the month of May as below, in pounds:

Imports from:	Ore: Gross Tons	Ore: Contents, Lb.	Metal, Lb.	Total, Lb.
Canada	744	616,600	11,693	628,293
Mexico	4,568	2,924,979	423	2,925,402
Australia	6,974	5,740,000	..	5,740,000
Cuba		.....	12,167	12,167
Brazil		.....	29,536	29,536
Uruguay		.....	69,467	69,467
Total	12,286	9,281,579	123,286	9,404,865
Zinc dust, Germany		.....	99,092	99,092

Exports:	Domestic Lb.	Foreign Re-exported, Lb.	Total, Lb.
Blocks, pigs, sheets, etc.	15,270,854	2,207,903	17,479,757
Zinc dross	1,147,385		1,147,385
Zinc dust	...	7,168	7,168

In addition manufactures of zinc to the value of $444,968 were exported. No exports of ore are reported. In May, 1914, the exports of domestic material were 214,201 lb. metal and 1436 tons ore, contents not reported; reëxports of foreign material were 224,000 lb. in ore and 3420 lb. zinc dust. For the five months ended May 31, the total exports of zinc metal, excluding contents of ore, were 588 short tons in 1914 and 59,263 tons in 1915; an increase of 58,675 tons this year.

Lead Imports

The statement gives the imports of lead into the United States in May as below, in pounds:

From	In Ore, Lb.	In Base Bullion, Lb.	Total, Lb.
England	54,320	...	54,320
Canada	143,000	...	143,000
Mexico	406,516	10,913,000	11,319,516
Chile	1,009,457		1,009,457
Peru	24,155	18,088	42,243
Total	1,637,448	10,931,088	12,568,536
Pigs, bars and scrap		...	1,480
Total lead imports		...	12,570,016

The total weight of ore imported was 1812 tons; of base bullion, 11,119,282 lb. Total imports of lead in May, 1914, were 5,619,050 lb.; in May, 1913 they were 8,822,722 lb. For the five months ended May 31 the total imports were 10,346 short tons in 1914, and 28,607 in 1915; an increase of 18,261 tons this year.

Shuman-Boys Sun-Power Plant at Meadi, Egypt

The history of the utilization of solar energy is outlined briefly by A. S. E. Ackermann (*Journ.* Roy. Soc. Arts, 1915, 63, 538-565; abst. *Journ.* Soc. Chem. Ind., May 31, 1915). Special reference is made to investigations culminating in the establishment of the Shuman-Boys sun-power plant at Meadi, near Cairo, during 1912 and 1913. This apparatus consists of five parallel units arranged with their axes N and S and mounted so as to "follow the sun" automatically. Each unit, 205 ft. long, is composed of a boiler placed on edge in a channel-shaped reflector of parabolic cross-section; and each boiler, placed at the focus of its reflector, is surrounded by an air space enclosed by a single thickness of glass. The total area of sunshine collected is 13,269 sq.ft., the concentration effected by the reflectors being 14½ to 1. In an extended series of trials made with this plant, the maximum quantity of steam produced was 12 lb. per 100 sq.ft. of sunshine per hour, or 183 sq.ft. of sunshine per b.hp. (1 b.hp. = 22 lb. of steam at atmospheric pressure); the maximum thermal efficiency was 40.1% (solar constant = 7.12 B.t.u. per sq.ft. per min.). In the best 1-hr. run, 1442 lb. of steam at atmospheric pressure was produced. The utilization of solar energy is regarded as almost a solved problem where sunshine is plentiful and coal only obtainable at about $17 per ton.

Australian Action on German Ore Contracts

The speech of Attorney-General W. M. Hughes of Australia, at the second reading of the Enemy Contracts Annulment bill introduced in the Commonwealth Parliament on May 5, is reported by the London *Mining Journal*, in part, as follows:

"The effect of war on contracts is to suspend some and terminate others, according to their nature. Some contracts are not contracts between enemies of the Empire, but between British subjects, but they are nevertheless contracts for the benefit of the enemy. These latter contracts are not affected legally by the war, but great uncertainty prevails as to the effect of the war on contracts, and it is to remove these uncertainties that the measure is introduced.

"It was impossible to tell what Germany was doing with regard to contracts, but if what was heard was to be believed, there could be no doubt that contracts were being voided, as well as the rights of private individuals. This bill cannot be judged fairly unless it is looked at in the lurid glow that rises from the gigantic battle in which the hosts of Christendom have arrayed themselves for the purpose of mutual destruction. It is a world-war, which is being waged for world-power—power that is not military power alone. It is waged by Germany for achieving commercial and industrial domination of the earth.

"The position is this: The mining companies of Australia, at least the majority of them, had entered into contracts for the disposal of their products up to the year 1921. In many of these contracts there are clauses which suspend them during the period of war, but which, after the termination of the war, enable the period of the duration of the war to be added to the term of the contracts. Thus, in a contract extending to 1921, a three years' war would mean that the contract would be extended to stretch out until 1924. Whether any of those contracts are discharged by the war I am unable to say. There is uncertainty and doubt about it all, and that uncertainty affects, not only the present operations of mining companies, but their future development, for no English capitalist would, for instance, invest money in a smelting works unless he was assured of a continued supply of metal.

Alleged German Domination of Markets

"The other way in which the position is affected is because these companies are unable to divert their produce from Germany, not only owing to contracts relating to supplies of metal, but because they have contracts for the sale of their metals which prevent them selling except through recognized persons and authorities. The price of lead today is fixed by the same people who fixed it before the war, although they are not outwardly the

same people. Every pound of lead the Admiralty or the War Office buys has to be bought through that one channel, and through that channel alone. The position originated with a German firm at Frankfort-on-Main, a firm whose methods were typical of the German character—systematic, thorough, and far-reaching. This German firm, or group of firms, exercised its powers in every important country of the world. The Metallgesellschaft, the American Metal Co., and the Australian Metal Co., were practically one and the same firm. The Australian Metal Co. is a company registered in Australia, though to all intents and purposes it is an offshoot of the one great concern. In London, the name of the firm is Merton, but Merton, though registered in London, is only one branch of the same power.

"The Broken Hill Proprietary has contracted to supply the Australian Metal Co. with its ores; that is an official fact. The greater number of that company's shares are held by Germans. The output of lead is still controlled by the Lead Convention, which is essentially German. The German element in London practically controls the sale of metal. Merton is the only selling agent for lead, and it is a fact that British buyers have been refused supplies since the outbreak of war because sellers are bound to Merton.

Legislation Necessary to Cancel German Contracts

"There is not the shadow of doubt that nothing but the sharp edge of legislation can cut the contracts which bind Australian commercial men to the agreements they have entered into. The Broken Hill Proprietary Co. has given notice of its intention to annul its contracts. But it does not know its position in law; neither does anyone else.

"The Government does not propose to act against the interests of any of the Australian companies. Just the opposite. The Government intends to use all the power in its possession to bring about a termination of German influence in Australian trade. The Broken Hill Proprietary Co. has undertaken to give three months' notice to sever its connection with the companies influenced by Germans or German capital, but the mere giving of notice does not legally terminate the agreement. Elder, Smith & Co. have also 'broken contracts,' but are still liable.

"The firm of Merton's, British in origin as well as name, is merely the conduit pipe through which the profits are taken to Germany. The Government has ample proof of that. The bill provides that all enemy contracts shall be null and void. It provides also, in Section 4, for another class of contracts—that is, for contracts that can be determined if one of the contracting parties so desires. That is to meet the case where war has made it impossible to carry out certain of the conditions agreed on."

[The above summary of Mr. Hughes' speech outlines what it is proposed to do in Australia with respect to the disputed ore contracts. There are not a few inaccuracies of statement contained in it. It should be remarked also that the Lead Convention, in which the American Smelting & Refining Co. and the Spanish producers were participants, was disrupted July 1 by the secession of the Australian producers.—Editor.]

NEW PATENTS

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

AGGLOMERATING—Treatment of Subdivided Ores for Agglomerating or Reducing Them and Apparatus Therefor. Gustaf Grondal, Djursholm, and Herman Nilsson, Nyhammar, Sweden. (U. S. No. 1,142,324; June 8, 1915.)

ALUMINUM NITRIDE—Process for the Manufacture of Aluminum Nitride. Paul Bunet, Whitney, N. C., assignor to Société Generale des Nitrures, Paris, France. (U. S. No. 1,145,747; July 6, 1915.)

ALUMINUM SOLDER. Jonas F. Gross, Allentown, Penn. (U. S. No. 1,145,307; July 6, 1915.)

ASBESTOS PACKING. Alexander Warrell, St. John, N. B., Canada, assignor to Continental Asbestos Corporation, Worcester, Mass. (U. S. No. 1,143,153; June 15, 1915.)

CONCENTRATION—Improved Apparatus for the Water Concentration of Ores or the Like. W. M. Martin, Redruth, Cornwall. (Brit. No. 2844 of 1915.)

CONCENTRATOR—Ore Concentrator. Joseph Weatherby, New Cumberland, Penn., assignor to Electric Ore Separator Co., New Cumberland, Penn. (U. S. No. 1,145,046; July 6, 1915.)

CONDENSER for Zinc and Lead Vapors. Edvin Andreas Johansson, Trollhättan, Sweden. (U. S. No. 1,145,685; July 6, 1915.)

COPPER MATTE—Improvements in the Process of Bessemerizing Copper Matte. J. B. Herreshoff, Richmond Hill, N. Y. (Brit. Nos. 12,916 of 1914 and 2219 of 1915.)

CRUSHER—Stone Crusher and Pulverizer. Edgar B. Symons, Milwaukee, Wis. (U. S. No. 1,145,629; July 6, 1915.)

CRUSHING—Improved Apparatus for Feeding Ores to Stamping Batteries and Other Pulverizers and Mixers. H. Standen, Zuitspanburg, Transvaal. (Brit. No. 18,622 of 1914.)

CUPOLA FURNACE. Michael Zippler, Jr., Pittsburgh, Penn. (U. S. No. 1,145,648; July 6, 1915.)

DREDGES — Floating Discharge Pipe for Hydraulic Dredges. Arthur Wells Robinson, Montreal, Quebec. (U. S. No. 1,143,321; June 15, 1915.)

DRILL—Core Drill. Clinton E. Wilder, Erie, Penn., assignor to National Forge & Tool Co., Erie, Penn. (U. S. No. 1,145,822; July 6, 1915.)

DRILL—Pulsatory Percussive Drill. Lewis Condict Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,144,990; July 6, 1915.)

DRILLS—Exhaust-Closing Valve for Hollow Steel Percussive Drills. Lewis Condict Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,144,991; July 6, 1915.)

DRILLS—Core Holder for Tubular Rock Drills. John F. Lindberg, Hibbing, Minn. (U. S. No. 1,145,323; July 6, 1915.)

ELECTRIC FURNACE. Paul Bunet, Whitney, N. C., assignor to Société Generale des Nitrures, Paris, France. (U. S. No. 1,145,748; July 6, 1915.)

GRAPHITE—Process of Purifying Graphite. Edouard Napoléon Lainé, Paris, France. (U. S. No. 1,145,924; July 6, 1915.)

HAULAGE—Improved System of Electric Signs for Main and Tail Haulage in Mine and Like Places. G. B. Burrows, Wellingham, Durham, Eng. (Brit. No. 13,310 of 1914.)

HOISTING—Improvements in Safety Devices for Mine Cages. E. Tillack, Berlin, Germany. (Brit. No. 20,254 of 1913.)

LEVELING INSTRUMENT for Use in Underground Workings. James Graham Bower, Johannesburg, Transvaal, South Africa. (U. S. No. 1,145,664; July 6, 1915.)

MINE-CAR WHEEL and Axle. Frederick A. Sweet, Salt Lake City, Utah. (U. S. No. 1,141,990; June 8, 1915.)

MINE DOOR—Electrically Operated Mine Door. William W. Murray and James F. Dillon, Dearing, W. Va. (U. S. No. 1,145,787; July 6, 1915.)

NITRATE OF SODA—A Two-Stage Evaporation Process for Recovering Nitrate of Soda from Liquors Containing It and Sodium Chloride in Solution, and an Apparatus for Carrying Out Such Process. Gibbs & Co., Valparaiso, Chile; Kestner Evaporator Engineering Co., Ltd., London. (Brit. No. 12,475 of 1914.)

NITROGEN OXIDES—Improvements in the Manufacture of Oxides of Nitrogen and of Catalysts to Be Employed in Such Manufacture. Badische Anilin & Soda Fabrik, Ludsvigshafen-on-Rhine, Germany. (Brit. No. 13,848 of 1914.)

PERCUSSIVE TOOL—Pulsator-Driven Percussive Tool. Arthur H. Gibson, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,142,514; June 8, 1915.)

SULPHIDE ORES—Process of Treating Mixed Sulphide Ores. Erich Langguth, Neerpelt, Belgium. (U. S. No. 1,144,481; June 29, 1915.)

WELDING—Electric Welding and Fusion Deposition of Metals. Arthur Percy Strohmenger, Westminster, London, England, assignor to Slaughter & Co., Ltd., London, England. (U. S No. 1,144,390; June 29, 1915.)

ZINC—Mechanism for Removing Residue from Vertical Retorts. Alexander Roitzheim and Wilhelm Remy, Duisburg-Ruhrort, Germany. (U. S. No. 1,144,065; June 22, 1915.)

ZINC—Method of Smelting Zinc and Other Ores. James M. Hyde, Berkeley, Calif. (U. S. No. 1,144,037; June 22, 1915.)

ZINC-SMELTING FURNACE. James M. Hyde, Berkeley, Calif. (U. S. No. 1,144,036; June 22, 1915.)

ZINC SULPHATE—Production of Zinc Sulphate. Ramon Bonastre Llopart, Cordoba, Argentina. (U. S. No. 1,140,354; May 25, 1915.)

Correspondence and Discussion

Which Is the More Useful—Steam or Explosives?

Say dynamite to the average man and he turns pale and gets ready to run; say it to the average woman and she shrieks.

Dynamite is not a gentle creature. It is always ready for a fight and it's a hard hitter. Jess Willard isn't in old Bill Dynamite's class as a biffer. Few people realize how indispensable a commodity dynamite really is. In Philadelphia recently a debate was held, the subject being: "Which is the more useful to mankind—steam or explosives?"

At first thought, ninety-nine people out of a hundred would answer without a moment's hesitation:

"Why, steam, of course; how could we do without it? It's the motive power of our passenger and freight trains; of our mills and factories; it heats our apartments and it propels our steamboats. Without it, manufacturing and shipping—the most important industries of the world—would stop.

"And dynamite—why all that's good for is to enable burglars to blow up safes and anarchists to destroy buildings."

Yes, that's the average thoughtless, uninformed person's idea of the high explosive. But not so fast. A little investigation, a little thought discloses that there is much to be said on the other side of the question. The debate isn't so one-sided as it might appear.

What is steam? A vapor generated by superheating water. How is it heated? By burning coal under the boiler. By what means is the coal obtained? By blasting with explosives. All right, then score one for the "big noise"; without it we would not have coal in sufficient supply to generate steam equal to the commercial requirements of modern times. Thus it would appear steam is dependent upon explosives.

Ores from which are made the raw materials most largely used in many of the mills and factories are equally dependent upon explosives for their production. Therefore, without explosives, many of the mills now in active operation would not exist.

And the passenger and freight trains. The locomotives are made of iron and steel, the ores for making which are mined with explosives; the coal that furnishes their power is mined with explosives. Sections of roadbeds on which they run were blasted through rock with explosives; the rails were made from ores which were mined with explosives; the ballast was quarried with explosives; the bridges along the lines are made of steel, made from ores, mined with explosives. Could we do without them?

And now as to steam. Electric locomotives will do nearly everything steam engines will do. They will pull the passenger and freight trains, and electric motors will run the machinery in mills and factories. There are many hydro-electric plants in the country and water power is available for many more.

Recently, dynamite has begun to play an important part in agriculture. Before the seed is planted, before the surface is even plowed, the subsoil is broken up by blasting, the idea being to improve drainage, aeration and increase the water-storage capacity of the soil. The holes in which nursery stock is planted are blasted to improve drainage, aeration and moisture storage and to enable the roots to spread out in the soil normally and easily.

Ditches are blasted with dynamite, drainage sink-holes are put down and stumps and boulders encumbering farm land are disposed of with it. Many millions of pounds yearly are used for these agricultural purposes.

Now, if we really had to do without one of them, could we not do without steam better than without explosives?

F. W. Wilson.

Wilmington, Del., July 8, 1915.

Classification of Technical Literature

The Joint Committee on Classification of Technical Literature is extremely desirous of obtaining the assistance of the *Journal* readers in making a collection of classifications of applied science which have been developed independently in the offices of manufacturing plants or engineering firms, especially those which exist in manuscript form, and have been used for filing or indexing data.

The committee would especially like to have copies of any extensions of present systems pertaining to any special industry or branch of engineering not now fully covered by the published classifications. Send data to 29 West 39th St.

W. P. Cutter.

New York, June 21, 1915.

Gold Dredging in Philippines

May I call attention to a slight error in the matter of fixing credit for an article on gold dredging in the Philippine Islands which appeared in the *Journal* of Apr. 17, 1915, p. 685, and was credited to the *Philippine Journal of Science?*

The original article was published through the courtesy of William Kane, the author, in the "Mineral Resources of the Philippine Islands" for the year 1913. The "Mineral Resources of the Philippine Islands" is an annual publication of the Division of Mines, Bureau of Science, Manila, P. I. It is distributed free of charge and reaches a different set of readers than the *Philippine Journal of Science*—to which all divisions of the Bureau of Science contribute. It is true that papers are occasionally published in both periodicals, but I believe that Mr. Kane's data appeared only in the "Mineral Resources of the Phillippine Islands."

Wallace E. Pratt.

Manila, P. I., June 7, 1915.

Editorials

Position of the Steel Industry

From present indications the steel industry of the United States, which for nearly two years has been passing through a period of great depression, is now well started on the up-grade. It was generally believed that the lowest point had been touched early in 1914, when the reaction caused by the overproduction of the previous year had nearly reached its limit, and prospects had begun to improve, when the outbreak of war disorganized all business temporarily and left the trade in worse condition than it had ever been. About November last the depression was greatest and production was at the lowest level.

Matters began to revive slowly and production to increase as domestic demands gradually improved; but as spring advanced, it became evident that the great war, which had for a time helped to depress our steel manufacturers, was going to give them some important aid in starting the revival. Foreign orders were booked at an increasing rate. Not all of them were for finished war material; many of them were for the iron and steel needed for making such material elsewhere, and many for railroad equipment and track material. Just how large a proportion of the increase of business is due to these war orders it is difficult to say. Not all of them are made public, and in some cases the recipients do not care to make the sources known. It is quite plain, however, that they have had much to do with the present revival of trade.

The value of the iron and steel exports has been creeping up. In the month of May the total tonnage of exports was 262,844 tons, against 138,514 tons in May, 1914—an increase of a little more than 90% being shown. It is probable that later months will show an equal—possibly a larger—gain.

War orders or foreign orders have not been the only source of improvement in the iron trade. There has been a fairly steady gain in the demand from domestic consumers, notwithstanding the fact that large construction enterprises have been rather slow, and that buying by the railroads has been on a moderate scale only, at least on the surface. The rate of operation of the mills has been gradually increasing, until at present it is approaching full capacity in most of the mills in the Central West. The Steel Corporation's monthly reports—which are generally considered an index to the condition of the trade—in June showed a noteworthy increase, indicating a large excess of orders over deliveries. The chief independent producers are in much the same condition.

To go back to the foundation, the production of pig iron, which was at its lowest point in January—at the rate of 57,200 tons daily, or about 20,850,000 tons yearly—has advanced month by month until on July 1 the make of pig iron was 81,300 tons daily, or at the rate of 29,650,000 tons a year. Notwithstanding this gain in the rate of production, the total make for the first half of 1915 was almost the same as the first half of 1914, the estimated total this year being 12,248,000 tons, while the completed report in 1914 gave 12,536,000 tons for the first half. For the second half of 1914 the actual make was only 10,796,000 tons, and the present indications are that the current six months will show a much higher figure than that. It does not seem probable, however, that the total for 1915 will reach the high point of 30,966,000 tons attained in 1913, though it may approximate it closely if the present rush continues.

The demand during the present year has been mainly for steel products, and the increase in pig-iron production has come chiefly from the steel-works furnaces. There has been complaint all along from the merchant furnaces that make pig iron for sale, that their market was slow and dragging behind the steel market. They also claimed that while the steel makers had been able to advance their prices from time to time and were securing from 15 to 25% more money for their product than they received at the opening of the year, pig-iron prices remained at a low level, and that it was hard to secure any advance. There seems to be ground for this contention. The general rate of production has advanced over 40% since January. That of the merchant furnaces has increased from about 16,000 tons a day in January to 20,500 in July, or less than 30%, while prices have remained low because a number of furnaces are ready to start at the first indication of improvement.

The demand, as has been stated, has been for finished steel, and so far the steel companies have been able to supply it from their own stocks without buying from outside makers. The foundry trade, on which the merchant furnaces largely depend, has been much slower to respond to improvement, as is indeed usually the case after a time of depression. Nevertheless, their position has not been altogether bad. Lake ore and coke prices have been cheap, and costs as well as selling prices have been low. It looks now as if the improvement in the pig-iron market was nearly due and that it would shortly follow the course upon which steel has already started so actively. In fact the present week brings reports of some large purchases of both bessemer and basic pig from outside furnaces, made by large steel companies.

Chromium Supplies Limited

There is probably going to be a scarcity in chromium and chromium compounds soon. The supplies of this material ordinarily come from New Caledonia, Turkey and Rhodesia. The Rhodesian and New Caledonian supplies have probably been commandeered to supply France and Great Britain. Turkish commerce is in eclipse. We know of only one mine operating in this country and two more which might be operated. As we understand that some of the brick manufacturers have notified their customers that they can only supply chrome brick for a little while longer and that some shapes already cannot be obtained, it would appear that the man with a chromium prospect might profitably spend some money on exploration and further development.

Increased Zinc Smelting Capacity

As the price of spelter moved upward during the first half of 1915, surpassing the price for copper, the *Journal* prophesied that the conditions would inevitably develop an increase in spelter production, and especially that this would be brought about by smelters adding furnaces to their plants. In previous reviews of the situation it was not considered likely that new works would be built, in view of the general opinion that the existing conditions would be so ephemeral that it would be unsafe to enter upon the construction of new plants and that no one would be likely to do so, having in mind the long time bound to elapse before production could be begun. These forecasts have been borne out in the main, as has been chronicled in this paper, but they were at fault in not reckoning upon the surprising number of supposedly defunct plants that have been restored to usefulness—some of them after idleness of 15 years—and there are two new plants being built. With respect to the latter, one is being built in Oklahoma by George E. Nicholson—an experienced and successful smelter—who appears to be able to build zinc smelteries in a marvelously brief time; and the other is a great plant that has been started at Donora, Penn., by the United States Steel Corporation.

The Donora plant has probably been planned less as a means of reaping fabulous profits out of the present extraordinary situation than as a method of insuring the supply of the largest consumer of spelter and relieving it from the vagaries and vicissitudes of a troublesome market. It will be a modern, efficient and substantial plant, wherefore its construction period will be lengthy and its production may not begin until spelter has regained a more nearly normal level. However, the construction is being pushed ahead vigorously and a large supply of Australian zinc ore has already been contracted for, indicating that no great delay in the ability to convert it into spelter is anticipated.

It is useful now to summarize what the recent and the prospective additions to smelting capacity amount to. At the first of this year it was estimated that the United States possessed a smelting capacity for producing about 500,000 tons of spelter in a year, that capacity being classified as active, operated irregularly, inactive, and new—the total number of retorts being about 120,000. In the inactive class were not included several old plants in Kansas and Missouri, most of which had been idle for more than 10 years.

At the middle of 1915, all of the smelting capacity listed at the beginning of the year was in use, and there had been revivals and additions—consummated and in process—of about 14,000 retorts, corresponding to about 60,000 tons of spelter a year. Adding to this the 40,000 tons that Donora is expected to produce, there is now in sight the means for making 100,000 tons more spelter annually than there was six months ago.

As to the status of this new capacity for production, a fairly large part of it is already available; another large part is expected to be ready by the end of August; the new Nicholson works will probably be fired up by October; Donora will surely not be ready until some time in 1916.

It may be assumed that the production of spelter in the United States is at present at the rate of 500,000 tons per year and that in the fourth quarter it will be at least at the rate of 560,000 tons per annum. Incidentally it may be remarked that the entrance of new companies—large and small—into the business is prima facie evidence that no combination in restraint of trade exists in this industry, as has always been known by every well-informed person. The ore supply is bountiful, as is reflected by the wide smelting margin that continues to exist. Miners have difficulty in placing their ore rather than do smelters find trouble in getting what they need. Of course many of the smelteries that have lately been put in operation are uneconomical and a large margin is necessary for anybody to be able to operate them. A return to normal conditions will extinguish them, as a strong wind blows out a candle.

Explosives Used in Mining

No one of the implements of his profession is shrouded in more mystery than the explosives which the mining engineer uses in his work. Originally this was due to the disinclination of competing manufacturers to give out any technical data relative to their product. The subject is still very much clouded by the sales policy of various companies and the idiosyncrasies of the many powder salesmen in the field. There are now so many brands of dynamite on the market, and there is so little correlated information at hand on the subject, that the buyer of dynamite is almost wholly at the mercy of the powder salesman or of a mine superintendent "wedded" to a particular brand.

It is an everyday occurrence for the salesman to advocate the use of some brand because, for instance, it has low-freezing properties or because it makes less gas, either one of which troubles may be giving the mine management a lot of worry. Because the mining engineer has been afforded no opportunity properly to compare and study the various classes of dynamite, he has had to rely largely on the salesman for such information, and frequently he has gone astray.

Very elaborate and artistic trade publications issued by dynamite manufacturers, while full of interesting and valuable information, fail to "fill the bill" despite the promise of their attractive exteriors. The Bureau of Mines has done much by analyses, tests and experiments to disseminate this much-needed information, but unfortunately its results are scattered through a considerable number of publications and the valuable nuggets of information therein are buried in a mass of repetition and information on extraneous subjects, which makes a lot of research necessary to get the benefits of their valuable work.

The day of indiscriminate dependence upon what the powder salesman thinks he knows is past, at least for the larger companies, and it is not too much to hope that it is nearly over for all companies that have progressive management. The cost of the explosives, the time lost waiting for powder smoke to get out of the working headings, the danger of asphyxiation from noxious gases, not to mention the disruptive effect of the powder itself, are each important enough to secure for this problem the attention and study which it deserves and which it has too long been denied.

BY THE WAY

Dispatches of July 16 announce the arrest of George S. Speets in Berlin. Speets had an American passport and was alleged to be doing a general brokerage business in American copper. If he were really selling American copper there, a number of people here would like to know how he did it. There seems, however, to be some doubt about Speets' copper sales, his citizenship, and his passport, all of which have been under investigation by Ambassador Gerard, as well as by the German Government.

Among the war news of the day is the report that the famous old bronze lion that stood on the battlefield of Waterloo has been pulled down and is being converted into German shells. The "Lion of Waterloo" was cast by Cockerill of Seraing, and stood on a mound 200 ft. high, marking the spot where the Prince of Orange was wounded in battle. It was made of the metal of captured French cannon and weighed 28 tons. Another writer calls attention to the fact that if the Germans had really taken the Belgian lion at Waterloo to make shells, it was only a final episode in a sad career. A few years after the famous battle, French troops marching to the siege of Antwerp deprived him of his tail.

The New York *Evening Post* of July 17 expressed the following appreciation of Doctor Holmes and his work:

A tribute of unusual and touching character is being paid today to the memory of a life of rare beneficence and self-sacrifice. Coal mines will be closed throughout western Pennsylvania and West Virginia, and owners and miners will do homage to the devoted labors of Joseph Austin Holmes, director of the United States Bureau of Mines, in behalf of the health and safety of the mine workers. Doctor Holmes' death last Tuesday, at the age of 55, was directly traceable to his zeal in this work, which led him, in the pursuit of his researches, to expose himself personally to those dangers and hardships which it was his purpose to avert or reduce to a minimum. Both as an administrative organizer and as a scientific investigator, his endeavors have borne rich fruit in the improvement of conditions and the perfecting of safety appliances. His death from tuberculosis must be set down as a result of overwork under conditions which would have been trying to a more robust constitution. It is in the contemplation of lives like this, sad as is the sense of loss, that one is heartened by the realization of the great store of unselfish devotion that is being unobtrusively expended by hundreds of quiet workers, in public and private station, for the betterment of the lot of mankind.

Real get-rich-quick schemes differ from the "get-rich-quick" variety in several ways, most prominent among which is the offer on the part of promoters of the latter to share the great benefits with the public at large. This seems to be the difficulty with the Nevin Electric Survey Co., the shares of which are now being offered to the public at 75c. each. The officers of the company are said to be men of the highest financial standing, but so generous that they wish to share with the public the great emolument that is to be received for the discovery of mineral deposits through the instrumentality of an electrical device invented by James E. Nevin. Mr. Nevin is quoted as saying that with this device "any deposit of matter contained in the earth can be defined with great accuracy as to area, depth and thickness of the deposit." Doubtless some people will buy the shares without stopping to think that anyone who could locate all the hidden deposits of gold, silver, copper, zinc, etc., would over night become the Pied Piper of the mining industry.

These are the greatest days the zinc miners have ever known—in more ways than one. Down in the Joplin district they are now finding ore in their dreams. Utah has long been known as the land of the revelator, and the story of the discovery of the Beck Tunnel mine by revelation is well known. That discovery proved so profitable that the principal owner secured a large following locally for the development of other Tintic mines, notably the Iron Blossom and the Colorado. But according to a Joplin dispatch, Missouri is now infringing on Utah's prerogative. The wife of one of the owners of the old Ethel S. mine, near Cooper Hollow, had a dream which, the dispatch states, is going to bring riches to the owners of that property. The mine is reported to have been paying fairly well until a few weeks ago, when the ore became very thin and finally gave out altogether. One morning Mrs. J. C. White told her husband, who owns a half interest in the Ethel S. mine, that she had dreamed of finding another great face of ore, but at the spot pointed out there was only a limestone wall. At night Mrs. White was lowered to the bottom of the mine, and while asleep she walked into the drift she had dreamed of. A single shot the next day broke "through the limestone wall into a great deposit of ore," and now the Ethel S. is the "Dream Lady" mine.

A writer in *World's Work* for July quotes Harry E. V. Brittain, one of the English founders of the Pilgrim Society, and who recently visited this country, as saying the following about H. C. Hoover and his Belgian relief work: "Do not think because we say little that we are not grateful. We know at home in England that to the American Commission for Relief in Belgium we owe the safety and the lives of the bulk of the Belgium nation. Our government takes the personal word of honor of your fellow-countryman, Mr. Hoover, as an international assurance in a way which has no precedent and no parallel in the history of peace or war. On the pledge of one American, we have allowed to go into Belgium millions of dollars' worth of food which would be of priceless military and other value to the Germans who occupy the country. Mr. Hoover, in the name of the commission, tells us this will go only to the Belgians. We take his word and have no reason to regret it. But our military and naval authorities would never be justified in taking the word, under the circumstances of a life-and-death struggle, of one American, or even of the American nation, unless they were convinced that with it went the power and ability to 'make good.' We have found that you are as good as your word. Your flag has safeguarded more relief than the philanthropy of the whole world ever dreamed it would be asked to supply. Under the Star and Stripes a distressed civilian army, greater than the combined militant armies of France and Germany, is being kept alive. Impelled by humanity and guided by an efficiency that is the envy of every European government, you have pierced the lines of all armies, broken all blockades, and gained the first really decisive victory of the war."

PERSONALS

C. W. Purington has gone to Petrograd on his way to the Lena district, Siberia.

W. H. Staver recently examined and sampled the Suffolk mine near Ophir, Colorado.

Roy C. McKenna has been elected president of the Vanadium Alloys Steel Co., Pittsburgh, in place of E. T. Edwards.

Faris V. Bush, of Lordsburg, N. M., one of the New Mexico contributors to the "Journal", has been chosen a director in the Arizona Eastern Ry. Co.

C. W. Wright, the general manager of important lead mines in Sardinia, has arrived in this country for his annual visit. He will return to Sardinia in September.

James Bowron, president of the Gulf States Steel Co., and a pioneer among Alabama iron men, is making an extended trip through the North, and expects to visit Alaska.

Lawrence H. Underwood, late with the Indiana Steel Co., at Gary, has been appointed superintendent of the byproduct coke plant of the Youngstown Sheet & Tool Co., at Youngstown, Ohio.

James McEvoy, formerly of the Canadian Geological Survey and more recently manager of the Crow's Nest Pass Coal Co., has become attached to the Canadian expeditionary forces as instructor in engineering.

J. F. McNamara has been appointed general manager of the Bayonne Castings Co., Bayonne, N. J., which puts the Monel metal made at the Orford Copper Co. works, in finished form. He succeeds W. E. Oakley, resigned.

E. Hampton, superintendent of the Bunker Hill mine, Amador City, Calif., has recovered from his recent illness and is again in charge of the mine. E. C. Clark who was in charge during Mr. Hampton's sickness has gone to Nevada.

Eugene C. Templeton, a graduate of Stanford University in 1910, has taken a position with the Irtysh Gold, Zinc & Lead Mining Co. in Siberia, and will leave for that country in a short time, expecting to remain at least one year.

Dr. Horace B. Patton, professor of geology in the Colorado School of Mines, is spending part of his vacation in California. He expects to undertake some field work in August in a survey of the Platoro-Jasper district, southern Colorado, for the U. S. Geological Survey.

Arthur Clark Terrill, who has been employed the past year as field representative of the New York State Museum collecting and placing on display the large mining exhibit representing the Empire State at the Panama-Pacific International Exposition, has been appointed head of the department of mining engineering in the school of engineering, Kansas University, Lawrence, Kansas, beginning with September.

OBITUARY

Cecil Chaplin, one of the pioneers of Tonopah and a partner of George Wingfield in opening the camp at Goldfield, died at Los Angeles, Calif., July 15, aged 60 years. He was also heavily interested in mining property in Montana.

Horatio Weber Baker, founder of the chair of mining engineering in the University of Nevada, died at San Francisco on July 8. For the past three years Mr. Baker was in the employ of the "Mining & Scientific Press" of San Francisco.

Judge J. P. Bradbury, who died at Pomeroy, Ohio, July 17, aged 77 years was well known as a lawyer and for a number of years judge of the Ohio Supreme Court. In his earlier days, however, he was an active gold miner in Utah and California.

Col. Jack Faw, a well known character in western North Carolina and Virginia, was killed July 14 at Jefferson, N. C., by the premature explosion of a blast. He was opening a mine there. He was 60 years old and had been a prospector and promoter for a number of years.

Prof. Frederick Prime died at Atlantic City, N. J., July 14, aged 65 years. He was born in Philadelphia, graduated from Columbia College, New York, in 1867 and later received degrees from Lafayette College and the Bergakademie at Freiberg, Germany. He was instructor in assaying at the Columbia School of Mines for some time and was professor of geology and metallurgy at Lafayette College for nine years. He was president of several iron and electrical companies in Alabama and Pennsylvania. In 1895 he was appointed professor of natural history at Girard College in Philadelphia and had since held that position. He was a manager of the Academy of Natural Sciences of Philadelphia and had been for some years one of the secretaries of the American Philosophical Society. He edited the English edition of Von Cotta's "Treatise on Ore Deposits."

Joseph Claybaugh Campbell died at San Francisco on July 1, from a ruptured blood vessel resulting from playing golf. Campbell was 63 years old, born in Oxford, Ohio. He studied for the bar at Frankfort, Ind., under his uncle Joseph Claybaugh, later a member of the Indiana Supreme Court. He had been in California for more than 40 years. In the early seventies he was elected district attorney of San Joaquin County. He served as chairman of the Republican State Central Committee and was once an aspirant to Congress. As an attorney he was identified with the Noyes-Alaska mining cases and was counsel for the defense in the Cœur d'Alene mining cases, and was chief attorney for Mayor Eugene Schmitz of San Francisco in the graft trials. He organized the law firm of Reddy, Campbell & Metson in San Francisco in 1889. At the time of his death the firm was known as Campbell, Weaver, Shelton & Levy.

SOCIETIES

American Institute of Mining Engineers—The Tintic trip of the Utah Section on July 15 was very successful and was attended by about 80 members and guests. After a welcome at Eureka by the mayor of that town, the members traveled around the district by automobiles and by the Knight railroad, going underground at the Mammoth, Silver City, Iron Blossom, Dragon Iron and Chief Consolidated mines. The banquet and a business meeting were held at Eureka in the evening, after which a dance and a moving picture show were given to the visitors. The party reached Salt Lake the next noon.

Lake Superior Mining Institute—The annual meeting for 1915 will be held Sept. 6-9. The first day will be spent on the Gogebic range, the second on the Cuyuna range and the third and fourth days in Minneapolis and St. Paul. This will be the first visit of the Institute to the Cuyuna. On the first day, a first-aid meet will be held at Ironwood under the charge of Edwin Higgins of the Bureau of Mines. Luther Brewer of Ironwood is general chairman of the Committee of Arrangements for the trip. L. M. Hardenburgh of Ironwood is president of the Institute this year and A. J. Yungbluth, of Ishpeming is secretary, as he has been for a number of years.

TRADE CATALOGS

Knox Motors Co., Springfield, Mass. Catalog. Tractors. 16 pp., illus., 9x12 inches.

International Nickel Co., 43 Exchange Place, New York. Catalog. Monel Metal. 12 pp., 4x8½ inches.

General Electric Co., Schenectady, N. Y. Bulletin No. 42,552. Motor Generator Sets. 28 pp., illus., 8x10½ inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1092. Synchronous Converters. 16 pp., illus., 8x10½ inches.

I. P. Morris Co., Beach & Ball St., Philadelphia, Penn. Bulletin No. 4. Hydraulic Turbines. 70 pp., illus., 8½x11½ inches.

Waterbury Co., 80 South St., New York. Catalog. Armored Wire Rope. 32 pp., illus., 3½x6 in. Catalog. Fiberclad Wire Rope. 24 pp., illus., 3½x6 inches.

American Roller Bearing Co., 416-20 Melwood Ave., Pittsburgh, Penn. Bulletin No. 1002. Roller bearings for power transmission devices. 4 pp., Illus., 7x10 inches.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3031. Ingersoll-Rogler Class FR-1 Air Compressors. 24 pp., illus., 6x9 in. Form No. 4034. Leyner-Ingersoll Water Drill. 4 pp., illus., 6x9 inches.

The Chicago Pneumatic Tool Co. has issued Bulletin 34-X, relating to its Class A-G "Giant" gas and gasoline engines. The bulletin illustrates these engines in six sizes, ranging in horsepower from 16 to 130. The engines are similar in general design to the well-known Giant fuel-oil-driven engines manufactured by the same company with the exception that they are designed for operation with manufactured or natural gas.

Editorial Correspondence

SAN FRANCISCO—July 11

A Gold-Dredging Installation is contemplated on the Sältzer ranch, four miles south of Redding, by Lawrence Gardella of Oroville who is reported to have purchased the property. The Sältzers have owned the tract for 35 years. It contains 2150 acres of which 1500 acres of tillable ground is under ditch carrying 1700 in. A dam, said to have cost $5000, was built last year to replace the one constructed 35 years ago. Reported that Gardella will build a new hull and use machinery from one of his dredges to be dismantled at Oroville, where it has worked out its field. This tract of land is between Redding and the old Horsetown dredging field, and has been prospected for dredging, but no satisfactory negotiation had previously been reached. There is a large amount of good dredging ground in this section of Shasta County but from returns that are available it is believed that the gravel does not run to high values. This field is adaptable for small dredges of from 5- to 7½-cu.ft. bucket capacity, and is one of the numerous fields in California worked by early hydraulic and other placer-mining methods to shallow depths. But these fields are not inviting to large operators with dredges of 9- to 15-cu.ft. bucket capacity. They are not attractive for the further reason that the cubic-yard content of the ground, so far as has been prospected, is generally small compared to what has been recovered in many of the prominent dredging fields in the state.

Mount Lassen Eruptions reached the one hundred mark on May 31, at 10 o'clock in the morning. The 99th eruption occurred at five o'clock in the evening on the previous day. That of May 30 carried no mud. That of May 31 came from the new fissure on the northern slope, 500 ft. below the main fissure and it was reported from Hat Creek Valley that no further damage was done and no dust fell, nor was there any quaking of the earth. A rise of 8 in. in Hat Creek was not due to the eruption but to the fact that Big Springs were cleaned out by the Northern California Power Co. These springs are the main feeder of Hat Creek, supplying the creek with 3100 in. of water. The daily newspapers state that no fire was seen. This would give rise to the belief that during other eruptions fire had been seen. The red glow said to be visible on Mount Lassen at night is in fact the reflection of the setting sun. Other weird sights said to have been witnessed by people within 10 to 50 miles of the eruption were the results of sunshine and probably some moonshine. There has been no fire nor any red-hot fragments blown out by these fissure eruptions, nor has there been smoke. What has been claimed as ashes was really dust of the crumbled soft rocks and the supposed smoke is a combination of steam and dust and sulphur fumes. For the satisfaction of people who insist upon calling Mount Lassen a volcano, it may be classed as a mud volcano That the mud is hot when it is poured out on the hillside, is true enough; but it has never yet assumed the condition of lava. A great deal of damage has been done and naturally farmers are anxious to reclaim the land and the water. A number of citizens of Hat Creek Valley have asked the Redding Chamber of Commerce to indorse them in a petition to the Federal Government for aid on account of the damage done by the mud flow of May 22. At the time of making this request at Redding it was reported that the choking up of Big Springs by the mud flow had shut off the water in Hat Creek. That was true enough, but as has been stated, the springs have been cleaned out and with the aid that may be given by the county and possibly the Government the water supply need be no further disturbed and destruction to the land may be overcome by proper methods of reclamation. A number of visitors at the Exposition have indicated the purpose to visit Mount Lassen, which may be of interest to tourists and which is not likely to be at all dangerous at proper distance.

BUTTE—July 14

The Butte Miners' Union Has Won the Suit brought by the Western Federation. The Supreme Court of Montana handed down a decision June 6 in Helena in favor of the Butte Miners' Union in its long litigation with the officials of the Western Federation of Miners. The order of the district court, recently made, turning over the property of the local union to Guy Miller as representative of Charles H. Moyer and the Western Federations of which he is president, is annulled and the property of the union is again placed in the hands of the local officers. Property is valued at $100,000.

Horace V. Winchell has been in Butte the past week creating interest in the special meeting of the Mining and Metallurgical Society of America, which will be held in Washington, D. C., Dec. 16. Mr. Winchell is chairman of the mining-law committee of the society and Charles W. Goodale, of Butte is also a member of it. Both are especially interested in securing a large attendance of mining men and those interested in mining for the purpose of formulating organized action to induce Congress to revise the existing and inadequate mining laws. Many individual and unorganized efforts have been made to get Congress to do something in the nature of needed revisions of the mining laws, but Congress has paid no attention to the matter or to the petitions of mining men. It is hoped that a united effort representative of many American mining and business organizations will be effective.

The Washoe Reduction Works at Anaconda is making extensive improvements and changes in many departments of the plant. A new box-type treater for the Cottrell system of precipitating dust and fumes from smoke has been installed which is less expensive than the one heretofore in use. In the concentrator, work is progressing rapidly on the remodeling of section No. 3. The filter plant for slime concentrates is being doubled and excavations for No. 3 roaster plant are completed and ready for concrete foundation work. The leaching plant for tailings is now running full capacity of 2000 tons a day, making a much better extraction than was anticipated. Plant for the Lavoisite process of manufacturing oxygen for oxyacetylene welding, recently completed, is proving satisfactory. Product is kept in tanks ready for shipment or for use in the works. In converter building, new repair shop is being built and the foundation for No. 4 Great Falls type converter is nearly completed. In the reverberatory department a new matte track and a new repair shop for the coal-pulverizing plant are being built. Two more dryers are also being added to that plant.

SALT LAKE CITY—July 16

Discovery of Zinc and Lead on Promontory Point 30 miles west of Ogden is reported to be exciting local enthusiasts. A territory 9 miles square is said to be dotted with locations. The Lakeview company is reported to have taken out $23,000 during the last three months.

Holdings of the Grasselli Chemical Co. at Park City have been taken under lease and bond by C. C. Broadwater, of the Merrill Metallurgical Co., of San Francisco, and associates. The property consists of a concentrating plant of 125 tons daily capacity and various tailings dumps. It is understood that an effort will be made by the San Francisco company to treat some of the latter. The principal value is in zinc with some lead and silver. Details as to the method of treatment have not been announced but tests have been made and it is thought probable that a flotation process will be used. A year or two ago another Grasselli mill—a zinc dry-concentrating plant—was sold to the Park City Mills Co., and remodeled for chloridizing-leaching.

SEATTLE—July 15

Fire Destroyed the Business Section of Valdez, July 15, with a loss of $500,000. United States troops from Fort Liscum aided in checking the flames with dynamite. No rain had fallen for weeks and the wooden buildings were dry as tinder.

Nineteen Tons of Gold were deposited in the Seattle branch of the U. S. Assay office during the fiscal year of 1915 ended June 30, according to official report. The coining value, smelted and resmelted into bars, is $8,850,454, representing 2288 deposits of a total of 555,323 oz. troy. The total valuation of Alaska contributions for the fiscal year is placed at $6,313,383 from the following districts: Kuskokwim, $2534; Circle, $54,922; Cook Inlet, $378,936; Copper River, $528,691; Eagle, $40,298; Iditarod, $1,437,038; Koyukuk, $114,891; Nome, $2,744,141; Southeastern Alaska, $104,769; Tanana, $908,061. The same districts also deposited 42,211 oz. of silver. British Columbia contributed $1,492,564 in gold and the Yukon territory, $843,968 in gold. Since 1898 the Nome district has deposited in the local assay office a total of $53,932,833 and the Tanana district, $45,990,912.

Shortage of Water caused considerable trouble in the Fairbanks district during the first part of June. On Vault and Dome there was scarcely enough water to feed the boilers. Cleary, Pedro and Fairbanks Creeks also suffered. In spite of this difficulty there was great activity on most of the old producers, especially at the mouth of Cleary, where Sam Weiss, Pete Malone, Scannel & Driscoll, Herman Magnusson, McConnell, Alex. Niemer, Keys & Rettig, and several smaller plants, were sluicing.

The Experiment of Water Transportation from Fairbanks to the Tolovana is working out well. The steamer "Dan" lands freight at the log jam for 2½c. per lb. Al. Lien is building a tramway past the jam and will transfer freight to navigable water above the jam for ½c. From the upper end of the portage the power boat "Doman" takes the freight to the West Fork of the Tolovana, about 8 miles from Discovery, Livengood Creek, for 2½c. Pack-trains transport it the rest of the way for 1c. a pound, making the total cost 6½c. from Fairbanks to the diggings. Dave Cascaden, Walter Fisher, Julius Hoffman, and J. H. McCord have incorporated the Tolovana Lumber Co. and will erect a mill near the mouth of Livengood Creek.

Another Stamp Mill Is to be installed in addition to the one now in use on Fairbanks Creek. The first installation proved so successful, although entirely too small to handle even the ore that is already waiting to be crushed, that it induced Thomas Gilmore to purchase a mill site on 13 Above, first tier, left limit Fairbanks Creek and the purchase of a five-stamp mill, the only one in the district, owned by Edward McConnell who had recently purchased it to work his ground on Garden Island. Several organizations are now figuring on purchasing small mills and shipping them from the outside this winter. Five more stamps will be added to the latest mill if the new one comes up to expectations and the quartz owners of the district are jubilant over the prospects of getting the values out of their properties. The first ore to be crushed will be taken from the O'Connor & Stevens property at the head of Fairbanks Creek where there is enough ore in sight to keep the mill operating for several months. The Mizpah and other properties are also preparing to ship ore as soon as the mill is installed.

BRISTOL, TENN.—July 18

The Interest in Southwest Virginia and East Tennessee has continued to increase, although no important undertakings have been developed. The Fall Branch mine, in Sullivan County, Tenn., is under option to Frank R. Walton and associates, of Philadelphia. This property is developed and has a mill. There is a peculiar asphaltum compound associated with the ore. The Haysville iron deposits in Greene County, Tenn., have been explored for zinc and it is reported that operations to mine the zinc and iron ore will be undertaken soon. The deposit is like that at Embreeville, about 20 miles to the northeast and on the same flank of the Unaka range The old iron mines at Embreeville which have been operated for several years for zinc are now controlled by the New Jersey Zinc Co.

The Carter Property at Ivanhoe, Wythe County, Virginia has installed an adaptation of the flotation process for the separation of the sulphide ores and the results are said to be satisfactory. Pittsburgh and Ohio men have options on the Jackson and Wissler properties at Ivanhoe and have done some developing. The Austinville properties, adjoining, are operating extensively under the ownership of the New Jersey Zinc Co. At Allisonia, about five miles southwest of Pulaski, the Forney-Caldwell interests have done considerable exploration work on an extensive deposit of zinc- and iron-sulphide ore, occurring in the limestone and crossing New River. The ore runs from 10 to 20% in zinc with a little lead. The property was recently examined by Kirby Thomas, of New York, and experiments with the treatment of the ore are being made. D. S. Forney, of Pulaski, has taken a lease on the old Clark ore bank, near Allisonia, and is shipping carbonate and silicate ore.

The Faber Mine, in Albemarle County, Virginia, has been recently taken under option by Philadelphia interests and is being unwatered. This property contains zinc ore and fluorspar and it is said that the present negotiation is with the view of operating the property for the latter mineral. State Geologist, Thomas L. Watson, will shortly undertake an investigation of zinc deposits of southwest Virginia.

ISHPEMING.—July 19

Ore Shipments for 1915, it is now believed, will total close to 40,000,000 tons, which would be an increase of almost 7,000,000 tons over 1914. Up to July 1, this year, the tonnage that went down the lakes amounted to 11,521,283 tons, an increase of 1,897,167 tons over the same period last year. It is safe to predict that about 26,000,000 tons will go down the lakes during July, August and September, and from the way orders are being booked and vessels chartered there will be a fair movement during October and November. Large sales of ore have been made during the last few weeks, and many of the furnace companies that stated the early part of the season that they would not require all of the ore called for in their contracts are now demanding that everything ordered be shipped. The Oliver Iron Mining Co. is working its mines to capacity, and many of the independents are now getting into better shape and mining more ore. Mining men of the district are wondering how long it will be before ores of the bessemer grades cease to command a premium in the market. Most of the furnaces that have been constructed during recent years manufacture steel by the open-hearth process and it will probably not be long before there are few bessemer plants in existence in this country. The non-bessemer ores work just as well in the open-hearth furnaces as do the ores carrying low phosphorus content, and the opinion is now held that it will be only a few years before the bessemer grades will no longer bring higher prices in the market. The non-bessemer ores greatly predominate at the present time, there being only a few mines now that hoist much of the bessemer product. Some of the Marquette and Gogebic range mines still produce a good deal of the higher-priced ore, but the percentage of the total is small. A short time ago the Montreal Mining Co., Montreal, Wis., shipped two cars of ore, running 69%, to New York, where it will be used for checking purposes. This is as high-grade iron ore as was ever mined in the Lake Superior district. There are millions of tons of low-grade ores in the district, but the time is coming when they will all be in demand.

CUPRUM, IDA.—July 10

The Seven Devils Mining District is apparently coming into its own, due to renewed activity on account of the advance in the price of copper and the gradual disappearance of the disadvantages under which the district operated in former times. The mines of the district have shipped between 20,000 and 30,000 tons of copper ore, averaging from 10 to 40%, mostly hauled by wagons over distances of 45 to 100 miles to railroad transportation. The Peacock Mine, whose deepest working is a 150-ft. shaft, has a lens of ore, which on surface measures 100 ft. wide by 300 ft. long. The ore from this mine averages 6% copper, which of course will not stand a 100-mile wagon haul. This company is said to be under option to San Francisco people and its early resumption of operation is expected. Adjoining the Peacock on the south is the South Peacock, which is being operated by Butte men. This mine has a 300-ft. shaft and has ore of about the same grade as the Peacock, which can be sorted to make a 16% grade which would stand being hauled to the railroad at Homestead, 20 miles distant and would show a profit at the present price of copper. At the Queen mine a carload of 30% ore, extracted during the past winter, on a lease, is being shipped. There is talk of resuming work on the Decorah-Arkansas group, and work is being done on the Badger group nearby. At Deep Creek, 6 miles north of the Peacock mine and within 2 miles of Snake River, at a point 17 miles north of the railroad at Homestead, the Red Ledge mine is being developed with a small crew. Talk of railroad accommodation is again current, and the state mine inspector is quoted as follows: "To my notion the most feasible solution of a north and south railway is over the Snake River route, by extending the present branch from Homestead, Ore., via the Idaho side of the cañon to Lewiston. The distance to build would be shorter than the route already outlined further east, and it would have the advantage of a natural water grade of 8 ft. to the mile and while probably more expensive to build in initial cost, it would afford the most direct connection in a single system of control through to north Idaho."

KELLOGG, IDA.—July 14

Activity on the North Fork of Cœur d'Alene River has been stimulated by prevailing high prices for zinc and antimony. Theodore Brown and John Finnel are developing a promising 14-in. vein of stibnite in Pine Creek district on claims that were abandoned several years ago and recently relocated. A good strike of zinc ore has been made at the Terrible Edith mine, near Murray, under lease to Charles and W. H. Conn. The lessees have been shipping 50 tons of ore a month and plan to increase output to 100 tons. At the 1000-ft. station in the lower tunnel the Samson has opened an orebody for 100 ft. that contains streak of milling ore several feet wide. The Paragon is engaged in blocking out ore. Shipments were held up some time ago by trouble over smelting contracts, but it is hoped to have difficulty removed soon.

JOPLIN—July 17

Miners' Strike involving 5000 lead and zinc miners fell to pieces and work was resumed full force July 12.

The Mining News

ALASKA

NO. 3 BELOW, DOME CREEK (Fairbanks)—Frank Fisher has purchased interest of Al Rice in lay on 3 Below, Dome Creek; large dump was taken out during winter.

CHICHAGOFF MINING CO. (Chichagoff)—W. R. Rust, of Tacoma smeltery visited property recently to inspect increased and improved milling capacity, as well as new compressor installation. James Freeburn is superintendent.

SELCH, DIETZ & WALKER (Ruby)—These operators, who expected to clean up $80,000 from their winter dump, obtained $90,000 after sluicing about half of it. Alexander Larsen has found $7 ground on Long Creek and let it out on lays.

MIDWAY ASSOCIATION (Fairbanks)—Sjolseth Bros. have found good pay on this Ester Creek claim and plan to move their plant from Gold Hill at once. Owners of claim, E. A. Suter, P. C. Charles and L. B. Clough, have bonded claim to Jack Leach for $20,000, of which $1000 was paid in cash.

E. M. ALDRICH (Juneau)—Located mining and water rights at William Henry Bay on Lynn Canal. This property is practically due West of Berner's Bay and across from the Jualin property, near Comet. Property likely to be opened up in small way this summer.

RELIANCE MINING (Fairbanks)—Workmen employed on property of this company, lying at head of Dome Creek, during summer and fall of 1913 have been granted lien against property by order recently signed by Judge Bunnel in District Court. Claim owners plan to carry case to Circuit Court of Appeals. Validity of territorial lien law involved.

CACHE CREEK DREDGING (Cook Inlet)—First gold dredge to be taken into Yentna mining district is being shipped by this company for operation during next summer. Material will be held at McDougal until snow flies when it will be shipped overland to ground to be worked. It is 7-cu.ft. bucket machine with capacity of 3000 yd. per day.

BIG CHENA (Fairbanks)—Shamrock Creek, on which $1.50 ground was found last winter, has been staked from end to end and is expected to make an important production this summer. Van Curler, who has been working in the district for several years, will probably move his plant, the only one of any size available this summer, to new creek.

M. O. BARNEY (Juneau)—Attorney for H. W. Martin, of New York, has taken possession of Hallum, Dora, Salmon Creek and other properties for his client. These properties have been under supervision of George R. Noble. It is reported that R. A. Kinzie, former superintendent Alaska Treadwell, will eventually take complete charge of properties.

VALDEZ CREEK PLACER MINES (Valdez)—Are ready to enter ranks of producing companies in Valdez district, hydraulic plant having recently been completed. Development work during last year cost about $200,000 and was financed largely by Boston capital. Ground shows value of $2.70 per cu.yd. Plant will run steadily until Sept. 1 when first cleanup will be made.

ALASKA GOLD (Juneau)—President Hayden is quoted as authority for statement that in June mill treated 90,790 tons of ore. First section of mill treated 2500 tons per day until middle of month, when part of second section went into operation, when 3500 tons were handled, which has now been raised to 4000 tons, and will in a few days reach 5000 tons daily. Third section expected to start latter part of August. By end of September expected to treat 7500 tons daily. Total 10,000-ton capacity to be reached by Jan. 1. There is no intention of increasing mill beyond this capacity in near future.

AMERICAN TIN DREDGING (New Cape York)—New tin dredge has been shipped here by this company to operate on Buck Creek. New dredge is equipped with screen and double flumes so that no time will be lost in cleaning up and is third of its kind to be installed in district. Gravel on creek contains large percentage of tin ore and small percentage of gold. About 200 tons of tin ore have already been taken out from this creek and a 2-ton motor truck, the farthest-north automobile on American continent, was recently shipped in to haul ore to tidewater for shipment to tin smeltery to be built in Seattle.

ARIZONA

Maricopa County

YOUNG MINES CO. LTD. (Mesa)—Stamp mill is in operation; oil is now being used for fuel instead of coal.

ORO FINO (Phœnix)—Is taking out carload of high-grade ore for shipment to Douglas. Sinking main shaft continues. Hoist is to be installed.

CALIFORNIA

Amador County

KENNEDY (Jackson)—The 100-stamp mill is crushing good ore from the lower levels. Tailing wheels are in satisfactory operation and the dam is proving a satisfactory method of impounding the tailings.

TREASURE (Amador City)—Savo Kosich, 31 years old, an Austrian miner was killed July 7 by the explosion of a missed hole. Kosich's head was blown off. His working partner lost an arm and was otherwise injured.

MACE ASBESTOS MINING CO. (Ione)—New incorporation with capital stock at $75,000. Directors are W. C. Lilian, of Stockton, H. Herman, A. L. Harnett and John V. Powers, of Ione, and George W. Lucot, of Jackson. Company will operate asbestos deposits near Ione.

CENTRAL EUREKA (Sutter Creek)—Shaft has passed the 3260-ft. point and is being deepened. At 3300-ft. level station will be cut and drifts driven to pick up the orebody developed in the 3100 level. Probable that shaft will be deepened to 3400 ft. and new level run at that point. Forty stamps dropping.

Eldorado County

BURTON (Garden Valley)—E. G. Carlquist has purchased this mine near Sailor Flat adjoining the old St. Lawrence property. Reported that a good ledge has been disclosed since development began.

RYAN (Shingle Springs)—Property has been taken over by mining men of Manhattan, Nevada. Installation of modern machinery is contemplated, including the 100-ton ore crusher. Water will be supplied from the Oakland Terminal Power Co. ditch through 2000 ft. of 3-in. pipe. A 50-hp. gasoline engine pumping plant will be installed on the bank of the creek.

Mono County

PITTSBURG-LIBERTY (Masonic)—Initial operation of the new tube mill and cyanide plant is reported to have proved that $10 ore can be profitably mined and treated. Development of orebodies shows sufficient ore blocked out to run the mill for two years.

Nevada County

CHAMPION (Grass Valley)—Reported that $300,000 produced in the past year has been expended in mining and development. A large amount went into new machinery, buildings and the opening up of large areas of underground work.

GOLDEN CENTER (Grass Valley)—Reported that contract has been let for 110 ft. steel headframe for the vertical shaft. Shaft will be deepened to 1000 ft. Pump will be installed at that point with a capacity of 300 gal. per minute. Crosscut at 1000-ft. point contemplated to cut the Peabody vein.

Santa Clara County

J. MORENO VS. NEW GUADALUPE QUICKSILVER MINING CO. (San Jose)—Plaintiff awarded $8000 damage by Superior Court for death of husband who was killed in an ore-car accident.

Shasta County

GLADSTONE (French Gulch)—Force of 120 men employed at this gold mine; 40-stamp mill running steadily. Sinking 200-ft. winze from lowest or 1200-ft. level underway.

SPREAD EAGLE (Kennett)—Considerable lateral development being done, sinking also under way. Property seven miles west of Coram and owned by Mammoth Copper Mining Co.

UNCLE SAM (Coram)—Operations resumed at this gold mine six miles west of Coram, on Squaw Creek. Ten-stamp mill put in operation. Property has made large gold production in past.

STOWELL (Kennett)—This copper property under option to Mammoth Copper Mining Co. which is doing considerable development work upon it. New 2-compartment shaft being sunk. Fair tonnage good-grade copper ore assaying a little in gold and silver blocked out; this ore discovered by diamond drilling. Compressor installed recently.

Trinity County

ASBESTOS MILLING PLANT—Installation is reported to be contemplated at Oakland by L. V. Stevens, mining engineer with interests in California and Mexico. The purpose is to handle asbestos mined in this county.

Tuolumne County

BLACK OAK (Soulsbyville)—Thomas Ayoob, a Syrian miner, 36 years old, was found dead on July 1, in a water sump just below a loading platform at the delivery end of a chute where he had been working. Body was cut by the falling rock but direct cause of death believed to be drowning.

COLORADO

Boulder County

GOLD FARM (Magnolia)—Exploratory work done on this property last season will be resumed and systematic development will be performed under direction of Col. W. H. Moore, representing group of Lincoln, Neb., men.

BOULDER TUNGSTEN (Boulder)—Promising orebody is being developed in east heading from Forest Home shaft. This level recently broke into old workings of Cold Spring No. 2 mine of Wolf Tongue Co., which is considered encouraging in view of fact that Cold Spring vein has produced high-grade ore in past.

Lake County

WESTERN ZINC OXIDE (Leadville)—Smeltery operating full capacity treating nonsulphide zinc ores of this region.

MOUNT CHAMPION (Leadville))—Four teams are kept busy handling high-grade gold ore from mine in Half Moon gulch on Mt. Massive to railroad at Malta.

NEW MONARCH (Leadville)—Leases all doing well, several averaging carload of ore each per day. Company is developing new deeper ground.

BIG FOUR (Leadville)—Mine is again active after its long shutdown following destruction by fire of its surface plant. Is shipping steady tonnage of $20 ore.

IBEX (Leadville)—Jacketts lease ships regular tonnage of high-grade smithsonite averaging 40% zinc. Tonnage pro-

duced to these properties during June was greatest monthly production in 5 years, while average grade was also highest.

PENROSE (Leadville)—Water having been lowered below 470-ft. point in shaft, first to projected pumping stations is being excavated. Shaft pumps will merely hold water below this level until station pump is ready to operate when they will resume heavy pumping and lower water to second pump station.

Teller County

VICTOR (Altman)—Schultz, et al, ship carload lot per week. Winston lease has made its first shipment to Golden Cycle mill, Colorado City.

VOLCANO (Cripple Creek)—In 60-ft. prospect shaft on Gold Hill, leasers struck vein of highgrade ore. They are preparing to ship.

ELLA B. (Cripple Creek)—Johnson and McQuarrie, in new prospect hole on Tenderfoot hill, have struck large body of ore and have begun shipments.

GRANITE (Victor)—Stock now listed on Colorado Springs Mining Stock Exchange. Company owns Granite, Gold Coin, Monumment, Dillon and Dead Pine mines, all close to Victor.

DEAD PINE (Victor)—On 400 level, McIntosh-Ingram leasers have drifted through cave-in that occurred years ago and are reclaiming an old stope said to have produced 1.5-oz. ore.

HONDO (Victor)—Sinking of main shaft continues. Body of milling ore was struck and is being mined and dumped on surface until contemplated mill may be erected. Some shipping ore is being marketed.

GOLDEN CYCLE M. & R. CO. (Colorado Springs)—Mill treated 36,000 tons of Cripple Creek ore during June, earning profit of nearly $60,000. It is still handling Cresson high-grade ore. Company is also producing ores from its own mines.

BLUE BIRD (Altman)—E. S. Johnson, sole owner and operator of this mine until few months ago, has granted option to purchase to Nelson Franklin who has been leasing since last December. Plans are being made to erect cyanide mill at mine. Property covers only 13 acres but its vein is remarkably strong and in many places very rich. Years ago, it produced many carload shipments of ore worth several dollars per pound. The shaft is 1865 ft. deep or 450 ft. above level of Roosevelt tunnel. Several sets of sub-leasers are operating on sliding-royalty scale.

IDAHO

Shoshone County

LITTLE PITTSBURG GROUP (Murray)—This silver-lead property, owned by G. A. Smith, is attracting considerable attention. Early in June the miners tapped the vein, which they crosscut for 14 ft. without reaching the hanging wall. Drift along vein shows 14 in. of high-grade zinc ore and 6 ft. of milling ore.

SUCCESS (Wallace)—June report shows that shipments of zinc ore brought $168,803 and shipments of lead ore $12,066. Operating and other expenses totaled $37,500, leaving net balance of $143,000. Report showed $179,531 on hand, with $85,069 worth of ore stored in mill and in transit to smelters, giving total of $264,600. The output is gradually being increased to 2000 tons per month.

HANDSPIKE (Wallace)—Handspike group owned by Little North Fork Mining & Mill Co., will be put on shipping basis, according to plans of management. Property lies above Horst-Powell mine and road is now being built from Handspike to that mine to provide outlet for ore. Driving is under way in mine and considerable ore taken out during development is on dump. Nearby Hamburg-American and Riverside properties are also being actively developed.

HYPOTHEEK (Wallace)—At a meeting of stockholders July 2 and 3 it was decided to use part of funds derived from sale of bonds to develop mine. Also decided to increase capital stock from 1,500,000 shares, par value 10c., to 2,000,000 shares. Drift on 900 level has been continued through mountain and three-compartment raise has been put up to surface on east fork of French Gulch. Raise now used as main working shaft in sinking to 1100-ft. level. W. W. Davidson, president, and J. H. Kern, general manager.

MICHIGAN

Copper

ONONDAGA (Houghton)—Has one diamond drill in operation and the second will be put into service as soon as the first strikes the ledge.

ALLOUEZ (Keweenaw)—Rock shipments are increasing and will continue to be maintained at the highest point in the history of the mine.

MASS (Mass City)—Will be back to 1200 tons daily this week. For the past week or ten days the shipments have been limited to 900 tons, due to difficulties with the hoisting plant.

LAKE (Houghton)—Shipped 15 cars of copper rock from mine to the Copper Range stamp mill at Beacon hill. Shipments will not be maintained at this high point for the present as this represents an accumulation of the first few days of rock hoisting. Plan to maintain the shipments at the rate of 10 cars, 400 tons daily, for the present. In getting the Lake mine cleaned and in running condition Manager Walker has achieved quite as much of a success as he did with Mass.

CALUMET & HECLA (Calumet)—The dredge, recrushing plant, classifier and turbine that furnishes the power for their operation are all out on commission and may be for a month or longer. A cable sheave broke into a live wire which created a short circuit. This put the generator for the turbine out of commission. This turbine furnishes the power that actuates the dredge and recrushers and classifiers. There is plenty of spare power but it is not applicable to the plants in question. Officials do not now know just how much time will be required to repair the damages and get the turbine generator into commission again. In the meantime the men employed in this auxiliary to the milling plant at Lake Linden are on vacation.

MONTANA

Hill County

HAVRE NATURAL GAS CO. (Havre)—Encouraged by recent strike of natural gas in well sunk by this company near Havre, it was decided to drill several more at once. Great Northern Ry. is said to contemplate erection of shops, using gas for power, and a number of capitalists are on the ground looking to the placing of other industries.

Silver Bow County

ANACONDA COPPER MINING CO. (Butte)—In spite of accident to concentrator of Washoe plant at Anaconda, which caused temporary curtailment in output in the latter part of June, the output for that month exceeded that of any month since last summer and was close to output for June a year ago. 22,300,000 lb. copper produced.

PARROT MINING CO. (Butte)—Work has begun on the removal of the steel headframe of the Parrot mine to the Never Sweat, where it will replace the old timber frame. The Parrot shaft was abandoned long ago as an operating shaft when mine was taken over by the Anaconda and exploited through the adjoining mines of that company. The removal of the frame marks final disappearance of evidences of activity at one of the famous Butte mines which was discovered in 1864 and became famous as a producer of exceedingly rich silver ore. The Parrot was taken over by the Amalgamated company in 1900.

NEVADA

Esmeralda County

JUMBO EXTENSION (Goldfield)—With exception of few days at beginning of month, daily shipments for June averaged 100 tons per day.

GOLDFIELD CONSOLIDATED (Goldfield)—Final official figures for May show production was 32,380 tons of ore from which $161,653 was realized.

ROUND MT. SPHINX (Round Mountain)—After legal battle lasting several years, Sphinx company, about year ago, adjusted its apex controversy with Round Mt. Mining Co. by turning over property to latter and receiving therefore cash and stock, which are now being liquidated to stockholders. Corporation will then be dissolved.

NEW GOLDFIELD SIMMERONE (Goldfield)—A round into what has been regarded footwall, after passing through seam of hard material, exposed 18 in. of ore which averages from $50 to $100 per ton. This is within 2½ ft. of old workings from which high-grade ore was extracted in early days of Goldfield.

Nye County

TONOPAH ORE PRODUCTION for week ended July 10 amounted to 8264 tons valued at $174,712 compared with 10,100 tons week previous. Decrease due to 4th of July holiday. Producers were: Tonopah Belmont, 2458; Tonopah Mining, 2400; Tonopah Extension, 1580; West End, 864; Jim Butler, 850; and miscellaneous leasers 112 tons.

TONOPAH-BELMONT (Tonopah)—H. P. Henderson, mining engineer, has been sent by Belmont company to make examination of Potosi mine, and he and his assistants recently arrived in Nicaragua. Steady progress being made at both Surprise and Hart properties, but no information is at hand as to the results obtained recently.

Storey County

MEXICAN (Virginia City)—Mill crushed 140 tons of ore, assaying $11.09 per ton.

UNION CONSOLIDATED (Virginia City)—At 275-ft. point in north drift 2500 level, 5 to 7 ft. of quartz assayed $4 to $14 per ton.

SIERRA NEVADA AND UNION (Virginia City)—West crosscut on 2500 level opened to 274-ft. point in Comstock country.

COMSTOCK PUMPING ASSOCIATION (Virginia City)—Flumes and dam installed on 2700 level to divert water to Ophir-Mexican winze pumps.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Mill received 1090 tons dump rock and 280 tons mine rock. One bar bullion shipped to smeltery.

OPHIR (Virginia City)—At central tunnel development was started on 6-ft. streak of quartz in parallel drift nearer the foot wall. Saved 232 cars of ore, and milled 175 tons.

OPHIR AND CONSOLIDATED VIRGINIA (Virginia City)—The 210-ft. level has been reached in reopening the east crosscut on the 2500 level boundary line, leading to the 2700 winze.

NEW MEXICO

Grant County

LESSEES IN THE TYRONE DISTRICT are taking out encouraging lots of copper ore. Dumps are being worked and many prospects are being developed. Shipments are being made over El Paso & Southwestern siding.

WORK ON THE SPUR connecting the Arizona & New Mexico Railway with the 85 Mine and other properties in the Virginia mining district, was begun July 13 by the A. & N. M. R.R. Co. No contracts were let. Company employing about 400 men on grading. Spur is expected to be in operation by Sept. 1.

SOUTHWESTERN NEW MEXICO MINES CO. (Hachita)—Has filed articles of incorporation. Will operate mines near Hachita.

MODOC (Fierro)—Mine under operation by J. W. Bible from Brockman estate. Shipments averaging a car-load daily. High in copper and iron.

WALDO (Lordsburg)—The Waldo lead concentrator will begin operations about July 18. Machinery in place and everything in readiness.

EMPIRE ZINC CO. (Hanover)—Grading to soon begin for a new powerhouse here. Lateral work under way on Thunderbolt mine. Carbonate shipments from Nason tunnel continue regularly.

CHINO (Santa Rita)—Company has increased wages of employees 10%, as long as selling price of copper is at 17c. or above. Notices to employees state: "This new scale is put into effect in appreciation of the friendly assistance of our employees in the past, and with a desire that they may share in the increased prosperity which has come so unexpectedly. No one can anticipate how long the present condition in the copper market may continue, but you can be assured that these rates will not be changed for every fluctuation that may occur below the price named."

Santa Fe County

SANTA FE GOLD & COPPER CO. (San Pedro)—It is understood that earnings in June were slightly over $20,000. Company has under consideration the erection of plant equipped with flotation machinery for treatment of its low-grade ores.

Socorro County

ERNESTINE (Mogollon)—Has declared first dividend in two years. Present dividend 2%, aggregating $50,000. Development work interrupted dividend payments.

MOGOLLON GOLD & COPPER CO. (Mogollon)—Property will be sold at Socorro, N. M., July 26 to satisfy judgment for $416,626 given the Equitable Trust Co., of New York. Milton J. Helmick, Socorro, N. M., trustee.

NEW YORK

St. Lawrence County

NORTHERN ORE CO. (Edwards)—This zinc company of Pilling & Crane, is speeding up production at its new mill recently erected to replace former mill destroyed by fire. Justice Grugan is manager. Another zinc property several miles from Edwards is being developed by A. J. Moore who preceded Mr. Grugan as manager for Northern Ore Co.

ALUMINUM CO. OF AMERICA (Massena)—The Massena plant of this company near the St. Lawrence River has been undergoing extensive additions. Large force of men employed on new work has boomed village of Massena. Electrical current, necessary in large quantity for reduction purposes is obtained from power installations on tributaries to St. Lawrence River.

UNIFORM FIBROUS TALC CO. (Taleville)—This company and St. Lawrence Talc Co., of Natural Bridge have materially increased their grinding capacity by addition of more cylinders and operating companies. International Pulp Co. and Ontario Talc Co. continue their usual productions. Operating power from Oswegatchie River which determines summer work has been good due to recent rains.

PENNSYLVANIA

Delaware County

BENZOL PRODUCTS CO. (Marcus Hook)—Plant now under construction expected to be completed within month or two. Product of plant said to be intended mostly for aniline dyes, on which problem General Chemical Co. is working in connection with American Coal Products Co. and Semet-Solvay Co.

Northampton County

LEHIGH COKE CO. (So. Bethlehem)—Contract has been let for new benzol plant to manufacture benzol from gas from present coke ovens, which treat 3000 tons of coal per day. Installation will be so laid out that it can be readily duplicated to handle gas from 212 additional ovens now under construction. Production of benzol expected to begin in less than four months.

SOUTH DAKOTA

Lawrence County

WASP NO. 2 (Flatiron)—Plant operating full capacity of 500 tons. Shipments of high-grade tungsten ore being made.

RATTLE SNAKE JACK (Galena)—Mill nearly completed and will be put into operation during present month. Trent system of cyanidation installed. Plant will treat 50 tons daily.

GOLDEN REWARD (Terry)—Roaster at Astoria mine will be put into commission about middle of month and kept in continuous operation. Mill at present is operating at capacity on oxidized ores from Bald Mountain mines.

HOMESTAKE EXTENSION (Deadwood)—Engineers are unwatering property, preparatory to thorough sampling of mine. Expected that this work will take several months. Jackhamer drills will be used to facilitate work.

NORTH HOMESTAKE (Maitland)—Shaft has been unwatered below 400 level by means of skips. It is expected that within week entire mine will be unwatered. Machinery is being put into shape and work will commence soon.

HOMESTAKE (Lead)—Company will enter first-aid team in contests at San Francisco Fair this fall. Work has been resumed on 1850 level of mine and it is probable that sinking will be commenced as soon as this level is opened up for active work. New boiler plant is nearing completion, one of 210-ft. smokestacks has been set up and work on second has commenced.

TEXAS

Potter County

WILL A. MILLER AND ASSOCIATES are promoting development of potash deposits near Amarillo. It is planned to install machinery and equipment for extracting mineral product from deep wells.

UTAH

Salt Lake County

COLUMBUS EXTENSION (Alta)—Drifting to southwest is being done under old Toledo fissure. Henry Barney is new superintendent.

ALTA CONSOLIDATED (Alta)—Development work is progressing more rapidly, since installation of machine drills. Six inches of ore has been opened in No. 2 drift, east from main tunnel.

WASATCH-UTAH (Salt Lake)—This company, which has installed Koering mill and is cyaniding low-grade gold-silver ore, is reported to be making good extraction. Property is at mouth of Little Cottonwood.

SELLS (Alta)—From three to eight inches of sulphide ore has been opened on quartzite-limestone contact, along which 110 ft. of drifting has been done. Objective point is intersection with Skipper fissure, which carries ore in shallow surface workings. Operations are being carried on through main South Hecla tunnel.

CARDIFF (Salt Lake)—Recent visitors to this property report orebody to be opening up larger than ever, with extent undetermined. It has been opened 250 ft. on strike; and crosscuts show width up to 100 ft. On dip ore has been followed for more than 200 ft. above tunnel by raising, while winze has been sunk 90 ft. in ore below it. Shipments of about 90 tons daily are being made, these being limited by number of ore wagons obtainable. Hauling costs about $1 per ton.

Summit County

SILVER KING COALITION (Park City)—Work on new flotation section is in progress. Capacity will be 60 tons per eight-hour shift.

THREE KINGS (Park City)—Shaft sinking continues at this property in Nigger Hollow, with depth of 500 ft. to be attained. W. M. O'Brien has sold out to his associates.

Tooele County

SIMMS GROUP (Gandy)—These claims in Deep Creek district, on which tungsten ore has been opened are reported sold to Colorado company. Mill may be built.

Utah County

CONSIDERABLE ACTIVITY IN AMERICAN FORK CAÑON at present. Camp is attracting outside attention. Roads are in good shape for more than 20 miles.

MILLER HILL (American Fork)—First car of ore to be brought down cañon since melting of snow has been shipped by Wadley lease on this property.

BELLEROPHON (American Fork)—Strike of silver-lead ore has been made in tunnel on Live Yankee claim. Road will be put in condition for shipping.

MINERAL FLAT (American Fork)—Ore hauling has been started from this property, operated under lease. Several cars running well in lead and silver, with some gold, are ready for shipment.

ETTA MAY (American Fork)—Work has been started on vein, which appears promising at outcrop. Property was recently inspected by Salt Lake mining men. George Paramore is general manager.

CANADA

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for month of June were from Cobalt Proper: Beaver, 36 tons; Chambers Ferland, 52; Cobalt Comet, 76; Coniagas, 108, Crown Reserve, 118; Kerr Lake, 98; La Rose, 150; McKinley-Darragh, 247; Mining Corp of Canada, Ltd. Cobalt Lake Mine, 84.68; Townsite City, 283.98; O'Brien, 56; Penn Canadian, 143; Peterson Lake—Seneca Superior ore, 62; Temiskaming, 106. From New Liskeard: Casey Cobalt, 32. From Elk Lake: Miller Lake O'Brien, 25; total silver ore shipments, 1665 tons. From Porquis Junction: Alexo Mine (Nickel), 989 tons.

TECK-HUGHES (Kirkland Lake)—Mine has been unwatered and is being re-sampled in view of prospective sale.

POWERFUL (Calcite Lake, near Gowganda)—Operation on this property, which have been suspended for about year, have been resumed.

GIBSON CLAIMS (Goodfish Lake)—In sump below 100 level two more streaks of high-grade ore have been cut. One vein has full 12 in. of ore.

HOLLINGER RESERVE (Porcupine)—Dominion Reduction Co., is now engaged in sampling this property, to decide whether they will take up or drop option.

LAKE SHORE (Kirkland Lake)—Main vein has been cut with diamond drill 100 ft. from shaft on 100-ft. level. Sludge from drill hole averaged $48 per ton for width of 3 ft.

BEAVER CONSTRUCTION (Cobalt)—Is increasing capacity of concentrating mill to 150 tons per day. New installation to be completed in six weeks. Company has 259,480 oz. bullion in storage in New York.

HAITI

HAITIAN MINING CONCESSION—A concession just granted by the Haitian Government to the local representative of a British company carries with it the right to prospect for minerals of all kinds within that island Republic. The indemnities to be paid the owners of the land prospected over and the obligations which the company incurs are set out in full in the text of the concession.

NICARAGUA

RAILWAY CONCESSION FOR MINING DISTRICT—The Republic of Nicaragua has made a contract with the Tunky Transportation & Power Co. for the construction of a railway, and of a plant or plants for the manufacture and transmission of power, in the mining district of Pis Pis. The contract has been approved by both branches of the National Congress and duly signed by President Diaz. The National Congress gave a great deal of attention to the provisions of the contract, which appears equable to all parties concerned and it is expected to operate to the advantage of Nicaragua.

AFRICA

Transvaal

GOLD PRODUCTION IN JUNE was 755,280 oz., which is 8268 oz. less than in May, but 37,354 oz. more than in June, 1914. For the six months ended June 30 the total production was 4,086,847 oz. in 1914, and 4,408,048 oz. in 1915; an increase of 321,201 oz., or 7.9%, this year.

The Market Report

Metal Markets

NEW YORK—July 21

The prices for all of the principal metals exhibited drooping tendencies during the last week. The recessions in the prices for copper and spelter were rather sharp owing to the efforts of the producers to find a basis on which they could sell liberally.

Copper, Tin, Lead and Zinc

Copper—This market, which had been dull and reactionary for fully a month, declined rather sharply during the last week. Previously the market had been to a considerable extent in the hands of traders and dealers, the producers (who had generally sold well ahead) being content to stand aloof. Certain of the larger producers continue to maintain that position, but lately some of the smaller producers have been manifesting a desire to sell copper, and in order to do so they cut prices sharply last week. Sales were made to domestic manufacturers. There was relatively little business done for export, the London market having passed temporarily into the hands of the Japanese and Australian producers of electrolytic, who were willing to sell on lower terms than the American producers were disposed to accept. Business in Japanese electrolytic was reported done at £88, equivalent to about 18.60c. At the close there were sellers in the New York market at 18⅞@19c., regular terms, for domestic business, and at 18.70@18.75, New York, for export.

Although it is considered likely that copper may experience a further decline, there is no pessimism in evidence among the producers, and a turn of the tide is expected shortly. Domestic manufacturers are believed to be not very well covered, while the settlement of the strikes at Bridgeport and in Wales are favorable factors. Even more important as an index is the increasingly strong position of the iron and steel industry, which is regarded as marking a revival in domestic business generally. Another important factor is the probability that the British Government will within a few days make an arrangement for the release of standard copper to foreign refiners, with suitable guarantees, of course, including the assurance that raw copper taken out of England will be replaced by an equivalent quantity of electrolytic. An arrangement of this sort will tend immediately to bring standard copper back to the normal parity with refined, and will remove the bad sentimental effect that the relatively low price for standard has had in distant and uninformed quarters.

Copper Sheets have brought 25@26c. per lb. The principal manufacturer makes no base quotations. Wire is quoted at 21½@22c. per lb. at mill.

Tin—The price declined owing to dull demand and anticipation of bad effects of the strike of coal miners in Wales. Following the receipt of news of the settlement of that strike, the market rallied.

Arrivals of tin and tin concentrates at Liverpool in June, reduced to their equivalents in metallic tin, were: Bolivia, 2085; Nigeria, 225, South Africa, 28; total, 2348 long tons.

Lead—But relatively little business in this metal was reported. Some extraordinary features in the quotations are explained by the narrowness of the market. Producers generally adhere to the price of the A. S. & R. Co. and report the realization of it. On the other hand, lead has been obtained from dealers and traders at much lower figures. If somebody wanted to buy lead he was apt to have to pay the producer's price, while, if somebody wanted to sell, he was apt to have to accept a considerably lower price. It will be remarked that the St. Louis market has not gone off to the same extent as the New York market.

Spelter—There was a steady decline right through the week on relatively small business. About all of the producers were sellers, and some of them appeared to be rather urgent. The trouble with the market was that there were not enough buyers. Certain consumers made liberal offers of prompt spelter for resale and put considerable pressure on the market. There appears to be an increased supply of spelter available, both for the earlier and the later months.

According to a U. S. Consular report another zinc smeltery is to be erected in Japan to use ore to reduce Siberian ore, which previous to the war was exported to Germany.

Zinc Sheets are strong, base price $27 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged. The demand is steady and business is good.

Other Metals

NEW YORK—July 21

Aluminum—The market continues firm, with good demand. Prices are unchanged at 32@33c. per lb. for No. 1 ingots, New York.

The latest London quotation is £140@150 per long ton—average, 31.5c. per lb.—for No. 1 ingots.

Antimony—The market has been rather quiet, with trading limited to actual necessities. There is no material change in prices. Chinese and other ordinary brands bring 37½@40c. per lb. The special brands are nominal, 50@52½c. per lb. being asked for Cooksons.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
July	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
15	4 7650	47⅛	19 05 @ 19 25	37¾	5 60 @5 75	5.50 @5.60	19.00 @20.50
16	4 7638	47⅛	18 90 @ 19 10	37⅛	5.60 @5 75	5.50 @5.60	18.50 @20.00
17	4 7650	47⅛	18 80 @ 19 00	37⅛	5 60 @5 75	5.50 @5.60	18.00 @19.50
19	4.7631	47⅛	18.75 @ 18.85	37	5 55 @5 75	5.50 @5.55	18.00 @19.00
20	4 7638	47¼	18 70 @18.80	36⅞	5.55 @5.75	5.50 @5.55	17.50 @19.00
21	4 7638	47¼	18.70 @ 18.80	36⅞	5.55 @5.75	5.50 @5.55	17.00 @19.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, easb, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6 3c.; St. Louis-Pittsburgh, 13 1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
July	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
15	22 9/16	76⅜	77¼	92½	19 70	170	163¼	25 1/16	5 35	100	21 73
16	22 5/16	75¼	77	91½	19.48	170	163	24 13/16	5 31	96	20 46
17	22 9/16										
19	22 9/16	74½	75¾	91	19 37	167¾	162	24 11/16	5 26	96	20.46
20	22 9/16	74½	76	90½	19.27	164½	160½	24¼	5.29	96	20 46
21	22 9/16	75¼	77⅛	90½	19.27	165⅜	161¼	24 11/16	5.26	96	20 46

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Nickel is steady and unchanged at 40@45c. per lb. for ordinary forms, according to size of order. Electrolytic 3c. per lb. higher.

Quicksilver is strong and in good demand, with prices well held and showing little change. New York price is $92@94 per flask of 75 lb. for large orders. For smaller lots $95@100 is paid. San Francisco quotations are reported by telegraph at $92.50@95 per flask, on a quiet market. London prices is £18 5s. per flask, with £18 2s. 6d. quoted by jobbers.

Gold, Silver and Platinum

NEW YORK—July 21

Gold—No important arrivals of gold are reported during the week. Sterling Exchange continues at a low level, with a tendency to lower points yet.

Platinum—The market continues quiet, but with some gain in demand, and no material change in prices can be reported. Dealers name $37@39 per oz. for refined platinum and $41@44 per oz. for hard metal.

Our Russian correspondent writes under date of June 27 the market and the prices are without change. In Petrograd for the last fortnight no transactions have taken place. Government permission to export the platinum can be secured on condition that security will be given that the metal will not be diverted to Germany. The quotations are: at Ekaterinburg, 8.20@8.30 rubles per zolotnik; in Petrograd, 33,000 rubles per pood—equal to $31.02 and $32.34 per oz., respectively, for crude metal, 83% platinum.

Silver—The market has been pegged at 22⅞d. for several days. The latest advices are that the Indian bazaars have not been active buyers and the daily transactions are limited. In the judgment of many holders of silver the price is too low and selling at current rates is not insistent.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 17

The base price paid this week for 60% zinc ore was $110@115 per ton. The base price paid for 80% lead ore was $70 per ton.

SHIPMENTS WEEK ENDED JULY 17

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,067,290	124,990	500,900
Year	102,040,720	3,993,460	14,762,170

Shipped during week to separating plants, 5,365,690 lbs. zinc ore.

JOPLIN, MO.—July 17

Blende, high price $123; base per ton of 60% zinc, premium ore $120@115; medium $105@95; and for low down to $70. Calamine base per ton of 40% zinc, $52@60; average price, all grades of zinc, $102.20 per ton. Lead, high price $61; base $60 per ton of 80% metal content; average all grades of lead $57.67 per ton.

SHIPMENTS WEEK ENDED JULY 17

	Blende	Calamine	Lead	Values
Totals this week..	6,939,860	941,310	1,106,520	$435,670
Totals this year...	310,910,260	27,085,390	47,208,190	$13,102,940

Blende value, the week, $376,630; 29 weeks, $11,282,610.

Calamine value, the week, $27,160; 29 weeks, $577,470.

Lead value, the week, $31,880; 29 weeks, $1,242,860.

The strikers all returned to work Monday and the strike leader has left the district, asserting he was going to Wisconsin to run a mine. Mine owners expect to compute a wage scale based on the average assay base price per month, the wages of the succeeding month to be governed thereby. It is intended to make it just to miner and mine owner alike. The first and only strike this district ever experienced ended as it begun peacably, and while the men will maintain a union it will be for their advancement along reasonable lines.

Iron Trade Review

NEW YORK—July 21

The expansion of the steel trade continues and steel makers are beginning to look forward with confidence to an active and prosperous second half.

June pig iron output in Alabama was 122,309 tons of foundry and 36,451 of basic, a total of 158,760. The June output was the largest of the year by 12,000 tons and that of July will show as great a gain, it is expected.

The Russian order for rails, recently referred to, was divided, 100,000 tons going to the Cambria Steel Co., while the Lackawanna Steel Co. took the remaining 60,000 tons.

PITTSBURGH—July 20.

Very nearly 90% of the steel productive capacity of the United States is now in operation, this including practically all the openhearth capacity and 70 to 75% of the bessemer, production of bessemer steel having been augmented by the starting yesterday of the Riverside plant, in the Wheeling district, of the National Tube Co. One of the Riverside blast furnaces was blown in last week, while the other goes in today, putting all the 11 stacks of the Tube company in blast. The Riverside plant was started chiefly to furnish billets and skelp, the latter for export, and will make only a limited tonnage of tubular goods, the demand for which is below normal on account of the lack of oil development work.

The demand for finished steel has been augmented in the past two or three weeks by the fact that in many steel products the mills are unable to make the almost instant shipment that characterizes dull periods, thus causing buyers to attempt to lay in stocks, which have been at record low levels. This buying gives such an impetus to demand that the future of the steel market will take care of itself, and full mill operations, with advancing prices, are regarded as certain, the only question being whether the movement will cover a period of months or of years.

The entire export business in iron and steel, direct and indirect, and including war material, probably amounts now to nearly 25% of the total production, but it certainly falls far short of accounting for all the improvement the steel trade has experienced in the past seven months.

Pig Iron—Offerings of Lake front iron in the general Valley-Pittsburgh territory appear to have been discontinued, and the Valley furnaces are firm at $14 for bessemer, $13 for basic, $12.75@13 for malleable, $12.75 for No. 2 foundry and $12.50 for gray forge, while the Pittsburgh market is quotable at 95c. higher. The Republic Iron & Steel Co. has bought 20,000 tons of bessemer at $14, Valley furnaces, for delivery in the next three or four months. The whole pig iron situation is greatly improved.

Ferromanganese—The market seems rather quiet and steel makers appear less disturbed about the future than might be supposed, considering the light supplies of manganese ore reaching England and the United States. The market remains at $100, Baltimore, on contract, and $100@105 on small spot lots.

Steel—Openhearth steel has become very scarce, with prices advancing sharply. Subsidiaries of the Steel Corporation are believed to have bought in the past three weeks about 150,000 tons of openhearth billets and sheet bars, cleaning up all the offerings at former prices. We quote prices $1 a ton higher than a week ago: Bessemer billets, $21; bessemer sheet bars, $21.50; openhearth billets, $22; openhearth sheet bars, $22.50, f.o.b. maker's mill, Youngstown, and $1 higher delivered Pittsburgh. Rods are $25.50@26, with light offerings.

IRON ORE

Of the ore shipped from the Lake Superior district in June 4,941,672 tons, or 82% of the total, were for Lake Erie ports.

New York and New Jersey ores are reported to have been sold to eastern Pennsylvania furnaces at prices which work out from 6¾ to 7c. per unit, delivered.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 340,742 short tons; shipments, 330,073 tons. Production in the Greensburg and Upper Connellsville districts, 39,086 tons.

Austrian Coal Production three months ended Mar. 31, in metric tons:

	1913	1914	Changes	
Coal	4,248,164	4,021,354	D.	226,810
Brown coal	4,582,203	3,702,631	D.	879,372
Coke made	641,383	441,335	D.	200,048
Briquettes made	109,497	123,788	I.	14,291

Of the briquettes reported this year 66,405 tons were made from brown coal or lignite.

Chemicals

NEW YORK—July 21

The general market remains quiet and is still rather uneven. The present tendency of business is to improvement.

Arsenic—Business remains about as usual, with moderate demand. Prices are unchanged at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady and shows little change. Prices are about the same at $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is steady, with a good demand and prices are unchanged. Quotations are 2.35c. per lb. for spot, and for all positions this year.

Pyrites—Imports at Baltimore for the week included 6482 tons pyrites from Huelva, Spain.

Assessments

Company	Delinq	Sale	Amt.
American, Ida	Aug. 7	Sept. 2	$0 001
Blue Bell, Ida	July 5	Aug. 4	0 003
Carbonate, Ida	June 23	July 23	0 001
Challenge Con., Nev	July 12	Aug. 4	0 05
Con. Virginia, Nev	July 19	Aug. 10	0 05
Contact Copper, Mich	May 15		0 50
East Hercules, Wash	Aug. 10	Sept. 10	0 0015
Eastern Star, Ida		Aug. 24	0 002
Four Timbers, Ida	July 28	Aug. 28	0 001
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1.00
Houghton, Mich	May 25		0 50
Idaho-Nevada, Ida	July 14	Aug. 6	0 001
Iron Mask, Ida	July 1	Aug. 10	0 002
Ivanhoe, Ida	July 12	Aug. 12	0 002
Maguire-Idol, Nev	Dec. 15	July 20	0 005
Mayflower, Ida	June 15	July 17	0 005
Michigan Copper, Mich	July 19		1.00
Mineral Range, Utah	May 24		0 003
Monarch Pitts., Nev	June 14	July 14	0 01
Moonlight, Ida	June 5	July 8	0 005
Nabob, Ida	July 5	Aug. 2	0 005
New Arcadian, Mich	June 1		0 50
New Arcadian, Mich	Dec. 1		0 50
New Baltic, Mich	July 15		0 50
New Baltic, Mich	Jan. 15		0 50
New Yerrington Cop., Nev	July 9	July 27	0 01
Nevada Douglas, Nev	July 21	Aug. 18	0.10
North Bunker Hill, Ida	June 12	July 17	0 002
Old Veteran, Ida	July 5	July 31	0 002
Oreano, Ida	Aug. 2	Sept. 2	0 0015
Rainbow, Ida	July 7	Aug. 7	0 002
Reise-Emla, Nev	July 14	Aug. 19	0.01
Revelator, Utah	July 17	Sept. 3	0.001
Revelator, Utah	Oct. 4	Oct. 25	0.001
Rhode Island, Ida	June 24	July 24	0 001
Sierra Nevada, Nev	July 27	Aug. 16	0.05
Sonora, Ida	July 23	Aug. 31	0 0004
Springfield, Ida	July 30	Aug. 30	0.002
Sunrise, Ida	July 17	Aug. 17	0 002
Sunset Dev., Ida	June 30	July 24	0 0025
Tarbox, Ida	July 17	Aug. 7	0.0025
Umatilla Tonopah, Nev	July 12	Aug. 16	0 01
Virginia, Ida., (post.)		July 29	0 02
West Tonopah Con., Nev	July 10	Aug. 10	0.01
Wyandot, Mich	July 28		1.00

Stock Quotations

Only a few of the mining stocks moved upward last week; among these were Mason Valley, Nevada-Douglas, Lake, Tamarack, Timiskaming & Hudson Bay and Dome Mines. A number of the Tonopahs declined slightly, as did also Alaska Gold, Juneau, Hollinger, Caledonia, Majestic, American Zinc and Granby Consolidated.

COLO SPRINGS	July 20	SALT LAKE	July 20
Name of Comp.	Bid	Name of Comp.	Bid.
Acacia	02	Beck Tunnel	04
Cripple Crk Con.	.009	Black Jack	.103
C. K. & N.	03	Colorado Mining	.10
Doctor Jack Pot	10	Crown Point	011
Elkton Con.	.38	Dab-Judge	7 25
El Paso	94	Gold Chain	20
Findlay	.033	Grand Central	61
Gold Dollar	02	Iron Blossom	69
Gold Sovereign	03	Little Bell	12
Golden Cycle	1.79	Lower Mammoth	03
Isabella	17	Mason Valley	2 50
Jack Pot	05	May Day	21
Jennie Sample	02	Opohongo	003
Jerry Johnson	05	Paymaster	78
Lexington	.005	Seven Troughs	01
Mary McKinney	37	Silver King Coal'n	3 52
Pharmacist	005	Silver King Con.	2 10
Portland	1 40	Slavs Con.	011
Raven B. H	02	Uncle Sam	03
Vindicator	1 71	Yankee	03

TORONTO	July 20		
Bailey	02	Dome Extn.	25
Conlagas	75	Foley-O'Brien	25
Peterson Lake	21	Hollinger	25 00
Right of Way	03	Imperial	06
Seneca Superior	00	Jupiter	12
Silver Queen	01	McIntyre	54
T. & Hudson Bay	00	Pearl Lake	09
Timiskaming	55	Porcu Crown	75
Werthaufer-Jor	05	Preston E. D.	03
Dome Mines	22 75	Rea	10

SAN FRANCISCO	July 20		
Comstock Stocks		Miscl. Nev. & C.	
Alta	05	Belmont	5
Andes	06	Jim Butler	79
Belcher	30	Jumper	05
Best & Belcher	06	Mac Omara	02
Caledonia	20	Midway	11
Challenge Con.	67	Mont-Tonopah	2
Confidence	10	North Star	14
Con. Virginia	10	Rescue Eula	08
Gould & Curry	03	West End Con.	75
Hale & Norcross	05	Atlanta	32
Julia	04	Booth	51
Mexican	36	Jim Butler Con.	07
Occidental	79	Comb. Frac.	08
Ophir	14	Jumbo Extension	32
Overman	07	Pitts.-Silver Peak	10
Potosi	02	Round Mountain	50
Savage	03	Sandstorm Goldfld	06
Sierra Nevada	05	Silver Pick	10
Union Con.	17	Central Eureka	15
Yellow Jacket	30	So. Eureka	11 50

N. Y. EXCH.	July 20	BOSTON EXCH	July 20
Name of Comp.	Clg.	Name of Comp.	Clg.
Amalgamated	73⅛	Adventure	2
Am. Sm. & Ref., com	78⅛	Ahmeek	396
Am. Sm. & Ref., pf.	107	Alaska Gold M	34⅛
Am. Sm. Sec., pf. B	80	Algomah	2⅞
Anaconda	34⅛	Allouez	53
Batopilas Min	1⅛	Am. Zinc	56
Bethlehem Steel	198	Ariz. Com., ctfs.	6
Bethlehem Steel, pf.	121	Bonanza	30
Chino	45⅛	Butte-Balaklava	3
Colo. Fuel & Iron	34⅛	Butte & Superior	70⅛
Federal M. & S., pf.	50	Calumet & Ariz.	64⅛
Great Nor., ore., ctf.	36⅛	Calumet & Hecla	560
Guggen. Exp	61⅛	Centennial	19
Homestake	118	Cliff	14⅛
Inspiration Con.	31	Copper Range	55⅛
Mex. Petroleum	71⅛	Daly West	2⅛
Miami Copper	27⅛	East Butte	13
Nat'l Lead, com	61⅛	Franklin	9⅞
National Lead, pf	107⅞	Granby	85
Nev. Consol	14⅛	Hancock	18
Ontario Min	2⅛	Hedley	29
Quicksilver, pf	4	Helvetia	50
Ray Con.	23	Indiana	5⅛
Republic I. & S., com.	34	Island Crk., com.	49
Republic I. & S., pf.	91	Island Crk., pfd.	89⅛
Sloss-Sheffl'd, com.	37	Isle Royale	28
Tennessee Copper	37	Keweenaw	2⅛
Utah Copper	66⅛	Lake	15
U. S. Steel, com.	63⅞	La Salle	6⅛
U. S. Steel, pf.	111	Mass	11⅞
		Mayflower	4
		Michigan	2⅞
		Mohawk	72
		New Arcadian	10
		North Butte	30⅞
		North Lake	2
		Ojibway	2
		Old Colony	3⅛
		Old Dominion	53
		Osceola	72⅛
		Quincy	85
		Santa Fe	3
		Shannon	8⅛
		Shattuck-Ariz	26⅞
		Superior	27⅞
		Superior & Bost.	2⅛
		Tamarack	39
		Trinity	4⅛
		Tuolumne	45
		U. S. Smelting	41⅛
		U. S. Smelt'g, pf.	46⅛
		Utah Apex	4⅛
		Utah Con	13⅛
		Victoria	2⅞
		Winona	3⅛
		Wolverine	61⅛
		Wyandot	75

N. Y. CURB	July 20
Name of Comp.	Clg.
Alask'a Juneau	12⅛
Alta Con	.82
Beaver Con	.30
Big Four	.05
Blue Bell	.02
Braden Copper	6⅞
Buffalo Mines	⅜
Can. Cop. Corpn	1
Can. G. & S	1.05
Caribou	2.50
Cashboy	.05⅛
Chambers Ferland	.15
Chile Cop	19⅛
Con. Ariz. Sm	1⅝
Con. Coppermines	12⅛
Con. Nev.-Utah	11/32
Davis-Daly	1⅞
Diam'Gold-Daisy	.04
Dia Black B	.02
Florence	.50
Goldfield Con	1 5/16
Goldfield Merger	.24
Greene-Cananea	.40
Kennecott Cop	33⅛
Kerr Lake	4⅛
La Rose	.50
McKinley-Dar-Sa	.21
Majestic	.75
Mines of Am	22⅛
Nevada Hills	22
New Utah Bingham	3
Nipissing Mines	5⅞
Ohio Copper	.25
Oro	.08
South Utah	1.25
Stand'd Oil Pf. A	100⅛
Standard S. L	1 1/16
Stewart	2
Tonopah	6⅞
Tonopah Ex	2 1/16
Tonopah Merger	.38
Tribullion	⅞
Tuscarora	1⅛
Yukon Gold	2⅛

LONDON	July 9		
Alaska Tre'dwell	£7	7s	6d
Cam & Motor	0	13	9
Camp Bird	0	4	6
El Oro	0	7	6
Esperanza	0	8	0
Mexico Mines	3	0	0
Oroville	0	14	6
Santa Gert'dis	0	7	6
Tomboy	1	1	10
Touch Oakes	0	7	6

BOSTON CURB	July 20
Name of Comp.	Bid.
Alvarado	.70
Bingham Mines	9⅛
Boston Ely	.29
Butte & Lon'n Dev	.27
Calaveras	1⅛
Calumet-Corbin	.04
Chief Con	1 1/16
Corbin	1.50
Cortez	.40
Crown Reserve	.50
Eagle & Blue Bell	1⅞
First Nat. Cop	2⅛
Houghton Copper	3⅛
Iron Cap Cop., pf	4⅛
Majestic	.70
Nipissing Metals	.22
Nevada-Douglas	.60
New Baltic	3⅛
Oneco	1⅛
Raven Copper	.11
Smokey Dev	.15
So. Lake	2 1/16
Tonopah Victor	.32
Trethewey	10
United Verde Ext	5⅛

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.855	28 083	26 553	22 731
February	61 642	57 506	48.477	28 357	26 578	22 753
March	57 870	58 067	50.241	26 669	26 788	23 708
April	59 499	58.519	50.250	27 416	26 958	23 709
May	60.361	58 175	49.916	27 825	26 704	23.570
June	58 990	56 471	49.034	27 199	25 948	23 267
July	58 721	54 678		27 074	25 219	
August	59 293	54 344		27 335	25 079	
September	60 646	52 240		27 985	24 260	
October	60 793	50.654		28 083	23 199	
November	58 995	49 082		27 263	22 703	
December	57 760	49.375		26 720	22 900	
Year	59 791	54 811		27 576	25 314	

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

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.49	14.394	65.259	63.494	70 188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.99	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.326	82.574	66.274	95.333
July	13.223		60.540		64 955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	14.739		53.227		*	
December	12.801		56.841			
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		149.391	
December	33.601		147.102	
Av. year	34.301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3 937	3.778	19 606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3 810	5.836	19.411	25.170
July	3.891		3.738		19.051	
August	3.875		3.715		‡	
September	3.828		3.658		‡	
October	3.528		3 384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19 097	
Year	3.862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21.413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5 074	14.781	4.924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920		4.770		21.568	
August	5 568		5.418		‡	
September	5 380		5.230		‡	
October	4 909		4.750		‡	
November	5.112		4 962		25.016	
December	5 592		5.430		27.369	
Year	5.213		5.066			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.50	$13 23	$13.47	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13.91	13.45	14 10	13.95
April	14.90	14.55	13.78	13.45	14 12	13.95
May	14.90	14.61	13.90	13.60	14 27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90		13.90		13.90	
August	14.90		13.90		14 08	
September	14 90		13 90		14 03	
October	14.84		13 75		13 97	
November	14.59		13 43		13 83	
December	14.70		13 45		13 83	
Year	$14 88		$13 78		$14 01	

The Engineering and Mining Journal

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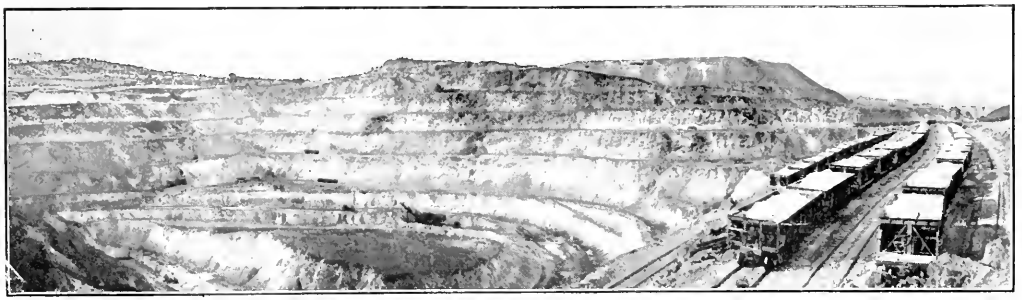
Essentials of Organization and Management

By J. R. Finlay*

SYNOPSIS—The methods and objects of mine management are so often misunderstood that a broad discussion is necessary. Mining is a business having clearly defined objects, among the most important of which are securing greatest ultimate profit and providing greatest present value of the property. Costs are interesting only in their relation to the whole; not as independent items.

I should like to put this discussion on broad grounds. Technical men are sometimes led into the superficial view that organization means only a list of positions to be filled; others sometimes have the idea that success in mining is not due to good management but to luck. That luck does play a good part in distributing the prizes of the mining business is undeniable, but it should be plain that it has no more to do with the proper administration of a mine than with the proper administration of anything else.



PART OF EUREKA PIT OF NEVADA CONSOLIDATED COPPER CO., ELY, NEV.

Efficiency Is Independent of Personalities

The question of efficiency in operating is quite distinct from the question of who is to be benefitted by that efficiency. We must begin by making it plain that the efficient management of a property as understood in this article relates only to getting out and disposing of the products with as little effort as possible. The emoluments that come from doing this may be so distributed as to leave many of the persons interested highly discontended, feeling that somebody is getting too much or too little of the proceeds of the industry, even though the work itself may be going on in the best possible manner. On the other hand, some individual may make a great personal gain out of a badly managed business.

Industrial efficiency means securing the maximum result from each effort and the elimination of unnecessary effort. Further, it means hitting the mark—making the organization do what it is designed to do—no more, because that costs too much; no less, because that would be a failure.

The mark to be hit by the business organization is profit. In a technical sense it is easy to conceive of an organization being highly developed to do something for which there is no commercial demand. I suppose mere scientific effort, however well directed—as, for instance, the effort of an astronomical observatory to find new stars—can hardly be called business. A mine is a purely business concern carried on with the sole object of making money. The best management—good morals and fair dealing being taken for granted—is the one that will make the most money for the stockholders.

The fire of efficiency is fanned by competition, but the management of many mining concerns is protected from competition by the nature of the enterprise. The deposit may be rich enough to pay whether it is properly worked or not, and when the profits are good the management is usually conceded to be good. This is a handicap to the managers of such properties. The proof of this is that the leading spirits of great mining concerns have usually been trained not in the management of rich mines but in the highly competitive smelting or manufacturing fields connected with mining.

*Mining engineer, 52 William St., New York.

The mining [illegible] comprises the following elements:

1. The determination of how big a field there is for the enterprise. This means usually how much ore can be counted on and how long it will take to get it out advantageously and market it.

2. How to do this work.

3. How to finance and promote the work.

These elements could be elaborated into an infinity of detail, but for the present purposes it seems best to state them this way merely to define the broad requirements which underlie the organization of mining enterprises. With this object in view let us dwell a little upon these elements.

The determination of the scope of an enterprise proceeds from information. This information comes broadly into three groups—(1) the local facts about the occurrence and development of the ore, the area of property available, the climate, facilities for transportation, labor, supplies, politics, etc.; (2) the geological situation; (3) the commercial situation—that is, knowledge of markets for the products to be dealt with.

Part of this information can and should be exact, namely, the first group. The second and third groups of information yield conclusions in the form of intelligent guesses or approximations. No one should conclude that because geological and commercial conclusions have an element of guesswork that they are therefore unimportant. Quite the contrary. For the very reason that it is impossible to see accurately through the ground or into the future it is all the more important to draw sane inferences from ascertained geological facts and from the facts of the commercial past. Just as the statesman and lawgiver would be a dangerous man if he did not know the history of nations and laws; just as the doctor would be a quack if he did not know the history of cases; so the promoter of a mining enterprise is a dangerous man if he is not acquainted with the history of mines.

It is very seldom indeed that the true measure of a mine's possibilities can be taken from the ore actually developed at the time the enterprise is launched. The development work generally keeps ahead of the extraction of ore only by a little more than the necessary margin of preparation. This fact is less sweepingly true now than it was a decade ago, and less true of low-grade deposits than of richer ones, for great progress has been made in testing mineralized areas and also in using good geology as an aid in the work of exploration. But it is unquestionable that the exploration of deposits to insure supplies of ore is in itself an important part of the conduct of the enterprise, and the wisdom of such exploration must be based upon geological inference.

Details of Operation and Finance

The actual work of mining involves all sorts of engineering—civil, mechanical, electrical, chemical, and metallurgical; the employment and discipline of labor; sanitation; transportation and the keeping of records. But the scale on which all this is to be done and the steps to be taken must be based upon the interpretation of the information already referred to. This is just as true whether the enterprise grows insensibly from a small beginning or whether it is launched suddenly as a great enterprise.

It is essential that the finances be accurately coördinated with the scale of operations. Too much money employed as capital means wasted power, the unnecessary use of resources. Too little capital means deficient operating power and may cause great losses through sheer failure to accomplish the required result. For instance, a capital limited to $1,000,000 used to start the Utah Copper Co. would have been all wasted, because the amount required to make that vast low-grade deposit pay was at least $5,000,000.

As in the case of operating, already discussed, it makes no difference in the importance of finance whether a concern grows gradually or suddenly, or whether it is owned by an individual or by a corporation, or whether it is large or small. Business involves the use of money whether that money is diverted from earnings, whether it is borrowed, or whether it is obtained from popular subscription. The financial guidance of an enterprise is just as important as its technical guidance; in fact, it underlies and empowers the technical guidance.

Futility of Unbalanced Efficiency

I have discussed the fundamental and more or less self-evident factors in order to illustrate what fields of accomplishment and training must be covered by the personnel of a mine organization, and also, if possible, to prevent persons interested in one department of the business getting a wrong idea of the importance of the other departments of it. I feel that it is so important to get these things right that it is worth while to risk repetition in laying stress on the axioms that knowledge of the physical characteristics of mines and markets will fail to reach its maximum usefulness unless it is backed up by the proper technical and operating equipment and efficiency; that, on the other hand, the technical scheme, however capable in itself, cannot deliver the proper results unless it is gaged to meet the true capabilities of the mine and its markets; and further, that commercial efficiency is out of the question unless the scheme is in tune with good finance.

The first requirement of a mine organization is that these facts shall be recognized by the owners. The basic element of efficient management therefore is efficient ownership. A substitute for ownership may be an efficient control of the stock. But after all, what security is there that the control of a corporation will stay in good hands unless the stockholders know how to see that it does?

I am inclined to think that the importance of good ownership is often overlooked by technical men and employees. It certainly is wasted effort to repair the superstructure when the foundation has given way. The secret of many a good enterprise going to seed lies in the deterioration of ownership. This is a fact that is thoroughly recognized by successful business men, whose first inquiry about an enterprise is not, "What is the property?" but, "Who are the people?"

It is of course out of the question to expect that every stockholder of a large corporation will be a good mining man, or even a good business man; but the average stockholder must know enough to put in control of the stock and of the board of directors a man, or group of men, who have the following qualifications: Honesty; sense to recognize good information about mines; good financial judgment; sense to recognize good technical, executive and commercial ability.

Assuming that an enterprise is conducted by a corporation, the cornerstone of actual management is a board of directors. While in the long run most of the work of a board is in a sense perfunctory, being habitually the indorsement of its officers, there can be no assurance whatever of good management unless it possesses the four qualifications just mentioned. A good board will probably depend on certain members to guide its judgment in certain special fields. The directors in general must be good business men; some members should be trained mining men, some trained technical men, and some trained financiers. This is the makeup of most of the boards of efficient and successful mining corporations. The more aggressive and successful a mining company is, the more decidedly has its board this kind of membership.

The idea that directors should be figureheads, if necessary, so long as they represent a certain amount of stock, generally means decadent management. A director is not necessarily a rich man. In strong concerns they are quite often distinguished employees, who contribute practical contact with the business and the interest that comes from the necessity of accomplishment. The idea that directorships should be mainly well-known names borrowed from famous financial institutions or be of social or official prominence arises generally from some need for advertisement, a need that should create suspicion.

The chief responsibility actually administered by the directors is that of finance. To them belongs the function of declaring dividends, or of authorizing loans. In this relation the importance of having a board which contains enough "mining men" to be fully alive to the peculiarities of mining is emphasized. The board must be able to understand the importance of changes shown in the development of the mines, to appreciate the need of caution when the signs point toward exhaustion, to gage the opportunities arising from favorable developments, to meet the requirements resulting from changes in the conditions of the mines, in the character of the ores and in metallurgical practice.

Duties of a President

I have been discussing the qualifications of the owners and their representatives in groups. The stockholders of mining concerns are usually many hundreds, sometimes many thousands, in number. The directors usually number from five to twenty-five. From now on I will consider individuals. Of these the most important is the president, who is the executive officer of the board. He is the central figure of the whole organization and represents both owners and employees. On the one hand, it is the president's business to exert upon the employees the authority and purposes of the owners; on the other hand, being generally an employee himself, he is bound to have to some extent the employees' point of view.

It is clear that the president's main function is to deal with people. In the case of large concerns where he must deal with thousands of stockholders and employees the job requires a decided faculty of leadership, which means insight into human nature, poise, calmness, energy and definite purpose. Technical qualifications fall into the background. Mining on a large scale approaches very closely other forms of business. The president of a large railroad system does not have to go into technical questions, but merely to deal with men who do. He forms his judgment not so much on what he knows of railroading as what he knows about men. A man who makes a success of railroading in this way could almost certainly run an equally large mining business acceptably.

The president's contact with the technical work increases as the scale of the business diminishes. In a small mine this office may become merely nominal. The president of a mining company employing only 50 men might very properly spend part of his time working underground as a miner. The division of labor is in proportion to the number employed in a given organization, and as this number diminishes, more and more functions are merged in the individual. This applies to workmen as well as officers. Just as the president of a small mining company may have to be financier, bookkeeper, manager, superintendent and foreman of his company, so the miner, who never sees the blacksmith-shop of a large property, may have to sharpen his drills as well as use them when he works in a small mine.

To create the greatest possible present value is the proper object of conducting the business. This is a point of view not easy to grasp fully or to reach, or adhere to. An abnormal exibition of low costs and large profits may be, and often is, made simply by suspending temporarily expenditures which must go on. It is also possible to take out, for a limited period, richer ore and more ore than a mine can average. So long as temporary profits are made abnormal only in the effort to obtain profits quickly, a proper object is gained by giving the stockholders the use of their profits sooner. But these temporary showings are often injurious to the property in both a physical and economic sense. Premature extraction of ores without adequate development is highly injurious by creating unnecessary dangers to men and losses of ore. Such premature mining often shows profits in such a manner as to produce a false impression of value.

Field of Technical Management

The responsibility for adhering to a broad scheme for obtaining the best results lies not with the technical management but with the president.

Among mining enterprises there is a great diversity of opinion as to what constitutes the main problem. Sometimes it is the maintenance of the ore supply by constant exploration; sometimes it is merely to secure low costs in the handling of large tonnages already assured; sometimes it is a struggle with metallurgical difficulties. But one general fact underlies practically all operations, namely, that results are obtained not through muscular activities of men, but by the intelligent use of mechanical units which men direct and of which men are parts. A certain bodily activity is of course necessary to manipulate properly the machines. While some work like shoveling is still propelled by men's muscles, the average man about a mining plant manipulates perhaps 10 hp. The proportion of mechanical as against human power is therefore several hundred to one, and the value of intelligent manipulation needs no further demonstration.

The responsibility for securing this intelligent manipulation lies with the manager. His aim is to produce the most profitable effect from his whole mechanical equipment; therefore he must see to it that each unit composing that equipment does its duty. To perform this

duty properly [illegible] must be worked as near to full capacity as [illegible] for otherwise men and power will be kept busy [illegible] at adequate result.

To accomplish this in mining requires energetic exercise of the sense of proportion, of constructive imagination, and of executive ability. The work in a mine is constantly shifting. A group of men and machines may be well occupied today in a certain stope, but tonight some change may develop which will permit only half the force to be occupied profitably there to-morrow. An exploring drift reaches its objective and that particular piece of work must be stopped; the time arrives when hand tramming is no longer either adequate or economical and mechanical tramming equipment must be installed; or, on the other hand, the supply of ore from a certain shaft has so fallen off that more equipment is in use than is justified by the output.

In any property of considerable size it is impossible for the manager to get into personal contact with all these details. It is necessary therefore to supplement his own activities with an organization so arranged as to keep him informed. Various organizers will call these departments by different names and approach their problems from different angles, but, broadly speaking, we may classify the manager's working force into two divisions:

1. The division of information, which will contain the map-makers, engineers and geologists, the samplers and assayers and the cost and record-keepers. This work is not inherently valuable; it is merely a means to an end. The manager must not make it the field of his own labors; its purpose is to add to his capacity to direct the productive work. It is of course important that this division should not be overdone.

2. The division of executives covering construction engineers and all the operating force.

Proper Supervision of Labor

The limits of this article will not permit much discussion of the various reports dealing with the supervision of labor; but I can briefly point out some of the essentials that must be covered. It is possible to gather the data collected by the division of information into a daily summary which will be at least approximately correct. This will show the following supremely important items:

1. The number of men employed and their distribution in whatever detail is desired.

2. The amount of product obtained from this labor, the quality of this product and the disposal of it.

These facts are decisive as to the efficiency of the job. The expenses of a company are invariably in proportion to the number of men employed. For instance, if at a given mine you employ 10,000 shifts of labor in a given month, and you find that your total expenses were $50,000, it is a mathematical certainty that next month when you employ 12,000 shifts your expenses will be $60,000. In other words, the expense involved in employing a man on the [illegible] ration is $5 per day. This figure once established [illegible] a short cut to your total expenditures which [illegible] at any moment.[1]

[1]The cost per man [illegible] not merely wages; it is the total expense of [illegible] power and administrative effort required [illegible] these items vary within such narrow limits that [illegible] approximate to speak of them as constant. In [illegible] these relations can only be disturbed by a radical [illegible] in the scale or method of operating such as are not [illegible] in these remarks.

The degree to which the manager can digest the details of labor will vary according to the size of the property, or in proportion to the number of superintendents he employs. On a small property the manager is his own superintendent, but on a large one he will have to restrict his observations to larger units, delegating the daily supervision to superintendents of particular fields. Each superintendent must watch his field of operations exactly as a manager does, the only difference being that instead of covering the whole property he only covers a part of it; that he deals with smaller units and has a more intimate contact with the men and products of his special field.

Constant Supervision of Products

Just as a proper record of the employment of labor gives a clear idea of daily expenses, a similar record of the product obtained gives an immediate line on the daily income. One is just as important as the other, but the supervision of product is more difficult and less exact. It involves correct weighing, sampling and assaying—three steps, each apparently simple but really very difficult. While the labor record involves no equipment except paper and pencil, it is not too much to say that the basis for proper accounting of the product lies deep in the design of the plant and the training of the whole technical organization. Proof of this is the care with which these subjects are elaborated in technical mining literature. I limit my observations simply to pointing out where they belong in the business scheme. A realization of the true importance of the supervision of products is the prime technical qualification of a mine manager. Without it he can have no effective engineering point of view and will have to depend on guesswork and rule of thumb.

To get maximum profits it is necessary to work out the following points: What volume and grade of ore extracted daily will cover the total expenses of the company? What grade will cover the cost of mining and smelting, but not necessarily the general and outside expenses? What ores, too low in grade to be a true object of mining, may yet profitably be treated if obtained in the process of development? Which ores should be sent directly to the smelter and which should be concentrated or otherwise treated at the mine or mill? What are the metallurgical losses of all processes, and the extent to which they may be curtailed profitably?

By balancing these factors against one another and against the cost of constructing and operating the necessary plants, the manager finally works out the number of steps of his process and the logical and most economic cost. This cost will naturally be as low as possible in proportion to the money received for the product sold; but a little reflection will show that this is not necessarily the lowest cost per ton of material handled in any department.

This problem is present at all mines. The coal or iron miner who deals with a homogeneous material may find it much easier to solve than the miner of complex ores of precious metals; but it is there just the same, and the intelligent manager will always recognize it.

It is a frequent mistake to suppose that the important facts are revealed by the cost-keeping or accounting system. This is emphatically not the case. A thorough accounting of a month's operations cannot be prepared

before the middle of the following month. This means that the acts of which it is a record are from two weeks to seven weeks old before the record appears. If a manager waited that long before taking action on the changes which develop from day to day he would make himself ridiculous. It is infinitely more to the point to have daily facts presented in usable form, even though some of the information is only approximate.

A discussion of accounting may conveniently follow the preceding remarks because it is important to combat a frequent misunderstanding of its true value. Accounting is not management. Broadly speaking, it is not a function of the technical management at all, but is a function of the board of directors, which should be administered by the financial officer of that body—the treasurer—who is frequently also the recording officer, the secretary. These officers are subordinate to the president, but they are quite distinct from the technical manager, who deals with only a portion of the business. It is the duty of these officers to account to the stockholders and creditors of the concern for the income and outgo of funds and properties. But we should bear in mind a broad distinction between company accounting, which is the business of the treasurer for the benefit of the stockholders and creditors, and department accounting, or cost-keeping, which is essentially a record of efficiency for the benefit of the work itself.

In either department the usefulness of the accounting depends entirely upon how effectively it presents the vital facts. Elaboration of detail where not needed is mere pedantry, which instead of serving the true purpose of accounting helps to defeat it. Simplicity and brevity of statement should be the aim. The figures of a cost statement may be likened to the topography of the country. When you find a vantage point you can see the lay of the land. A man in the cañons at the foot of Pike's Peak might lose himself looking for the summit, but if he walks out on the plain he can see it easily. Likewise in business, the man who wants to know where he is going refuses to bury himself in a maze of figures. He tries to keep before himself the general outline of his problem in order that when he plunges into detail he may still not forget the relative size of things.

Unit Costs as Operation Guides

In the general accounting of a company's business all figures are stated necessarily in money. But in cost-keeping or department accounting an eye should be kept not only on money values but also upon the things which the money represents. The work is done by labor aided by mechanical power, by explosives, by timber, tools and other supplies. The efficiency of the job is exhibited even more decisively when shown in terms of these elements than when shown in dollars and cents. For instance, Nevada Consolidated Copper Co. reports that the average amount loaded per steam-shovel shift is 1472 tons, but that the maximum loaded was 6784 tons. The average time each shovel was actually at work was only 30% of the working day. It is plain that their operation is frequently interrupted and that efficient operation has much to do with minimizing those interruptions. The manager may have found that the cost of increasing the working time of the steam shovel would be too great to justify it. While he might increase the output per steam shovel, he might decrease the output per man. He would then lose money. But if he can increase his output per shovel by increasing his concurrent cost in less proportion, he will gain. We have thus reasoned back to the conclusion that the work of the steam shovel is not the decisive criterion of efficiency, unless we include with it everything needed to make its work complete.

Lowest Costs Per Man Not Always Best

To illustrate this let us take the whole situation just outlined. Nevada Consolidated employs 611 men all told and eight steam shovels working two shifts each. The number of men actually attached to each shovel is only about 17 for both shifts, and it burns 5.7 tons coal per day. With labor at $4 per day and coal at $5 per ton the cost of the steam shovel is about $100 per day, and its output is 2942 tons for the two shifts. But the total number of men employed is 611 and the cost is, say $3055, or $5 per man. Eight steam shovels are employed, the total output being 23,852 tons. Suppose we employ another steam shovel and get half as much from it as we get from the others. We have increased our cost by $100 a day and our tonnage by 1472. The total number of men is now 628 and the total cost $3155. The cost per man is now $5.02 per day, which is very close to what it was before. But the output has risen from 23,852 tons to 25,324 tons. Per man it has risen from 39.04 to 40.32. The difference does not appear to be great in either cost or output, but proportionately it is, for with an increase in cost per man less than 0.5%, the output per man has increased over 3%. Thus the increase of output is about seven times the increase of cost. Let it be remembered that in doing this we are decreasing the averaging efficiency of the steam shovels. This indicates that the cost per man is much more stable than the cost per shovel.

Now, applying this discussion to the cost-keeping problem, we come straight back to the vital importance of making the statements indicate the decisive facts which prove efficiency. What these facts are needs to be worked out for each property. I have found it beyond my powers to make a general statement that will apply everywhere. While it is true that the output per man is a most important figure, it is equally true that it must be applied only when modifying factors are clearly understood, and then only to the proper units. It has been shown that a mistake would have been made in assuming that a steam shovel taken by itself must be run at full capacity, regardless of other things. The fact is, however, that instead of bringing in the full normal equipment that goes with a steam shovel we only brought in a part of it. The eight shovels employed 611 men, or 76 each; but with nine shovels we only had 628 men, or 70 each. The point brought out was that the machine itself is relatively unimportant so long as it does not alter the normal scheme of things. In keeping the cost of operating that shovel it would be a great mistake to rivet attention on the engineers, cranemen, and firemen, and the amount of coal it burns and the supplies it uses. The real unit is the shovel combined with the locomotives, tracks, cars, railroad and dumping facilities. The force required to operate such a unit night and day is generally 75 to 100 men, and not the 15 or 20 men working on or about the shovel. When this fact is got straight the true unit cost is made effective.

It is an axiom that each operating unit should be worked as nearly as possible to its full capacity. The converse is that where the output is limited at some point—as, for instance, by the capacity of a mill—the units required to supply that output should be cut down to the smallest possible number. A shaft is such a unit. The cost of a shaft and the maintenance of its hoisting, hauling, pumping, lighting and compressed-air equipment, its railroad trackage, shaft houses and shipping equipment mean a large amount of fixed expense. Whenever it is found that a number of such shafts can produce more than the required output, economy demands that some of them should be ruthlessly shut down in spite of the apparent waste. The truth in such a situation is that capital has been wasted in providing unnecessary equipment, but that is no excuse for wasting still more money to operate it. How often situations of this kind arise it is hard to say. One example is found in some mines in Southeast Missouri, where a few years ago 24 shafts were used to supply 2,300,000 tons a year. Now eleven of the same shafts supply 3,200,000 tons a year. Thirteen shafts with abundant ore reserves are rotting and rusting at a saving of possibly $1,000,000 a year.

Estimation of Major and Minor Units

In the whole process of organization there are controlling limitations. The company itself is limited in its activities by its capital and its opportunities. Its properties are each limited in some way—the output of a mine by either its own capacity to produce or by the capacity of a mill or smelter or market. These limitations are extremely important in calculating the size and number of concomitant units. Minor units make up major ones, and the effectiveness of each within its sphere becomes highly important once that sphere is established. There is a certain subtlety about these distinctions that is worth dwelling upon.

The cost of power, for instance, is an important thing in a mining property, but its unit cost is capable of being misapplied. The power plant properly should deliver the minimum output required for the work. The proper aim is not cheap horsepower but cheap work. In one case a plant was supplying compressed air and electric power at a cost of 1c. per kw.-hr., while its neighbors were making power at 1.25c. per kw-hr. But at this plant the cost of power per ton of ore was 45c. and at its neighbors' only 25c. The superintendent was astounded when brought to task for his high power costs, pointing to his low cost per hour. The fact was that the power was being wasted. Efficiency at the engines did not excuse leaky pipes, scattered and inefficient pumps, and machinery used where it was not needed. Accounting, with the emphasis on the wrong point, was exhibiting a false economy, which was costing the company in reality $80,000 a year.

But the mere fact that the kilowatt-hour is a minor unit does not destroy its importance. It is important to make cheap power, but the supply must be limited to the requirement. Any additional power made is a waste, no matter how cheap it is.

It would be a false economy, likewise, in order to show a low consumption of drill supplies, to let them run in bad repair, or, in order to show a low consumption of compressed air per drill, to use more machines than necessary and let them stand idle part of the time. The true result to be reached is cheap ore breaking and not cheap supplies or cheap air per drill. That fact, however, does not in the least argue against economy in both these items—economy rightly applied to its proper unit.

Big Things vs. Little Things

The argument leads to one principle that should underlie effective organization, namely, that big objects take precedence over little ones. It is a theory with some people that if you "take care of little things the big things will take care of themselves." This is like starting in to make an automobile by first making the screws and bolts. It is an utterly illogical and ineffective theory. The first essential of an automobile is a design—some plan by which a vehicle can be made to serve a certain purpose, have a certain appearance and attain certain speed. This design involves the use of definite mechanical principles which must be satisfied by the creation of essential mechanical entities—the motor, running gears, wheelbase, etc. The mass of detail work which follows must be adapted to the essential scheme and grow out of satisfying the needs of that scheme. Success depends on the nicety and intelligence with which the details are worked out. A lot of work can be put on the paint, but the paint is not wholly essential. It is well to remember that the car will go just as fast and ride just as easily whether the paint is black or white. But when the car is sold the color of the paint may decide the buyer for or against the whole car, and may therefore determine its commercial success or failure. Some people will argue that this proves the vital importance of this small detail. But the manufacturer is entitled to answer: "Our design is to create a car that will sell; we are merchants as well as engineers. To please our customers is a prime essential; the color of the paint is a trivialty. Our customers cannot decide fundamentals of construction, but on this point their judgment is controlling. By our theory of doing business we are bound to accept their decision."

Thus the question is decided not in the least by virtue of minute detail in itself but by the application of a cardinal principle. The true organizer will neither disparage nor overlook details, but he will be their master and not their slave. He will not love them for their own sake, but will use them to further his plans.

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North Carolina Metal Output

North Carolina easily retained first rank in gold output among the Eastern or Appalachian States in 1914, the yield having been the second largest in the last 10 years. The total production of gold in 1914 amounted to 6343.94 fine ounces, according to the Geological Survey, the value of which was $131,141.

The gold was obtained from 12 placers and 9 deep mines, but several of the mines made a very small production. The largest producing placer was the Bigger-staff, in Rutherford County. The Iola mine, in Montgomery County, had the largest yield of gold from deep mining. Other mines which contributed an appreciable part of the gold output were the Rich Cog and Uwarra mines, in Montgomery County; the Gold Hill, in Rowan County; and the Howie, in Union County.

The silver output of North Carolina, recovered as a by-product from gold milling, was 1524 fine ounces, valued at $843, against 1812 fine ounces, valued at $1095 in 1913. The copper production in 1914 was 20,434 lb., valued at $2718.

Piegan-Gloster Cyanide Mill

By Alexander McLaren*

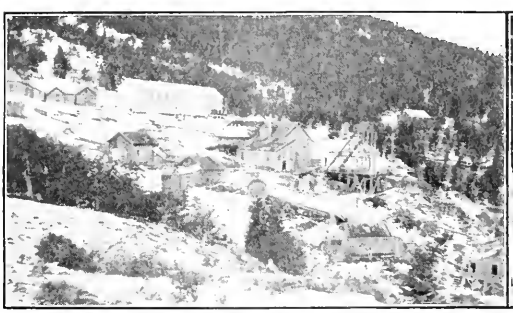
The Piegan-Gloster, of Marysville, Mont., is one of the many gold properties characteristic of those old mining camps which, after years of idleness, are once more experiencing activity because of the more economical and efficient methods of mining, milling and cyanidation of the present day. This property is situated about three miles from Marysville, Mont., and is owned by the Barnes King Development Co. The ore is delivered to the mill from the mine over 1400 ft. of Riblet two-bucket aërial tramway, dumping into a receiving bin on the same level as the mill bins. From this the ore is fed to a No. 5, T. L. Smith short-head (gyratory) primary crusher by a belt conveyor. This crusher breaks from mine-run down to approximately 1¼-in. ring and the ore is then elevated by a continuous-bucket elevator to an automatic sampler at the bin head, then by a distributing belt conveyor to the main or mill bin.

From the mill bin the ore is fed to three Lane slow-speed chilean mills by Stephens-Adamson automatic belt feeders. The mills are 10 ft. in diameter and each one handles approximately 50 tons of ore per 24 hr., performing the crushing in cyanide solution. It may be said that the ore is slightly harder than the average quartz. A 6-in. overflow discharge is used with a strip of ordinary fly screen to withhold the chips and prevent clogging the pulp pipes. The consistency of the pulp is 4½ parts of solution to 1 of solids. The combined output of the three Lane mills is carried by launder to a Wilfley roughing table, the concentrated output of which drops to a Wilfley finishing table. The product is a black sand with some coarse gold, and is treated by amalgamation in a cleanup pan. The overflow from both the roughing and finishing table goes to an Akins classifier for further separation.

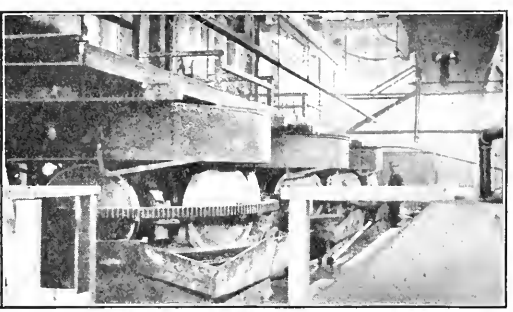
The sands proceed to one of a series of leaching tanks, 10 ft. staves and 26 ft. in diameter, the unloading of which, after treatment, is performed by flushing. The slimes are taken to a 24-ft. Dorr thickener, 7 ft. deep, from which the thickened pulp is transferred by diaphragm pump to one of a series of Dorr agitators 16 ft. diameter by 14 ft. deep. These agitators are not connected in series, the charge method being used. Overflow solution, prior to going to zinc boxes, is filtered in two small tanks through a layer of sand. Zinc shavings are used as precipitant.

One 40-hp. motor drives three Lane mills, two concentrators, one Akins classifier and the pulp distributor for the leaching tanks. In this mill, after considerable experiment on the part of the management, the slow-speed chilean mill has been found far superior to the stamps formerly used. The advantages are less wear and tear; less power consumed per ton of output; a pulp better adapted to cyanidation and water consumption nearly 80% less than that required by stamps for crushing. Less operating vigilance is required.

*Litchfield, Conn.



PIEGAN-GLOSTER PLANT, MARYSVILLE, MONT.



CRUSHING INSTALLATION OF LANE MILLS

Rescinding Purchases of Mining Property

By A. L. H. Street*

Under a decision of the Kansas City Court of Appeals, a purchaser of mining property cannot rescind the transaction on account of misrepresentations made by the seller to the purchaser's agent concerning the character of the property, if the agent was not deceived by such misrepresentations or did not rely upon them. The court says: "Applying the rule that an attempt fraudulently to deceive must be so far successful as to have induced belief and reliance on the part of the person claiming to have been injured, we find that plaintiff's case failed."

It is further held, in the same opinion, that one induced by fraud to enter into such a contract must promptly elect to rescind on discovering the fraud, or his right to cancel the purchase will be deemed to have been waived. (Greenstreet vs. Walsch, 176 Southwestern Reporter, 1062.)

Exposition of American Chemical Industries—The first American exposition of chemical industries will be held at Grand Central Palace, New York City, during the week beginning Sept. 20, 1915. It is to be managed by C. F. Roth and A. Nagelvoort, assisted by an advisory committee of nine eminent chemical engineers. It is expected to include coal, wood and petroleum products, metals, minerals, water and sewage purification, air and gas processes, glass and ceramics, oils, varnishes, plastics, rubber, leather, glue, etc. Working exhibits will be shown. Inquiries should be directed to the National Exposition of Chemical Industries, 46th St. and Lexington Ave., New York City.

*Attorney, St. Paul, Minn.

Orebodies of the Mesabi Range—III

By J. F. Wolff*

SYNOPSIS—Methods of exploring Mesabi orebodies. Combination diamond-churn drill outfit used. Holes spotted on definite systems. Continuation and extent of drilling based on results obtained as work progresses. Vertical sections constructed through lines of drill holes. Correlation of beds cut by the several holes. Division into layers and connecting between holes. Precautions to be observed.

The first explorations in the Mesabi district were carried on by test pits. The depth of these was limited to the level of the groundwater. In several cases where test-pitting developed a fairly large body of ore, shafts were sunk and the orebody developed more completely both in depth and laterally by underground workings. Several bodies explored by test pits were developed as openpits, having shafts and a few drifts and crosscuts for drainage purposes. In the middle '90s diamond and churn drills were introduced for exploration work and have been used for such work ever since. Some mining companies do their own exploration work, but a great deal of contract work is done also. Although such work is expensive, the total cost in any extensive explorations is but a few cents per ton of ore developed, this includes drilling on barren properties. As will be shown later, the drilling is so thorough and systematic that the shape and extent of the orebody are determined with extreme accuracy. Obviously such information is invaluable in the proper planning of development work, whether openpit or underground. It will be shown here how to interpret drill explorations properly, and how to work out the shape of the orebody closely from such records.

The drilling outfit will be described, as it is well known to most mining [illegible] detailed description of both outfit and drilling operations in the University of Minnesota bulletin mentioned in Part I. The accompanying illustration, Fig. 21, is a good view of the ordinary Mesabi drill outfit.

A brief account of drilling operations is appropriate, as they must be considered in interpreting drill records. A 3-in. casing pipe is first driven down through the glacial drift, locally called "surface." The drift is full of boulders of all sizes, which are blasted when encountered or are drilled through with diamonds and then blasted. Before blasting, the casing pipe is pulled up a few feet to prevent its bottom from being broken by the blast. The surface is churn-drilled and washed up out of the casing pipe after every few feet of advance of the casing. A 200- to 300-lb. cylindrical weight is used as a drop hammer to drive down the casing pipe. When the ore is encountered, the casing is driven down into it a few inches so that the surface material will not run down under the end of the pipe and become mixed with the ore sample. A 2-in. casing pipe is then put down inside the 3-in. and churning proceeds in the ore just as in the surface. Samples of the ore are taken for intervals of 5 ft. as the drilling proceeds, unless rock is encountered, in

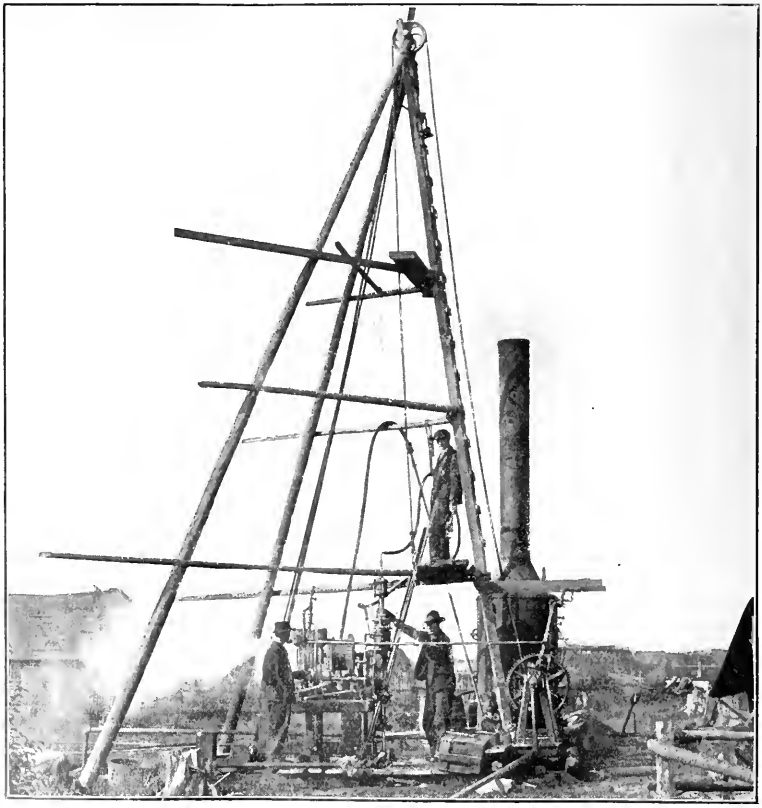


FIG. 21. STANDARD MESABI DRILLING OUTFIT

*Mining engineer, Oliver Iron Mining Co., Duluth, Minn.

which ease the drill runner attempts to chop and blast through the rock. Often the rock is only a thin seam and can be cut through with a chopping bit, but if it proves to be a thick layer of taconite the chopping bit is taken off and the diamond bit put on. Then diamond drilling proceeds until ore is again encountered or until the engineer in charge of explorations decides the hole is deep enough. If more than 5 ft. of ore is encountered under the taconite, the entire depth of the taconite is blasted so that the easing pipe can be driven down through it to the ore beneath. This operation is known as blasting down easing. After the casing has been driven down to the ore under the taconite, churn drilling proceeds as before until the bottom of the ore is reached. The depth to which drilling in taconite is carried depends entirely upon geological conditions, depth of ore in adjacent holes or depth of nearby orebodies, except in case of special contracts or leases in which a specific depth in taconite is provided.

Samples Taken for Each Five Feet

In taking samples of the ore, the choppings or sludge for each 5-ft. sample is caught in three or more barrels as it is washed up through the casing pipe and is allowed to settle for two hours, after which the water is drained off and the settlings collected in a pan and dried. The sample is then divided into a number of parts to provide samples for the mining company, the fee owners, etc. These are sent to the laboratory and analyses of the material dried at 212° F. are generally made for iron, phosphorus and silica, and by some companies for manganese and alumina. Pieces of the core from that part of the lode which was diamond-drilled are saved also. The different mining companies have different methods of preserving samples, some using paper bags, some glass bottles and some specially constructed tin boxes which can be packed or filed away easily. The drill runners make reports of the material encountered to the director of explorations, generally an engineer, giving also the depth of material diamond-drilled. The chemical determinations of all samples are also reported to the exploration chief. The actual samples, choppings and core are examined by him and the material classified as to its character, whether ore, taconite and ore, paint-rock, taconite, slate, quartzite, etc. He also checks the depth of diamond drilling reported by the drill runner. From this information, that is, chemical determinations and physical classification, the record of the drill hole is platted on tracings together with records of all other drill holes on the forty.

Location of Drill Holes

The unit of ownership is a 40-acre tract, therefore the unit of exploration is generally a 40-acre tract. Before drilling is started on any property a system of drill holes is laid out on a map of the property and then staked out on the ground. Different systems are in use by different companies and each has its advantages and its adherents. No one system can be prescribed as the best for all parts of the range. The more irregular and rocky orebodies require more closely spaced drill holes. In some of the early explorations drill holes were spaced 150 to 200 ft. apart. In many cases no regular system of spacing drill holes was followed. The system most widely used at the present time and for some years past is to spot drill holes at intersections of north-south and east-west lines 300 ft. apart, giving five rows of holes each way or a total of 25 drill holes per 10-acre tract. If the property adjoins an ore-bearing property so that something is known of the possible position of an orebody the drilling is started in that part of the forty where the orebody is suspected. If nothing is known as to the probable existence of ore on the property at least five of the 25 holes are drilled. One of these holes, the one nearest the outcrop of the quartzite is drilled through the iron formation to quartzite. If no ore is encountered in any of these holes the exploration is discontinued temporarily. If the mining company controls the surrounding properties and upon exploring them finds ore near the property lines of this property in question, exploration is resumed on the abandoned property. If ore is encountered in one or more of the five drill holes which were drilled first, others of the 25 locations on the forty are drilled and the explorations are continued until the outline of the orebody is well established. The engineer in charge of explorations studies the results of the drilling carefully as it progresses and if he considers it

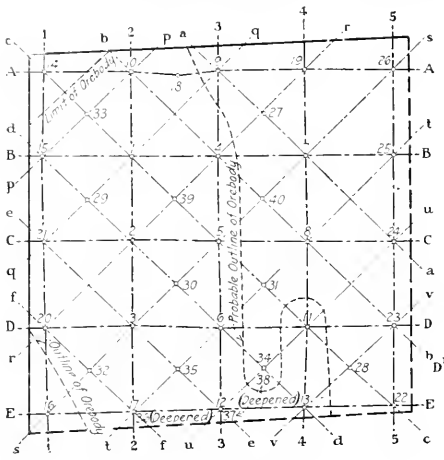


FIG. 22. TYPICAL EXPLORATION OF FORTY-ACRE TRACT

necessary, for determining either the depth of the ore or the outline of the orebody, holes intermediate between these 25 locations are put down. Even in cases where the orebody covers the whole 40-acre tract it is not always necessary to drill all of these intermediate holes. A close study of the structure of the orebody by the engineer determines the necessity of these holes. However, if all of these intermediate holes are drilled the distance between drill holes will be 212 ft. This may seem to be excessive exploration, but experience has proved that drill holes even 200 ft. apart are not too close. In many instances rock horses have been found in the orebody within a few feet of a drill hole and none of the drill holes showed any rock intrusions.

The system of drilling only five holes and abandoning the property if these show no ore is not universally used, nor is it to be recommended as the best practice, because small narrow bodies might occur between such drill holes. As a rule, at least 10 of the 25 locations ought to be drilled before abandoning the property. This of course depends much on the position of the property and is applicable particularly to properties near the center of the iron-formation outcrop or north of it. For those proper

ties near the Virginia slate five barren holes is a reasonable test.

As the drilling progresses sections are prepared to a convenient scale (40 ft. or 50 ft. to the inch) looking north and looking west. Thus there will be five east-west and five north-south sections showing the 25 holes originally laid out. If the intermediate holes are drilled, additional sections are made, looking northeast and northwest, giving two sets of diagonal sections, and the east-west and north-south sections are discarded, except such of them as may have drill-holes not shown on the diagonal

LEGEND OF FORMATIONS OF OREBODY CROSS-SECTIONS

B.O.	Blue ore	O.	Ore
B.T.	Broken taconite	P.Q.	Pokegama quartzite
C.	Conglomerate	P.R.	Paint-rock
Cret.	Cretaceous	P.R.L.	Paint-rock layer
C.S.	Cretaceous shale	P.R.O.	Paint-rock ore
C.T.	Cherty taconite	Q.	Quartzite
D.S.	Decomposed slate	S.	Slate
D.T.	Decomposed taconite	S.T.	Slaty taconite
G.	Greenstone	T.	Taconite
G.D.	Glacial drift	T. & O.	Taconite and ore
H.G.O.	High-grade ore	U.H.G.O.	Upper high-grade ore
I.P.R.L.	Intermediate paint-rock layer	U.N.L.	Upper nonbessemer layer
I.S.L.	Intermediate slate layer	U.N.O.	Upper nonbessemer ore
L.B.O.	Lower blue ore	U.S.& C.T.	Upper slaty and cherty taconite
L.C.T.	Lower cherty taconite	U.S.T.	Upper slaty taconite
L.H.G.O.	Lower high-grade ore	U.Y.O.	Upper yellow ore
L.H.S.	Lower Huronian slate	U.Y.T.	Upper yellow taconite
L.N.O.	Lower nonbessemer ore	V.S.	Virginia slate
L.O.	Lean ore (40%–49% iron)	W.O.	Wash ore
L.Y.O.	Lower yellow ore	Y.O.	Yellow ore
L.Y.T.	Lower yellow taconite	Y.T.	Yellow taconite
		U.B.O.	Upper blue ore

sections, such as a section along A.A, Fig. 22. Positions of drill holes and of sections are shown on the plat of Fig. 22, which represents a 40-acre tract explored as just described. From a study of these intersecting sets of sections an accurate knowledge of the shape, extent and structure of the orebody can be obtained.

In making a section the drill holes are platted in their proper relative locations and elevations, the latter data having been obtained previously by field engineers. The elevation of Lake Superior is the common datum plane generally used by many of the mining companies. Some companies use sea-level datum. Opposite each drill hole on the section are recorded all analyses and the classification of material. Fig. 23 shows an actual section of an orebody as developed by drill records. The chemical analyses and classification of material are shown. With the drill records thus made into sections, the structure of the orebody is worked out. Two general divisions of ore material are made. Churn-drilled material analyzing below 49% or 50% dry iron is classed as lean ore. Churn-drilled material analyzing above 49% or 50% dry iron is classed as standard ore. This, however, does not mean merchantable ore. The standard ore is further subdivided into bessemer and nonbessemer. The criterion for bessemer ore is not absolutely rigid with all companies, but an ore in which the ratio of phosphorus to iron is 0.00075 to 0.00080 is classed as bessemer; 55% natural iron, equivalent to an ore carrying 62.50% dried iron and 12% moisture, with 0.045% phosphorus, is the market standard or base for iron in the bessemer class. Of course ores somewhat lower than this in iron are sold as bessemer in the market. Most engineers in the district have been in the habit of working out the structure of the ore by joining up ore layers of similar classification lying approximately in the same horizon in the orebody and connecting the bottoms of the ore in adjacent holes either with straight lines or with regular curves. In many cases this procedure is approximately correct, but in others it leads to erroneous results.

The following description will outline the most recent and accurate method for determining the structure of an orebody. Having at hand all the cross-sections, the engineer examines the cuttings and core samples of each drill hole and divides up the entire hole into the different structural layers as shown by the sections in Parts I and II. These layers are upper blue or high-grade ore, upper yellow, nonbessemer, ore, intermediate paint-rock layer,

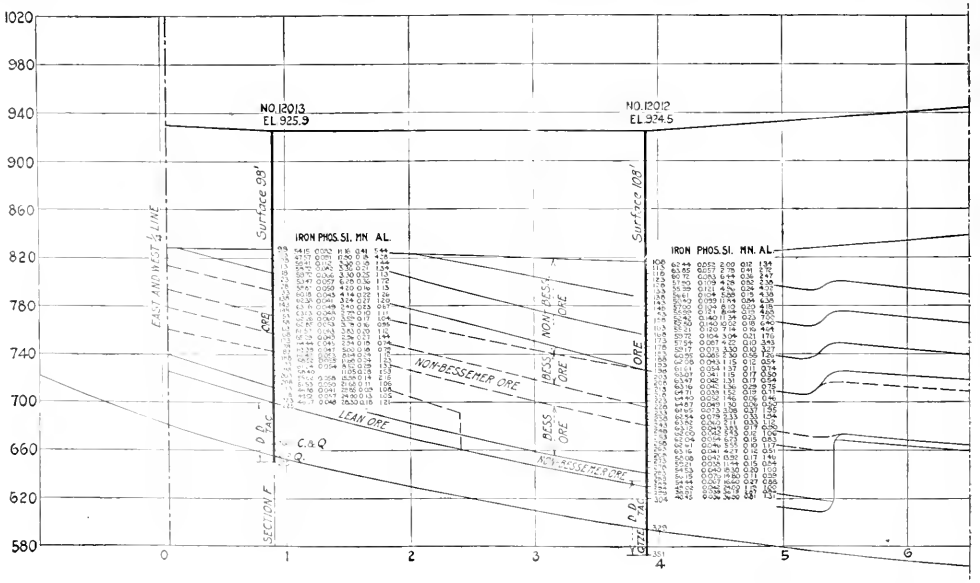


FIG. 23. SECTION OF A DEVELOPED OREBODY

lower yellow, nonbessemer, ore and lower blue or high-grade ore. The high-grade ores are generally high in iron, though not always so, and generally low in phosphorous, though not always bessemer ore. In making this division, all the drill samples, choppings and core, from a hole are laid out in order on a long table and divisions made largely from physical appearance. The paint-rock is characteristically reddish and the yellow layers are yellow. The chemical analyses help considerably in this classification also. The paint-rock layer generally is noticeably high in phosphorus and alumina, the phosphorus ranging from 0.075% to 0.300% and the alumina from 4% to 8 or 10%. The break between lower yellow ore and lower blue ore usually is marked by a sharp drop in both phosphorus and alumina, the blue ore being the lower in both elements. The division between upper yellow and upper blue ores is marked best by a drop in phosphorous, the blue ore having the lower phosphorus. This division is not so universal as in the lower orebody. The alumina in the two layers is about the same. Of course exceptions to these general statements are not uncommon.

The descriptive terms, high-grade ore, blue ore and yellow ore should not be taken literally. In the yellow-ore layers considerable red or purplish paint-rock material may occur; in the intermediate paint-rock layer, which is usually of reddish appearance, layers of yellow ocher occur, and in the high-grade or blue bodies there are found layers of paint-rock and brown ore. The terms blue ore, yellow ore and paint-rock are here used simply to describe structural layers. This division into layers is not always easy to make, but as stated in Part I the division between intermediate paint-rock layer and lower yellow ore is sharp and always can be made easily. In fact the experienced engineer usually can pick this division from the chemical analyses and classification of material. The upper 5 to 15 ft. of the lower yellow layer, just below the paint-rock layer, frequently is sandy ore or decomposed taconite. On the Western Mesabi it is almost pure sand. In any well-concentrated orebody drill holes can be found which can be divided accurately into the aforementioned layers, and will give the average thicknesses of the respective layers. With such data as a guide the other drill holes can be divided into the several layers, and such classification can be carried out even in the holes drilled in barren rock. In some well-concentrated orebodies further subdivisions can be made. The lower blue body can be divided into a bottom body of decidedly blue ore and

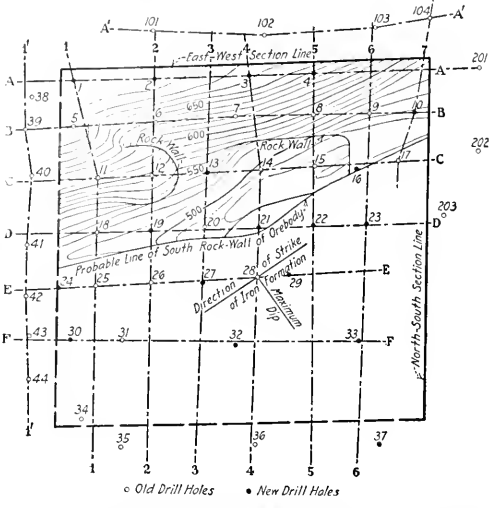
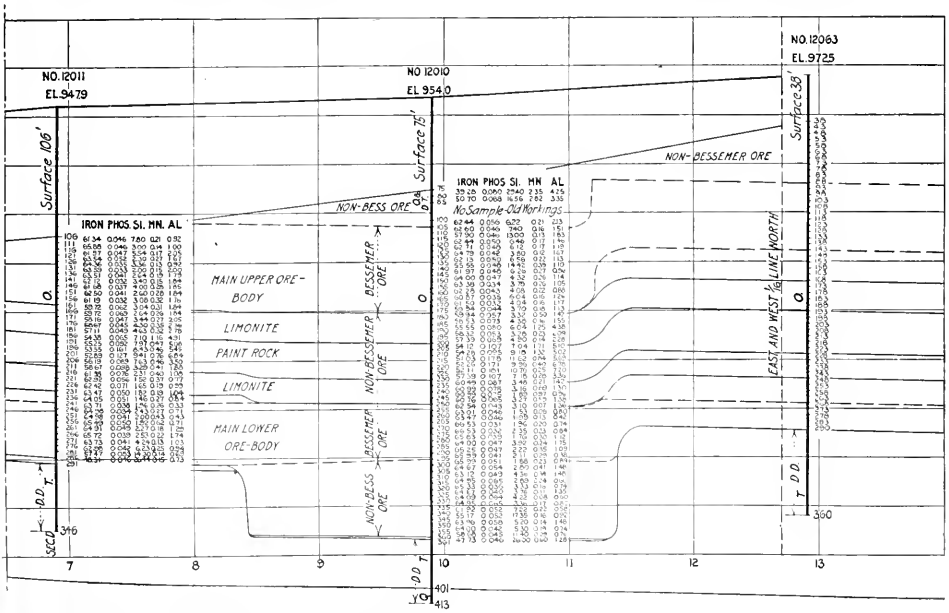
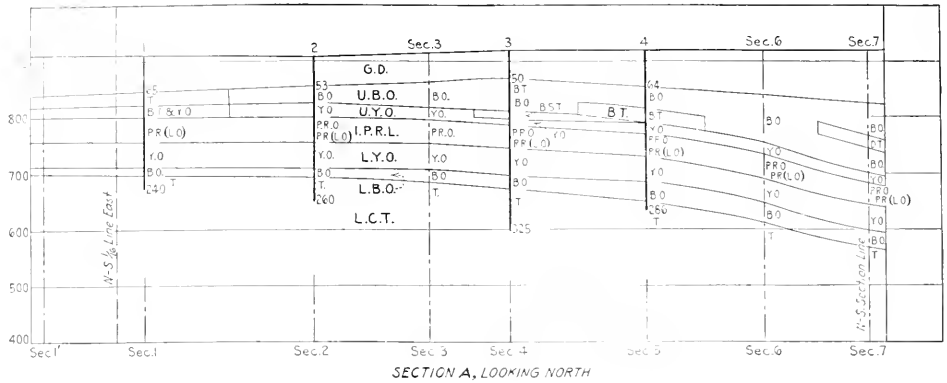


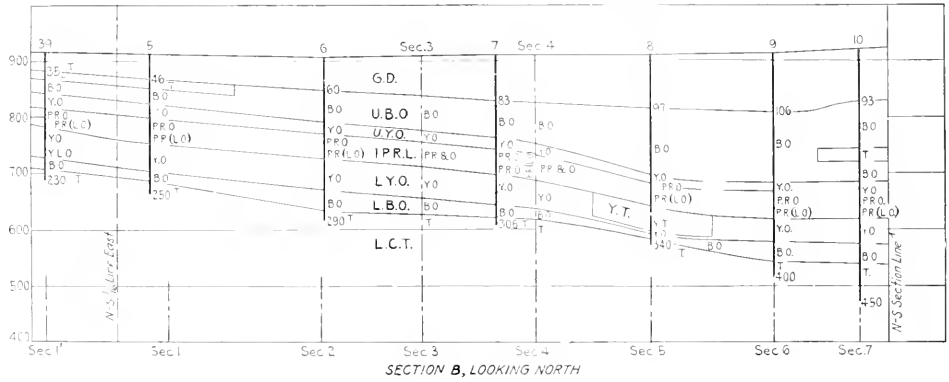
FIG. 24. CONTOURS OF BOTTOM OF OREBODY WORKED OUT FROM DRILL HOLES



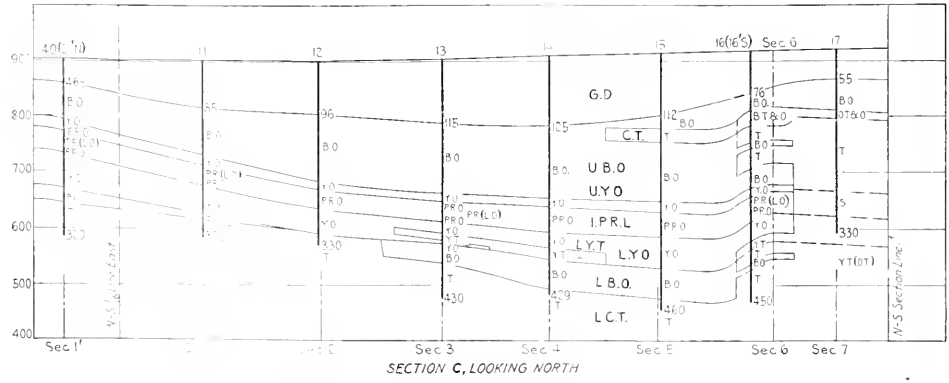
WITH ANALYSES OF SAMPLES FOR EACH HOLE



SECTION A, LOOKING NORTH

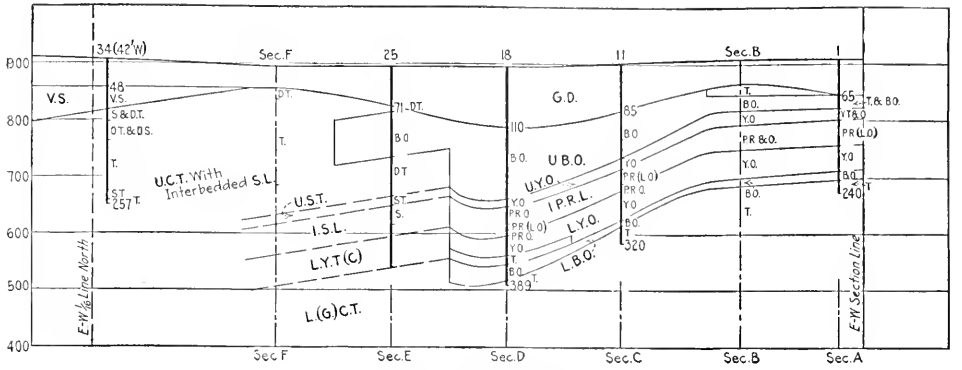


SECTION B, LOOKING NORTH

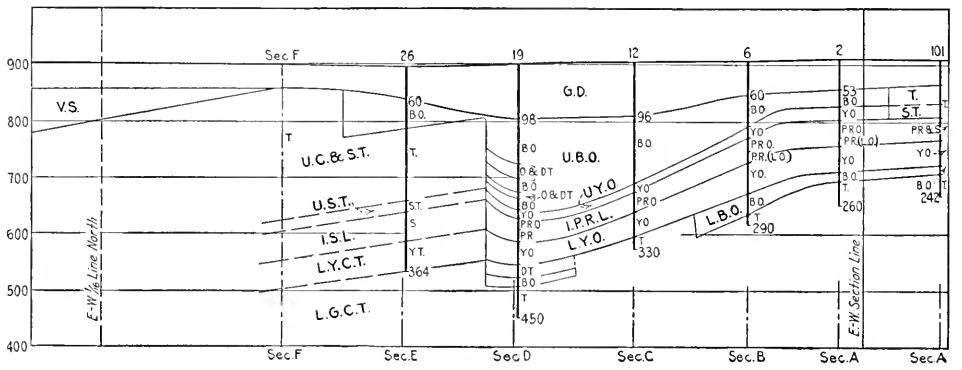


SECTION C, LOOKING NORTH

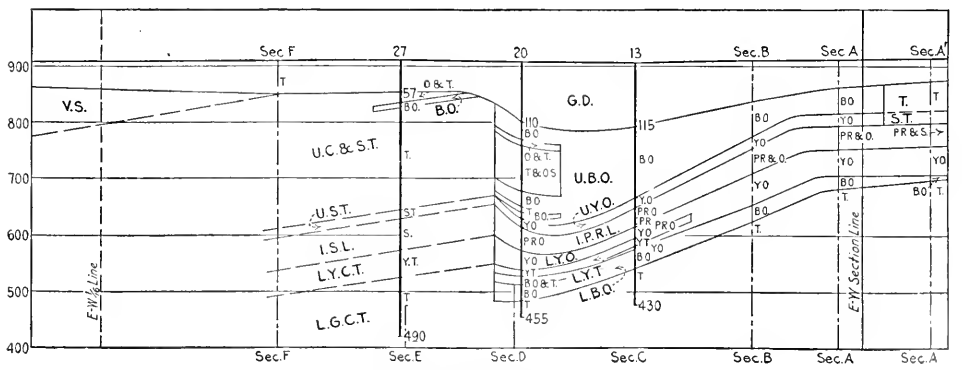
FIG. [illegible] SECTIONS FROM PLAT SHOWN IN FIG. 24



SECTION 1, LOOKING WEST

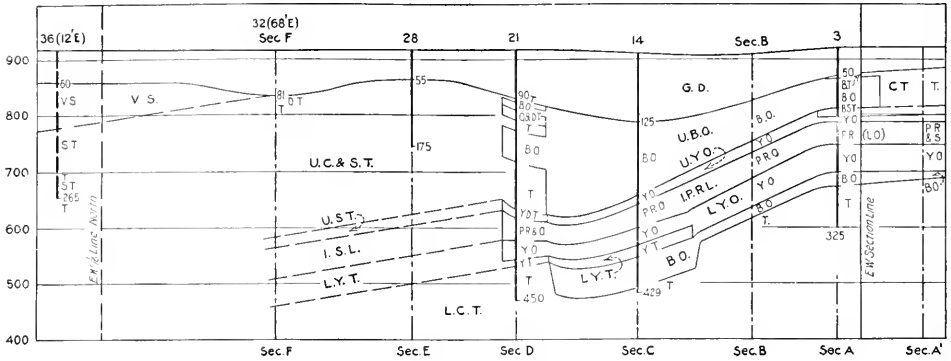


SECTION 2, LOOKING WEST

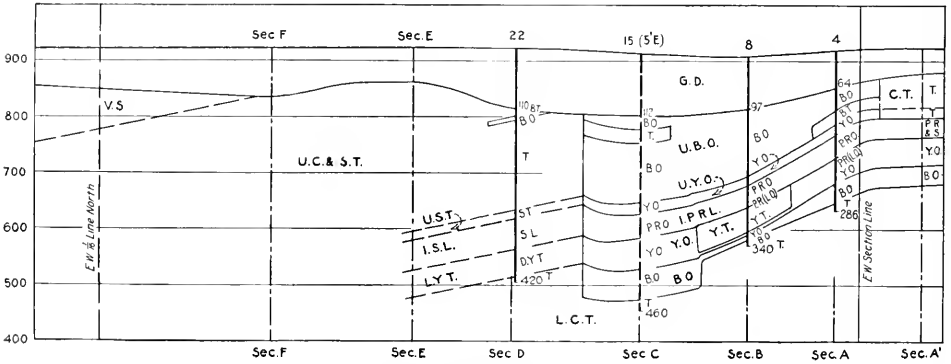


SECTION 3, LOOKING WEST

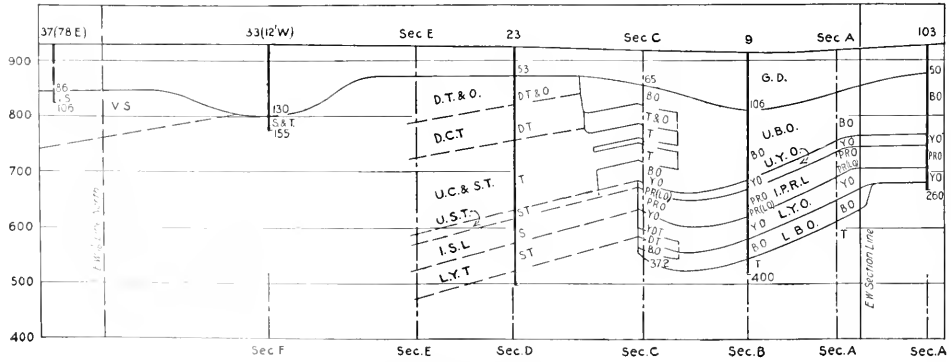
FIG. 26. SECTIONS FROM PLAT SHOWN IN FIG. 24



SECTION 4 LOOKING WEST



SECTION 5 LOOKING WEST



SECTION 6 LOOKING WEST

FIG. 27. SECTIONS FROM PLAT SHOWN IN FIG. 24

an upper brown ore, the gradation downward from the lower yellow ore. In the upper blue body an interbedded red or yellow slaty or paint-rock ore can be distinguished, being the alteration of the upper interbedded slate layer mentioned in Part I and shown in Fig. 6.

How to Correlate the Strata

When all of the drill holes have been thus divided into their structural layers, the structure of the orebody can be worked out accurately by connecting corresponding layers in adjacent drill holes on each section. Account must be taken, of course, of preglacial erosion, of slump in the orebody and of the effect of rock layers or rock horses in the ore, in connecting these structural layers. In some small orebodies which are alterations of only part of the upper taconite, and in which only a few or none of the holes have been drilled down through the Intermediate slate, the structure can be determined accurately by examining all the drill-holes for layers of slate or taconite having distinctive characteristics, and correlating and connecting such layers on the sections. Fig. 24 is a plat showing location of drill holes and lines of the sections, and bottom of ore contours of the main part of an orebody whose structure was accurately worked out along the lines described. Figs. 25, 26 and 27 show the principal east-west and north-south sections of this orebody. This plat and these sections are worthy of careful study by engineers of the district, as they combine many essential points in the working out of structure.

Attention is called to the dip of layers of rock south of the orebody. This was obtained by observing the dip of the cores of slate, particularly of the Intermediate slate layer. For this purpose a clinometer or a triangle divided into 5° angles can be used. In this particular case the dip was found to be from 15° to 23°. The strike of the formation is 55° E. as shown by the surface geological map in the vicinity. The dip observed from the drill cores was the maximum dip, at right angles to the strike. By a simple computation the dip on a north-south section was determined to be from 9° to 14°. One must take care in determining dip from rock cores not to use dips of ore seams in the taconite, because these may differ considerably from the dip or bedding of the whole formation. The slate cores give the best bedding and dip.

Attention is also called to drill holes 16, 20 and 21 which are near the south rock-wall of the orebody. Observations of slate cores found in the samples from these drill holes showed a dip of about 5°. Since the average dip of the rock south of the orebody is about 19° the small dip of 5° in these drill holes is taken to mean that the dip is down to the north and that these holes are north of the south rock-wall of the main orebody. On the sections it can be seen that these holes contain a great deal of rock, which is further evidence that they are near the limit of the ore. Furthermore the analyses of the ore in these drill holes was low in iron and fairly high in silica as compared with the drill holes to the north in the main part of the orebody. All this evidence was used in locating the line of the south rock-wall as shown in Fig. 24. Of course this information may be interpreted differently by different engineers, but it is presented here to call attention to facts and data which are not taken into consideration by most engineers in developing structure. Obviously the exact location of a rock wall is a matter of considerable importance, particularly in the development of openpits. In many cases considerable rock area might be stripped unless the drill records are studied carefully and interpreted along the lines just indicated.

The orebody shown is unusual in that the layers have so pronounced an initial southerly dip. The average dip of the iron formation is only 6° to 7°, instead of 19° as in this case.

In working out structure it is not entirely necessary to divide the orebody into all of its different layers; in fact it is often difficult to do so; but it is always possible to determine the division line between the intermediate paint-rock layer and the lower yellow ore, and with this division established on all sections as a guiding structural line, the essential structure can be worked out by drawing all ore layers shown by drill-holes on lines parallel to this structural line. In applying this rule the engineer must bear in mind the effect of rock layers and pillars and slump in deep parts of the orebody.

Good Drilling Makes Easy Work

After the deposit has been divided into its structural layers on the sections, the bodies or layers of lean ore and standard ore and bessemer and nonbessemer ore can be connected. The great value of the structural work really consists in being able to connect these different grades of ore with the certainty that they exist in the ground approximately as connected on the sections. Since the Mesabi iron formation is sedimentary, the alteration and concentration have proceeded along bedding planes, and lean layers or high-grade layers do not connect across the bedding. Therefore the great value and importance of this structural work should be apparent. It can hardly be over-emphasized. It is not only important in openpit development but is even more important in planning underground drift systems. One can easily see that if the structure is not worked out properly drifts may be planned which will drive into rock where ore was anticipated, and *vice versa*. Furthermore during the exploration of a property this structural study is a great aid to exploration and in fact is the best way to direct exploration. Such structural study shows plainly to the director of exploration where additional holes may be necessary or where some proposed holes may be superfluous. A case in point may be seen on Fig. 24; a drill hole intermediate between drill holes 18, 19, 25 and 26 and one say 100 ft. north of drill hole 22 would locate quite accurately the actual south rock-wall of the orebody shown on this plat.

Important to Supplement Drill-Hole Records

With the structure accurately determined as outlined, mining operations, whether openpit or underground, can be conducted much more skillfully than could be done otherwise. Development and mining work, whether test-pits, steam-shovel cuts, or underground drifts and raises, will give additional information as regards the structure, and all of this can be correlated and used to supplement the structure as shown by the drill-hole sections. Especially in openpit work is it necessary to keep in mind the ore structure in estimating the grades of ore which will be produced in a certain season. Of course most mining companies supplement the drill records by sampling the cuts made by the shovels and by test-pits, but to be of value all such information must be correlated structurally.

(To be concluded)

Details of Practical Mining

Wood vs. Steel Mine Ladders

By George E. Collins*

In the *Journal* of May 29 is a note with sketch by my friend E. S. Wiard, about steel ladders used at the Capital mine, Georgetown, as to which I wish to suggest a word of warning. In most mines such ladders would be unsafe. Moisture is apt to collect behind the rungs where the latter are riveted to the sides. This results in rust, and when the rivet has rusted through the ladders are very dangerous, as the defect is not visible. Steel ladders should be used only where liability of dry rot renders wood unsuitable; and even then I believe a design in which the pipe rungs actually pass through the sides would be safer and more generally preferable. Even in a dry mine there is usually moisture enough to develop rust on metal surfaces, especially when two such surfaces are in approximate but not actual contact.

In my experience, light weight in ladders is ordinarily a matter of secondary importance. Where a length of

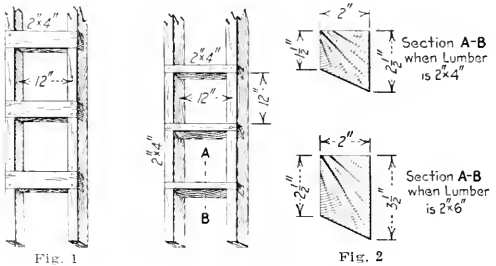


Fig. 1 Fig. 2

LIGHT WOODEN MINE LADDERS

ladder has to be moved frequently, very light ladders will of course be built. Ladders are intended primarily to travel on; and next to safety, convenience in climbing is the most important requisite. Pipe or other metal rungs are cold to the hands, and when wet and gritty cut the skin more than wooden rungs. Moreover, pipe is slippery and does not afford so good a grip for the feet as wood.

In most places, wooden ladders are best. Probably the most generally suitable design, taking convenience and cost into consideration, is that shown in Fig. 1, where sides and rungs are both made of 2x4 stock, the rungs being inset 1 or 1½ in. into the sides. If neatly made of dry lumber, the rungs swell when wet, so that they are firmly held in the slots, even if the nails with which they are originally secured should rust out. Worn rungs are easily replaced—an important consideration, for the neglect of which there is no excuse—and even when a rung is worn through or broken, the pieces hold sufficiently for safe travel. Such ladders made of red spruce, at a high-altitude mine in Colorado, cost 10½c. per foot complete as against Mr. Wiard's figure of 25c. per foot for the steel ladders. Their life, apart from damage by falling rocks—which in my experience is equally destructive to the 1- or 1½-in. pipe—is very long, sometimes exceeding that of the mine itself.

Where the ladders are exposed to the drip of acid water, I have used the form shown in Fig. 2. Here the rungs are made of 2x4 or 2x5 lumber, sawed on an angle lengthwise, so as to make pieces of the section as illustrated 1½ in. one side and 2½ in. the other, when sawed from 2x4 lumber, or 2½ in. and 3½ in. respectively, when sawed from 2x6 lumber. In either case, one cut in the side pieces is made at right angles and the other obliquely, so that the rungs are firmly held without nails. Of course the flat side of the rungs is placed uppermost. These ladders cost but a trifle more than the first mentioned.

Where there is liability of dry-rot, I have used 2x4 lumber for the sides and old pipe sawed into lengths for rungs. If the holes in the sides are a tight fit, no other fastening is necessary. I do not know why wooden uprights last so much longer than rungs—to a greater extent than the increased section would suggest—but such, in my experience, is the fact. The sides might be dipped in creosote or treated with copper sulphate, although I personally have not tried either. Either preservative used on wooden rungs, would be a nuisance.

The facility with which the sides of wooden ladders may be spiked to timbers or fastened to one another by means of cleats is much greater than that by which steel ladders can be suitably fastened by hooks or staples. Of course the advantage mentioned by Mr. Wiard, of each section being supported by the others, may and usually does apply to wooden ladders as well as to those made of steel.

In the old district of Gilpin County, ladders usually have sides of 2x4 lumber, with rungs made either of round 1¼-in. hardwood or of 2x2 native lumber chamfered at the edges and turned down at the ends to 1¾ in., which fit closely into a round hole of equal diameter in the side pieces. A nail through the side into the rungs at each hole adds some further security. These are good ladders to climb, but are not quite so safe as those made of 2x4 slats nor so durable. They retail at the rate of 12c. per running foot.

Slats made of 1x3 or 1x4 are sometimes used, but are not strong enough, and give poor footing. They should be used for movable ladders only.

*Mining engineer, Boston Building, Denver, Colo.

Why Is a Stinker?

The large volume of poisonous gases produced by the burning of a powder charge in a drill hole and delicately designated as a *stinker* is also similarly produced from causes other than burning of the charge. If the explosive has aged to such an extent that its sensitiveness has materially decreased; if the explosive is in a frozen or partly frozen condition, or if too weak detonators are used, an incomplete and improper detonation of the charge will

result and an unusual volume of poisonous gases will be given off. Many of the burned-out holes which are unexplainable, in view of the care taken in making the primer, selecting the fuse and loading the hole, are in reality not burned out at all, but simply the result of incomplete and improper detonation from one of the causes enumerated.

Rocker and Grizzly Mining on the North Saskatchewan

By J. A. Macdonald*

The newly discovered placer mining on the North Saskatchewan River which is now being vigorously prosecuted by the rocker and grizzly methods, recalls the early days of the Klondike when those crude implements were the only methods of mining the gold of the Yukon where today the mighty dredge does 75% of the mining. In the early days the "dirt" being rich, there was big money for the miner and prospector in operating the rocker, the grizzly and the sluice-box. One hundred dollars a day was not an uncommon output for the Yukon miner in the late '90s, and anything less than a "10c. pan" was not worth bothering with. The rocker and the grizzly are used yet to some extent in the Yukon, but the sluice-box has largely taken the place of those appliances where hand-mining is still pursued.

The grizzly is a modification of the sluice-box; it is in fact a section of a sluice-box, and is used where running water is not available. The rocker is a cruder affair, and is now chiefly used by the prospector in determining the value of a find. Running water is not necessary with the rocker, for the water can be used over and over again.

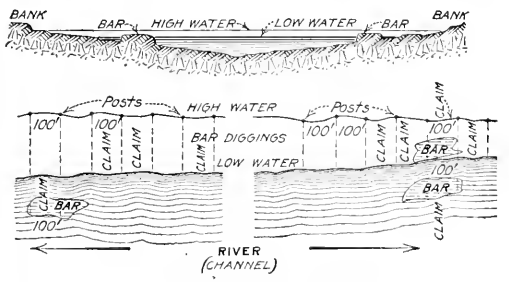


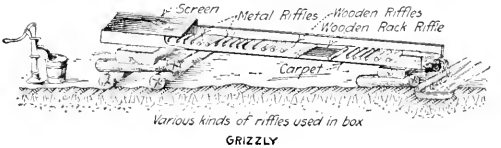
FIG. 1. LAYOUT OF CLAIMS

In the new diggings on the Saskatchewan, the grizzly and the rocker are the only methods thus far used. There is plenty of water in the Saskatchewan, it is true, but in order to use it for sluicing expensive machinery is required. These diggings known as "bar diggings" and "tidal diggings," can only be operated in certain parts of the year; that is, when the water is very low in the river; so it would scarcely pay to install expensive machinery. "Bar diggings" are covered with water until fall, when the bars are exposed and digging for gold begins. With the freeze-up the work stops, of course, only to begin again just before the ice breaks up in the river previous to the spring floods. Before the last freeze-up between two and three hundred claims had been taken up, and large numbers of claims have been staked out since.

Along the bank of the river only 100 ft. is allowed any one prospector. These narrow claims may, however, extend out a considerable distance over the flats and bars. The "shore" of the river may extend out in some places several hundred yards, and "bars" show up in areas of an acre or more at low water. These bars and banks are where the gold is found mixed with the fine earth and sand. The layout of these claims is given in Fig. 1. New regulations covering those placers have had to be issued by the Mines Department of the Interior. By the general mining regulations in the Western provinces and the Yukon a mining claim for gold or other precious metals is from 500 to 1500 ft. in width. Here, however, the width is but 100 ft.

In order to prevent the speculator, with no intention of working them, from acquiring valuable claims, the Government regulations provide that any person who, having staked out a claim, ceases work for three consecutive days during the working season sacrifices his claim, unless a "lay-over" has been granted him by the mining recorder. This regulation is very necessary and quite fair.

In Fig. 2 a sectional view of the rocker is shown. It is a box-like contrivance about three feet long by two feet wide, with a separate box or "hopper" on top, and stands on rockers, similar to those on the baby-cradle, hence the name. Inclined shelves covered with blankets to catch the fine gold are placed inside the box. The illustration shows but one in addition to the inclined bottom, but sometimes there are two or more, all covered with blankets. The bottom incline is covered both with blanket and riffles. The water at the outlet is usually held in place and used over and over again. The bottom of the upper box or hopper is perforated with holes about ¼ to ½ in. diameter and is usually of metal. Sometimes the bottom is heavy galvanized netting, which allows the fine gravel to fall through and the rough dirt and stones to be thrown out. Water is added to make a thin grout, and in this grout is the free gold, which is collected as it falls on the blanket and on the riffles. The rockers are necessary to agitate the wet dirt and



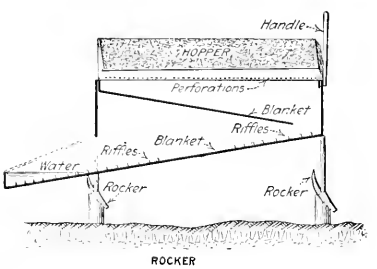


FIG. 2. DETAILS OF ROCKER AND SLUICE BOX

*Box 83, Ottawa, Ont.

water in the hopper, so that the finer parts may work through. There is a handle to the rocker with which the operator works or "rocks the cradle." At the same time he adds fresh water to the hopper, taking it from the spout with a long-handled dipper. Not much water is needed.

The rocker is placed on two posts set in the ground, as shown, or is placed on scantlings, if obtainable. There is a short bolt in the center of each rocker which enters into a corresponding hole in the post or scantling to hold the rocker in place and prevent its sliding away.

Construction and Use of the Grizzly

The grizzly is nothing more than a section of sluice-box about 10 ft. long, 1 ft. or more wide and 6 to 8 in. high. On its bottom riffles are set or nailed for the same purpose as in the case of the rocker. The box is set on an incline and the water and dirt are fed at the end courses down the incline, the riffles holding the free gold. The grizzly requires much more water than the rocker, and can be used only where water is fairly abundant. The riffles are made in many ways, but usually are of iron laid across the bottom of the box so as to stop the fine dirt in suspension as it slowly flows down the box. The first used in Canada was the wooden rack-like riffle. This was the only kind used in the Klondike for many years and is yet used on the Stewart. Small poles, an inch or more in diameter, are placed side by side in the box, longitudinally, and are either nailed or fastened in a rack at both ends, as shown. These poles are an inch or less apart, and are 3 to 6 ft. in length. These placed in the bottom of the box answer the purpose of holding the fine dirt, while the coarse and poor dirt flows over and out at the other end. A piece of carpet or heavy blanket is used near the end, and often both riffle and blanket are utilized in combination. Ordinarily the riffle is a piece of wood about 2 in. square, cut in lengths to fit crosswise of the box. They are placed about 6 in. apart. Riffles are, however, made in different shapes but all answer the same purpose.

Sewer Tile of Concrete

By B. B. Hood*

Concrete sewer tile is something that can be made to advantage around a mine or smeltery, especially when it is desirable to keep a skilled mason—or an unskilled one for that matter—busy rather than to lay him off when repair jobs are few. The illustration shows the forms used and two 15-in. concrete sewer tile completed. The tile are 39 in. long, including the 3-in. bell, and are 1½ in. thick, with no reinforcing of any kind. The outside form is made in halves of ¼-in. dressed-pine staves 31½ in. long held in place by two bands of iron screwed to the outside. One of the bands is 7 in. wide and projects 4½ in. beyond one end of the stave form, thereby providing the outside shape for the bell. On the inside of the opposite end is nailed a wood strip ¼ in. thick and 3 in. wide which makes the end of the finished tile 17½ in. outside diameter. The inside form is made of two parts hinged together, which, with a single keying piece makes a cylinder 15 in. diameter by 36 in. long. A taper core of wood, 3 in. thick, with diameters of 18 and 18½ in. completes the set and is used to form the inner part of the bell.

In assembling, the outer forms are placed on boards which make a bottom and are bolted together with six ¼-in. stove bolts. The key is placed in the inner form, being secured by pins through two lugs. This form is placed inside the outer one. For the first tile it was centered at the bottom by dropping three 1¼-in. cubes of wood, between the two forms and about 120 deg. apart. Trouble was caused by these blocks floating out of place when the concrete was put in. This was remedied by putting in three ½-in. setscrews, similarly spaced, near the bottom and through the outer form. As soon as 8 or 10 in. of concrete is in place, there is no danger of

FORMS AND COMPLETED CONCRETE TILE

the center form shifting, so the setscrews are turned back till they are flush with the inside of the form thereby freeing them from the tile. The center form is then filled to the top with concrete and the bell core put in place and filled around.

The concrete is really a mortar, being made of cement and sand tailings, from a concentrating mill, from which the slimes have been washed. Three bags of cement are used to make five tile. The forms are liberally coated with grease to keep the concrete from adhering to the wood and iron. A cheap grade of paper was tried instead of grease, but was not satisfactory.

Five sets of forms complete, cost $64. They were well made, of good material and were as good as new after making 300 ft. of tile. The cost of 210 ft. of these 15-in. tile was, $39 for labor and $30 for supplies, making a total cost of 33c. per running foot, with no allowance for cost of forms. The five forms were filled twice a week. They could be removed after three days, the tile standing where cast for three or four days more to harden. The tile was made indoors and therefore was sheltered from sun and rain while hardening. A week after it was cast it was rolled out-of-doors.

The method of testing one of the tile, eight days after it was cast was as follows: A smooth place was made in the sand and the tile laid upon it. The sand was dug out from under the bell so that little or no weight came upon that part. (Notice that the tile had no side support as it would have had in a culvert.) Full cement sacks were piled upon it, weighing approximately 100 lb. each. The tile broke just after the twenty-seventh bag was in place making the load 900 lb. per linear foot.

*Mining engineer, Chrome, N. J.

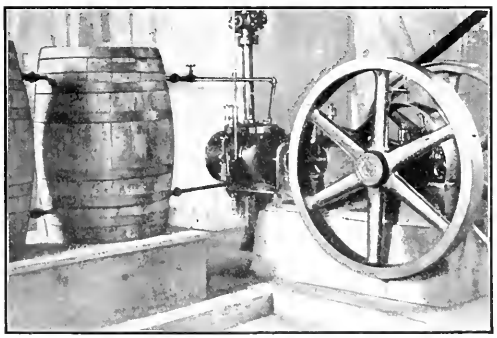
Details of Milling and Smelting

Air-Compressor Cooling With Water Barrels

By Jesse Simmons*

It is not always convenient to erect a tank, or even to secure the necessary water for cooling an air compressor by the usual method of a constantly flowing stream through the water jacket. Especially is this so in underground installations of small compressors to operate one or two hammer drills. It also applies in the desert country.

To overcome the difficulty, many operators arrange for a thermic circulating system of the cooling water by connecting two or more barrels with pipes at tops and bottoms. From the compressor a pipe is run from the bottom of the water jacket to a point near the bottom of the first barrel. From the top of the water jacket a connection is made near the top of the barrel. The accompanying illustration gives an idea of the character of the piping, showing an installation at the Echo Gold Mining Co.'s plant at Maitland, S. D. The compressor



WATER BARRELS FOR COOLING COMPRESSORS

is a single-stage belt-driven Bury machine with 6x8-in. cylinder. The water-jacket connections are made with ½-in. pipe. Between the two barrels—one shown complete and one in part—¾-in. pipe is used. Later a valve was put in the lower connection between the first barrel and the bottom of the jacket. Then by closing the two valves and opening the union on the bottom pipe and petcocks on the water jacket, the water could be readily drained on cold nights. Of course it is necessary at all times to maintain the water in the barrels at a point an inch or so above the top connections. The addition of a bucket or two of water daily replaces that lost by evaporation.

[If the night temperatures do not drop to much below 0° C. it is not necessary to drain off the water, as a little glycerin or alcohol, or some calcium chloride can be added to the water, just as is done in automobile engines.—Editor.]

*Mining engineer, Deadwood, S. D.

Lead Acetate and Zinc Salts in Silver Extraction

By Charles R. Morris*

The experiments described here were made at the Mexican mill, Virginia City, on the effect of lead acetate and zinc salts on the extraction of silver from ores, and also with the idea of finding some method, other than empirical, for the determination of the amount of lead acetate to be used for a given silver ore.

After laboratory tests were made on the ore the extraction appeared to be slightly better when using lead acetate in new solutions, but slightly poorer when using mill solutions. This was attributed to the zinc accumulating in the mill solutions. As the Mexican mill is a continuous-treatment plant, it was decided to run long mill tests with and without lead acetate, keeping all other conditions as nearly the same as possible. The ore was ground so that 92% would pass a 200-mesh screen. The temperature was kept at 95° F., cyanide at 2.5 lb. KCN, and lime at 0.5 lb. CaO. The accompanying table shows averages for each period.

The zinc was determined daily by direct precipitation as sulphide. The reducing power of the solution was also determined. No connection could be found between the extraction and the reducing power. The extraction of silver was 3.2% better in the second test than in the first, the time of treatment was 18% less in the second than in the first, and the consumption of cyanide was ¼ lb. more in the second than in the first.

During test No. 1 we found lead at head of the zinc sump solution by Clennell's method.[1] I believe the

AVERAGE RESULTS OF MILL TESTS

	Test No. 1	Test No. 2
Length of test, days	92	72
Tons per day	72	85.5
Silver, oz., heads	15.88	17.87
Silver, oz., tails	2.22	2.24
Extraction, per cent	84.2	87.4
Acetate, lb. per ton	0.9	nil
Zinc, grams per 100 c.c. solution	0.0848	0.0168
NaCn, lb. per ton of ore	1.875	2.125

accumulation of zinc in the first period was due to the use of lead salts and that the amount of zinc in solution should be kept as low as possible, or rather that there should be only sufficient lead or zinc salt in solution to precipitate the alkaline sulphides. An excess amount of metals in cyanide solution will retard the rate of extraction. As alkaline sulphides will precipitate lead, zinc and silver out of cyanide solution, in the order named, a daily estimation of zinc should be made to determine whether the silver is protected or whether it is in excess.

During 1913 the Mexican company took over a lease on the Monte Cristo mine and I did more work along these same lines. Before starting the mill on this ore, two series of laboratory tests were made—one with freshly prepared solution and the other with mill solution from

*Superintendent, Mexican mill, Virginia City, Nev.

[1]"Engineering and Mining Journal," Sept. 8, 1912.

Mexican ore—varying the proportions of solution to ore and the amount of lead acetate. The tests made with new solution showed that a dilution of 1:10 gave a maximum extraction without lead acetate, while at a dilution of 1:2, which would be more nearly mill-working conditions, the maximum extraction was obtained with $1\frac{1}{2}$ lb. of lead acetate.

Tests made with mill solution at a dilution of 1:10 without the use of lead acetate gave maximum extraction, but slightly lower than that obtained with fresh solution. With a dilution of 1:2 the maximum extraction required $\frac{1}{4}$ lb. of lead acetate. Besides, an excessive amount of lead gave poor extraction in all tests. Judging from this information, the amount of zinc salts in solution appears to have some relation to extraction.

Upon starting the mill on this ore I determined not to add any lead salts until the zinc salts were lower and some marked change of extraction of silver occurred.

Daily tests were made for zinc and for alkaline sulphides by the nitroprussiate test. The results are shown in the accompanying table.

MILL TESTS ON MONTE CRISTO ORE

	Heads, Oz. Silver	Tails,* Oz. Silver	Acetate, Lb. per Ton Ore	Zinc, Grams per 100 C.C.
1	6.12	2.20	nil	0.0650
2	5.17	1.54	nil	0.0420
3	5.04	1.58	nil	0.0380
4	6.96	1.56	nil	0.0380
5	9.21	1.76	nil	0.0203
6	16.62	1.80	nil	0.0124
7	15.72	2.18	$\frac{1}{4}$	0.0050
8	11.59	3.03	$\frac{1}{4}$	0.0050
9	11.21	3.95	$\frac{1}{4}$	trace
10	11.63	4.60	$\frac{1}{2}$	trace
11	13.79	3.04	$\frac{3}{4}$	trace
12	13.26	2.65	$\frac{3}{4}$	trace
13	18.83	2.10	$1\frac{1}{4}$	0.0050
14	10.03	2.09	$1\frac{1}{4}$	0.0168
15	14.36	1.67	$1\frac{1}{2}$	0.0168
16	10.46	1.46	$1\frac{1}{4}$	0.0230
17	14.56	1.37	$1\frac{1}{4}$	0.0295
18	8.31	1.07	$1\frac{1}{4}$	0.0395
19	5.51	1.21	$1\frac{1}{4}$	0.0346
20	5.50	1.14	1.0	0.0356
21	5.03	0.80	1.0	0.0380
22	6.15	0.74	1.0	0.0320
23	4.88	0.54	1.0	0.0340

*The tails for a given day are for heads three or four days previous.

The table gives the silver content for heads and tails, the amount of lead used and the amount of zinc in solutions returning to the head of the gold tanks.

In testing for alkaline sulphides we were unable to detect any, but from the cleanup made during the period when no zinc was in solution matte was formed on our bars. This was the only time we had matte. I believe that alkaline sulphides must have been in solution at that time. During the period we had trouble in titrating with silver nitrate. After first adding silver, a dark brown precipitate would form, which would disappear on shaking, and the final precipitate would be dark.

Complex cyanide solutions were made in the laboratory to test for alkaline sulphides by the nitroprussiate method. It was found that cyanide solutions containing small quantities of sulphide would react with nitroprussiate only in absence of silver or zinc salts.

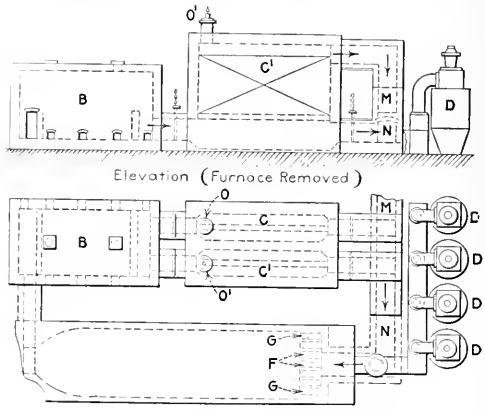
New Method for the Preparation of Copper Sulphate

A new method for the technical preparation of copper sulphate has been proposed by T. Fabiola, according to the *Journal of the Society of Chemical Industry*, in the issue of Apr. 30, 1915. A hot mixture of sulphur dioxide and air—that is, the gas from sulphur or pyrites burners—is passed upward through a glass tower surrounded by a hot-air jacket and packed with copper turnings or shot. Nitric acid, or nitrous gases, are introduced at the upper end of the tower. Copper sulphate free from nitrate has been obtained in this way in laboratory experiments, and it is suggested that towers packed with copper might be used in place of Glover towers in the manufacture of sulphuric acid by the chamber process.

Perkins Gas-Fired Reverberatory Furnace

Walter G. Perkins, of London, has been granted a patent (U. S. pat. 1,136,834) for a gas-fired reverberatory furnace, the gases from which pass through an enlarged dust chamber and then into a checker-work regenerator having two chambers which are worked alternately. The construction is, in effect a non-reversible gas-fired regenerative reverberatory furnace.

The accompanying drawing shows a typical plant. The gas producers *D* are placed as near the furnace as practicable, and the gas flows through the collecting flue to the gas ports *F* of the furnace. Issuing from these the gas meets the heated secondary air from the ports *G*,



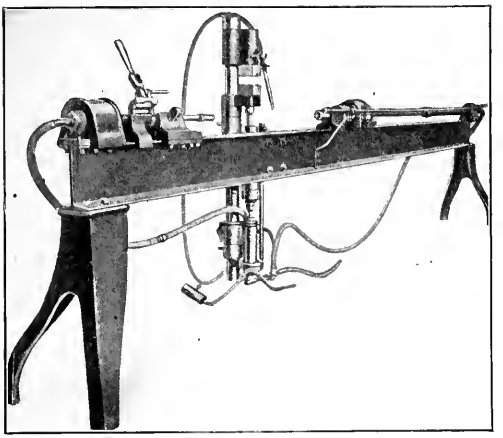
NONREVERSIBLE GAS-FIRED REVERBERATORY FURNACE

which has come from the regenerator. The waste gases from the reverberatory pass to the dust chamber *B* upward through the generator and thence to the chimney through the flue *M*. The regenerator chambers *C* and *C*¹ are constructed in the usual manner with checker-work and are used alternately. On top of each regenerator chamber is an air-admission valve *O* and *O*¹ permitting the air to flow downwardly through the regenerator chamber into the secondary-air flue *N*, and thence to the reverberatory furnace. It is expected that the passages of the regenerator will be kept clear of dust which may be carried along with the gases by providing an updraft of such gases through the regenerator and a downdraft when the chamber is used for secondary air. The use of reversible regenerative furnaces for copper smelting proved unsatisfactory in the past largely on account of dust troubles in the regenerator which the inventor claims to have obviated in the present design.

Mining & Metallurgical Machinery

The Wonder Drill Sharpener

A new drill sharpener of unusual type is being put on the market by the Hardsoog Wonder Drill Co., of Ottumwa, Iowa. This machine, although suitable for sharpening any style of hammer-drill steel, is very light, weighing only 1200 lb., and consists of the usual two elements,



WONDER DRILL SHARPENER

one horizontal and one vertical, for upsetting the drills and forming the wings. Both of these elements are mounted on an I-beam, which constitutes the main frame of the machine, which is supported on two pair of legs like an engine lathe.

This machine is claimed to have all of the advantages of any machine sharpener plus the additional advantage that it requires only 40 ft. of air for its operation and weighing very much less its cost is smaller.

Armored Wire Rope

Armored wire rope, Gore construction, is claimed to have a wearing life two or three times greater than similar quality rope of standard construction. In this rope each strand is wound with flat steel wire having convex edges, and forms a protective armor that prevents all exterior abrasive wear on the tensile-strength wires. The flat armoring wires are held transversely to the axis of the rope so that they do not affect its flexibility, and the convex edges of the armoring wire permit the flexing of the rope without any creeping of the armor. This rope is marketed by the Waterbury Co. of 80 South St., New York, as Waterbury armored wire rope, Gore patent. The standard constructions are composed of 6 strands, 19 wires to the strand; 6 strands, 37 wires to each strand; or 6 strands, 61 wires to each strand. The rope may have a hemp or wire center, as conditions demand.

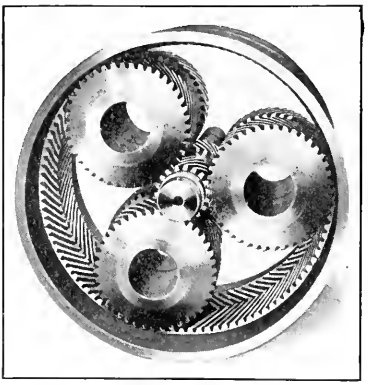
The Waterbury armored rope has been applied to steam-shovel service, dragline excavators, harbor and gold dredges, etc. El Oro Dredging Co., of California, tested some of the Waterbury armored rope in competition with ordinary wire rope and has written the manufacturers as follows:

> We used as a side line on a larger dredge 650 ft. of ⅞-in. high-grade rope from one of the large manufacturers, which cost $123.22, and lasted 183 days. We replaced this with 650 ft. of ¾-in. crucible-steel, Gore construction, steel-clad rope furnished by you at a cost of $82.56. To make the units of service the same for each dollar of cost, your rope should have given us 122 days' service, but at this writing it has been in service 254 days, and we have no present intention of taking it out. In other words, it has already given us twice the service of the other rope for each dollar of cost, and we are not through with it.

The Waterbury Co. also markets a fibre-covered wire rope under the name of Waterbury Fibreclad wire rope. The tarred marline covering protects the wire strands of the rope from moisture and grit, and unlike manila rope is not affected by changes in atmospheric conditions. Hence it neither stretches nor swells and jams in the blocks. It is claimed that it will outwear either bare wire or manila rope. Its strength is said to be greater than that of manila rope of the same size and the weight is 50% less than that of manila rope of the same strength.

Planetary Reduction Gear

The planetary type of gear shown is a recent development of the Turbo-Gear Co., Baltimore, Md. It is designed to be used as a speed-reducing or speed-increasing



TURBO-REDUCTION GEAR

gear and will run either right- or left-hand. The driving and driven shafts rotate in the same direction.

The gear consists of a large internal double-helical gear made of an openhearth steel forging. A double-helical pinion cut integral with the high-speed shaft is made of chrome-vanadium steel. The intermediate double-helical gears are made of manganese-bronze and are

mounted on hardened and ground forged-steel shafts, secured to the slow-speed member.

The slow-speed member, to which is secured the slow-speed shaft, is mounted on two heavy-duty ball bearings, one on each side of the gears, and is supported directly by the heavy housing. Thus, it will be seen that the slow-speed member and the shaft carrying the intermediate gears and the high-speed shaft and pinion are independent of each other for support.

Schoop Metal-Spraying Pistol

In the *Journal* of Mar. 11, 1911, there is a description of an early form of apparatus for mechanically applying a thin coat of metal, the device being known as the Schoop metal-spraying pistol. By its use it is possible to apply a metal coating to other metal surfaces and to many other substances, such as wood, plaster, paper, leather, glass, porcelain and cloth. An important feature, also, is the variety of metals and alloys that can be so applied. The coating may be thick or thin, as desired, and is applicable not only to fine decorative construction, but also for rough work, as coating iron or steel articles with some noncorrosive covering such as lead, zinc, tin or copper.

In a paper read by R. K. Morcom before the Institute of Metals the Schoop process is described as follows:

"The essential parts of the machine, or 'pistol' as it is called, are a combined melting and spraying jet and a feed mechanism. The metal, in the form of rod or wire, is fed to the melting flame. The flame can be formed by coal gas, water gas, acetylene, hydrogen, etc., burning in air or oxygen, according to the metal used. The gases are supplied at such pressures as to prevent blowing out and to insure a highly reducing flame. The spraying jet can be of carbon dioxide, nitrogen, air, steam, etc., the pressure used being necessarily high enough to produce an adhesive coating. To obtain the best adhesion, the surface on which the metal is sprayed must be absolutely clean and of an open nature to give a key for the deposit. Sand-blasting with sharp sand has been found best. Shot give too polished a surface. Such surfaces as fabrics, wood, unglazed earthenware and asbestos require only freedom from grease, as their surfaces give a natural key.

"As at present constructed, the standard pistol uses about 0.55 to 0.6 cu.ft. of air per min. for every 1 lb. per sq.in. air pressure, so that with an air supply at 80 lb. per sq.in., which is a very suitable figure for ordinary spraying, the air consumption will be from 45 to 50 cu.ft. per min. The mass of this will be from 830 to 920 grams, and the mass of metal sprayed by this air will be from about 8 grams in the case of iron to about 200 grams in the case of lead.

"The action of deposition is probably a complex one. The minute particles of solid metal are driven with such force against the object that in some cases they fuse, but, owing to their small relative size, are promptly chilled by the object to which they adhere. If any of the particles are molten or gaseous they will adhere. In addition, the suddenly chilled particles are possibly, or even probably, in the state of unstable equilibrium found in 'Prince Rupert's drops,' and act like so many minute bombs, bursting on impact to almost molecular dimensions.

"The process requires some care in manipulation, as by varying the conditions it is possible to spray porous or nonporous coatings, and with some metals anything from a pure metal to a pure oxide. With care, however, nonporous, oxide-free, adherent coatings can be produced of almost any metal on almost any solid. In addition to metals it is possible to spray fusible nonmetals, or, by stranded wires, alloys of metals or mixture of metals with nonmetals."

The spraying pistol and process are the invention of a Swiss named M. U. Schoop, and while it has been in use in Europe for some time, it has been introduced into the United States only within the last 18 months. The pistol is a portable hand tool weighing about 3½ lb., and is connected by small tubes with reservoirs supplying oxygen, hydrogen and compressed air. The compressed air-blast nozzle is concentric with the oxyhydrogen burner. As the compressed air issues from the pistol it drives a minute turbine, which in turn propels friction wheels that feed the wire into the flame.

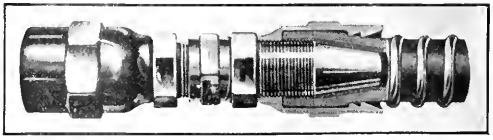
In at least one instance the apparatus is employed in the mining field. Phelps, Dodge & Co. use it at Douglas, Ariz. The purpose for which it is there operated is best described by Lawrence Addicks, formerly of that company, who says under date of Feb. 6, 1915:

"I have been experimenting with several processes for lead-coating materials of construction to protect them from acid liquors. One particular problem has been the coating of the copper connections attached to carbon anodes in the electrolysis of copper in a sulphate electrolyte. The ferric sulphate formed gradually eats away unprotected copper, and it is difficult to devise an all-lead connection.

"A Schoop pistol, furnished by the Metals Coating Co. of America, People's Gas Building, Chicago, Ill., has made coatings of a satisfactory appearance. They have not as yet been tested for durability in service. Our method of anode construction is to electroplate the upper ends of the carbon plates with copper, then to attach the copper terminal strips with copper bolts; next to apply a coat of acid-proof paint; finally to spray a substantial coating of pure lead over the paint."

"National" Hose Coupling

The "National" hose coupling embodies durability and efficiency in attaching a hose to a threaded metal terminal. The principle of the device is distinctive, since it makes no attempt to apply pressure to the outside of the hose,



"NATIONAL" HOSE-COUPLING DEVICE

the whole force being applied from the inside, making it easy to obtain a tight connection.

It is particularly adapted to compressed-air connections on drills, pneumatic tools, and to similar uses. It is made by the National Hose Coupling Co., People's Gas Building, Chicago.

What the Dip Needle Can and Cannot Do

By C. A. Cheney, Jr.*

SYNOPSIS—A series of questions and answers covering the conclusions to be deduced from dip-needle indications. Experience is required both in observing and reasoning. It is not reliable in the hands of the amateur.

In the course of a long experience I have met many so-called "practical" mining men who have expressed themselves as having little faith in the results of magnetic surveys made for the purpose of delimiting iron formation. One went so far as to remark that an old steam gage would indicate the position of an iron-bearing formation as well as would a dip needle.

At the other extreme there are many who are able, from a dip-needle survey, to make marvelous deductions as to the depth of burial, quality of ore, size of orebody and attitude of the strata of the formation. These persons visualize the iron formation as made up of inclined strata with beautifully regular dips and curves, and if necessary, they often unconsciously obtain needle readings which will agree with a preconceived theory as to the attitude of the underlying formation.

Its Value in Iron-Ore Exploration

Between these two extremes are a small number of men who have had the opportunity of following exploration work from prospect to mine and are therefore able to recognize the extent to which it is wise to draw inferences from a magnetic survey. The dip needle is now in greater use than ever before and is invaluable in many ways, but its real limitations are little known. For this reason, answers to some oft-repeated questions are of interest to those engaged in exploration for iron ore.

Do the dip-needle readings furnish any clew as to the depth of burial of the formation?

Observation leads me to assert that in any district in the Lake Superior region the readings do not indicate, even in a most general way, the distance of the formation below the surface. It follows that the differences of elevation in any district probably are not great enough to cause any relative variations in the amount of magnetic dip. As evidence I can cite the following cases: A maximum magnetic dip of 10° on a Vermilion Range outcrop of iron formation; a maximum magnetic dip of 40° on a possible southwestern extension of the Vermilion Range at a point where drilling subsequently proved the depth of surface to be 450 ft. In another district the maximum reading was 35° at a point where geological considerations indicate that the formation causing the magnetic dip is at least 1200 ft. below the surface. In this same district maximum magnetic readings actually grow less with decrease in thickness of overburden.

Enough other cases might be cited to prove conclusively that in any Lake Superior district the relative variations in the amount of magnetic dip are not indicative of variations in depth of overburden. In instances where geologists have considered the dying out of the magnetic indications as indicative of an increasing depth of overburden, the real reasons are, probably, that the iron formation has "petered out" or if present that it was originally less metamorphosed than the adjoining portion and consequently is so thoroughly altered to the nonmagnetic oxides as to cause no variations of the magnetic needle.

Quality of Ore Not Determinable

Do the magnetic readings furnish any evidence as to the quality of the ore?

In only two mines in the Lake Superior region is magnetite mined as a magnetic ore. Practically all of the ore produced in the region is composed of hematite, limonite and other nonmagnetic oxides.

The magnetic field encountered in crossing most iron formations is therefore ordinarily not caused by the ore, but by the associated magnetic slates, which may be the hanging wall, foot wall or bottom of an orebody, or may not be associated with any ore. There may be enough disseminated magnetite in some ores to influence slightly the needle, but where magnetic slates are present the relative amount of this pull would be very small.

The almost completely altered and productive formation of the central Mesabi district exerts but a small pull on the magnetic needle, but in an adjoining district a similar small magnetic attraction is frequently found to be due to a little-altered and unproductive formation. On the other hand, high magnetic readings of equal value have frequently been found, caused in one case by a richly productive iron formation and in another case by an absolutely barren iron formation.

From these considerations it is evident that it is unwise to estimate the probable quality of the ore by means of the dip-needle readings.

Do the readings indicate the size of the orebodies?

No, for reasons that have already been enumerated. In practically all cases, however, the area of the magnetic field is directly proportional to the area of a horizontal plane passing through the top of the iron formation. That is, a wide area of magnetic attraction is representative of a wide area of iron formation, and vice versa. Examples are so plentiful that this fact is universally recognized.

Maximum Magnetic Line

Does the maximum magnetic line overlie the iron formation?

Most exploration work is conducted on the theory that the maximum magnetic line overlies the iron formation. In general it does, but frequently it does not. There are numerous cases where the maximum magnetic line sometimes lies completely outside of the boundary of the iron formation as projected vertically to the surface.

*Geologist, Madison, Wis.

On the Cuyuna range the distance of the maximum magnetic line outside the vertically projected boundary of the iron formation is in some cases over 100 ft. Furthermore, in the same district the maximum magnetic line occasionally crosses the strike of the iron formation at small angles. Because of these conditions, in that district at least, the drilling should not be confined too closely to the locus of the maximum magnetic readings. It has been common practice to do this and as a result some properties have been condemned before all exploration possibilities have been exhausted.

Character of Magnetic Readings Differs with Sedimentary and Igneous Rock

Does the character of the magnetic readings indicate whether the attraction is caused by a sedimentary iron formation or by a basic igneous rock?

In general, yes. One who has done much work with the dip needle can usually recognize the freakish character of the magnetic dips caused by other material than the type iron formation.

My experience has been that massive basic segregations in igneous rocks almost invariably attract the south end of the needle, whereas the sedimentary iron formations attract the north end. Sometimes these magnetic areas are in many respects similar to magnetic areas caused by a sedimentary iron formation, the difference being that a different end of the needle is attracted in one case or the other.

Negative readings—attraction of south end of needle—are also obtained in many cases along formation boundaries, usually the contact of a slate and an igneous rock.

In some instances positive readings are due to the presence of magnetite in greenstone schists. These dips may be recognized by their erratic character. The maximum readings in general are not related on adjacent cross-sections and die out rapidly in a transverse direction.

Is it possible to determine the dip of the formation from the magnetic readings?

Deductions derived from dip-needle readings as to the attitude of the formation seldom "pan out" right, and when they do it is probably largely a case of coincidence. Where the variations of magnetic dip are uniformly similar on several cross-sections and where the differences in variation of magnetic dip are marked, they may give a real clew as to the dip of the formation. Any theories based on small variations are, however, very apt to be exploded when the formation becomes known by drilling.

In spite of the limitations of the dip needle, I doubt if any other invention has made or saved so much money in proportion to its cost, for men engaged in search of iron formation. It is an undeniable fact that an iron formation can be located and traced by means of a dip needle, and this is always the prime reason for such a survey.

Furthermore, the knack of taking correct dip-needle readings can only be obtained by much experience with the little instrument in several districts. The work looks extremely simple and I have heard many say, "There's nothing to it, I can do it," but these persons are in the same class with those who think that they can "guess which shell the little pea is under."

Bureau of Mines Radium Production

The production of radium from Colorado carnotite ores by the Bureau of Mines, in connection with the National Radium Institute, has passed the experimental stage in its new process and is now on a successful manufacturing basis, according to an announcement made on July 27 by Secretary of the Interior Franklin K. Lane. He also declared that the statements made to Congress concerning the ability of the Bureau of Mines to produce radium at a greatly decreased cost over that of other processes had been substantiated.

The cost of one gram of radium metal produced in the form of bromide during March, April and May of the present year was $36,050. The cost of producing radium in the small experimental plant during the first few months of the Bureau's activities was somewhat higher, but not enough to affect seriously the final average.

It should not be inferred, however, that this low cost of production necessarily means an immediate drop in the selling price of radium. The National Radium Institute was fortunate in securing through the Crucible Steel Co. the right to mine on 10 claims of carnotite ores belonging to it, and this was practically the only ore available at the time. Since then new deposits have been opened, but these are closely held; and according to the best judgment of the experts employed by the Bureau of Mines, the Colorado and Utah fields, which are much richer in radium ores than any others known, will supply ore for a few years only at the rate of production that obtained when the European war closed foreign mines. The demand for radium will also increase rapidly.

The 10 carnotite claims being operated at Long Park, Colo., by the National Radium Institute have already produced more than 796 tons of ore averaging over 2% U_3O_8. The cost of ore delivered at the radium plant in Denver has averaged $81.30 per ton. This included 15% royalty, salary of the Bureau of Mines employees, amortization of camp and equipment and all expenses incident to the mining, transportation, grinding and sampling of the ore.

A concentrating plant for low-grade ores has been erected at the mines and is successfully recovering material formerly wasted. The radium plant at Denver has now a capacity of three tons of ore per day, having been more than doubled in size since last February. Before that time the plant had been run more or less on an experimental scale, although regularly producing radium since June, 1914. To July 1, 1915, slightly over 3 grams of radium metal were obtained in the form of radium-barium sulphate containing over 1 mg. of Ra per kg. of sulphates. The conversion of the sulphates into chlorides and the purification of the radium therefrom are easily accomplished, and with small loss of material. Unfortunately, however, acid-proof enamel ware, obtainable only in France, has not been delivered of sufficient capacity to handle the crystallization of the full plant production, so that only 1304 mg. of radium have been delivered to the two hospitals connected with the National Radium Institute. The remaining radium can be crystallized at any time from neutral solution in apparatus already installed. But the greater rapidity and efficiency of production of this valuable material by the methods

used have decided the Bureau of Mines to await the completion of apparatus now being built before pushing the chloride crystallization to full capacity.

The average radium extraction of all ore mined by the National Radium Institute has been more than 85% of the amount present in the ore, and for the last five carloads of carnotite treated, above 90%.

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War Affects the Manganese Industry

The production of manganese ores in the United States in 1914 amounted to 2635 long tons, which was 1413 tons less than the output of 1913, according to the Geological Survey. The manganese ore shipped in 1914 was derived from mines in Virginia, South Carolina and California. The domestic output was small compared with the imports of manganese ores, which amounted in 1913 to 345,090 long tons and in 1914 to 283,294 long tons.

India, Russia and Brazil have been the principal countries from which manganese ore has been imported. In 1913 the largest imports were from India, amounting to 141,587 tons, and the imports from Russia were 124,337 tons. The closing of the Dardanelles, and probably the scarcity of vessels for transportation from India in 1914, had the effect of reducing the imports from Russia to 52,681 tons and those from India to 103,583 tons. These decreases were partly compensated for by the increased shipments from Brazil, which were 70,200 tons in 1913 and 113,924 tons in 1914.

The output of all grades of manganiferous ores in 1914 was 445,827 long tons (mainly from the Lake Superior region), of which 60,414 tons contained more than 15% of manganese and was used in the manufacture of low-grade ferromanganese and manganiferous pig iron.

The marketed domestic production of ferromanganese in 1914 was 100,731 long tons and the imports of ferromanganese were 82,997 long tons. The marketed domestic production of spiegeleisen decreased from 106,980 long tons in 1913 to 76,625 tons in 1914, and the imports increased from 77 tons in 1913 to 2870 tons in 1914. The larger part of the spiegeleisen was made from manganiferous zinc residuum derived from New Jersey mixed manganese and zinc ores, though for the first time since 1909 spiegeleisen was produced from the manganiferous ores of Leadville.

As heretofore, practically all the domestic output of ferromanganese was made from imported ores, though some medium-grade ferromanganese was made from manganiferous iron ores of the Cuyuna Range in Minnesota at the Dunbar furnace in Pennsylvania.

If the domestic production of steel and steel products increases considerably on account of the temporary elimination of competition from European steel products, the sources of manganese supply may be abnormally taxed to meet the demand. The increased price, however, will stimulate domestic production and permit the mining of manganese ores which, under normal conditions, could not be profitably worked.

[The situation at the present time has aroused interest in the manganese ores of Virginia, and several of the deposits in the southwestern part of that state are being investigated.—Editor.]

NEW PATENTS

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

ALUMINUM ALLOY. William A. McAdams, Bay Shore, N. Y. (U. S. No. 1,146,185; July 13, 1915.)

BRIQUETS—Binding Means for Briquets. Wilhelm Schumacher, Osnabrück, Germany. (U. S. No. 1,146,455; July 13, 1915.)

CONCENTRATOR—Ore Concentrator. Fritz Oscar Stromborg, Salt Lake City, Utah. (U. S. No. 1,146,211; July 13, 1915.)

CRUSHER. Thomas L. Smith, Milwaukee, Wis. (U. S. No. 1,145,929; July 13, 1915.)

CRUSHERS—Lubricating Device for Gyratory Crushers. Richard Bernhard and Jacob M. Sholl, Milwaukee, Wis., assignors to Power & Mining Machinery Co. (U. S. No. 1,145,967; July 13, 1915.)

DRILLING—Air and Water Blowpipe for Rock Drilling. Frank T. Sanders, Colorado Springs, Colo., assignor of one-half to Owen Dodge, Colorado Springs, Colo. (U. S. No. 1,146,284; July 13, 1915.)

DRILLS—Feeding Means of Percussive Rock-Drills, Coal-Cutters, and the Like. Frank Simon and John William Scott, Minnaar, Transvaal, South Africa. (U. S. No. 1,146,356; July 13, 1915.)

EXTRACTION—Composition and Process for Extracting Precious Metals from their Ores. James F. Williams, San Francisco, Calif. (U. S. No. 1,145,954; July 13, 1915.)

FILTERING APPARATUS. William E. Holderman, Salt Lake City. (U. S. No. 1,146,256; July 13, 1915.)

FLOTATION—Concentration of Minerals by Flotation. Archibald R. Livingston, Cañon City, Colo., assignor to the New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,147,633; July 20, 1915.)

GRAPHITE—Process for Converting Coke into Graphite. H. Plauson. St. Petersburg, Russia. (Brit. No. 17,732 of 1913.)

PHOSPHATE—Fertilizer Composition and Process of Making It. Thomas Leopold Willson and Maximilian Matheus Haff, Ottawa, Ont., Canada, assignors, by direct and mesne assignments, to Southern Investment Co. of Canada, Ltd., Montreal, Canada. (U. S. No. 1,145,107; July 6, 1915.)

PIG IRON—Process for Dephosphorizing Pig Iron. Amand Francois Pasquier, Dijon, France. (U. S. No. 1,145,506; July 6, 1915.)

POTASH—Process of Making Potash and Structural Materials and Products Thereof. Arthur C. Spencer, Washington, D. C. (U. S. No. 1,146,532; July 13, 1915.)

PUMPS—Balancing Means for Centrifugal Pumps. Ferdinand W. Krogh, San Francisco, Calif. (U. S. No. 1,146,078; July 13, 1915.)

REHEATING FURNACES—Improvements in or Relating to Reheating Furnaces. Eickworth & Sturm Ges. mit Beschrankter Haftung, Dortmund, Germany. (Brit. No. 5875 of 1915.)

ROASTING—Ore-Roasting Furnace. Irven R. Margetts and Earl R. Pembroke, Salt Lake City, Utah. (U. S. No. 1,145,329; July 6, 1915.)

SCREEN or Separator. Thomas Joseph Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,141,988; June 8, 1915.)

SEPARATOR—Magnetic Separator. Francis B. Dutton and Benjamin E. McKechnie, Lebanon, Penn., assignors to Pennsylvania Steel Co., Philadelphia, Penn. (U. S. No. 1,146,141; July 13, 1915.)

SIEMENS-MARTIN FURNACES—Improvements in or Relating to Siemens-Martin Furnaces. Eickworth & Sturm Ges. mit Beschrankter Haftung, Dortmund, Germany. (Brit. No. 5651 of 1914.)

SKIMMING LADLE. Jesse L. Jones, Wilkinsburg, Penn., assignor to George L. Curtiss Co., Pittsburgh, Penn. (U. S. No. 1,145,422; July 6, 1915.)

SLAG STEAM GENERATOR. Leonce L. Battu, New York, N. Y., assignor to Slag Steam Generator Co., New York, N. Y. (U. S. No. 1,145,178; July 6, 1915.)

SMELTING FURNACE. Pierre Plantinga, Cleveland, Ohio. (U. S. No. 1,146,097; July 13, 1915.)

SMELTING FURNACES—Reversing Valve of Gas-Fired Smelting Furnaces and the Like. Evan Lewis, Swansea, Wales. (U. S. No. 1,146,582; July 13, 1915.)

SMOKE—Cooler-Flue and Hopper for Fume-Arresting Apparatus. Alfred U. Field, Redding, Calif. (U. S. No. 1,146,319; July 13, 1915.)

SULPHUR SMOKE—Recovery of Sulphur Dioxide. James B. Garner, Pittsburgh, Penn., assignor to Metals Research Co., New York, N. Y. (U. S. No. 1,145,579; July 6, 1915.)

SULPHURIC ACID—An Improved Apparatus for Concentrating Sulphuric or Other Acids. P. L. Pfannenschmidt, Thornhill, Leeds, and Richard Moss, Dewsbury, Eng. (Brit. No. 13,642 of 1914.)

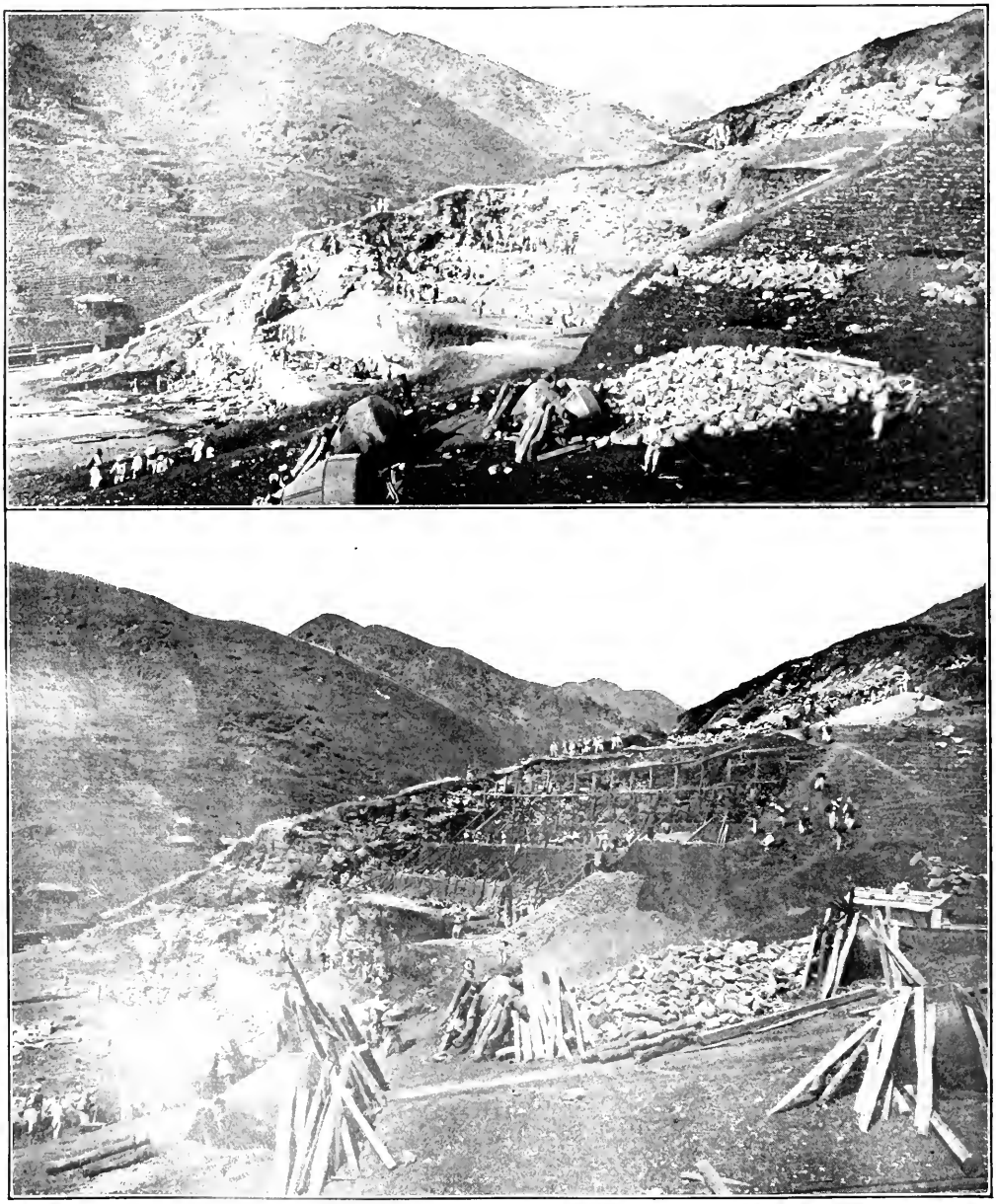
TUBE MILL. Guy C. Howard, Everett, Wash. (U. S. No. 1,146,760; July 13, 1915.)

TUNNELING MACHINE. Dighton A. Robinson, Seattle, Wash. (U. S. No. 1,146,281; July 13, 1915.)

ZINC—Process of Treating Zinc-Bearing Materials. Woolsey McA. Johnson, Hartford, Conn., assignor to Continuous Zinc Furnace Co., Hartford, Conn. (U. S. No. 1,146,075; July 13, 1915.)

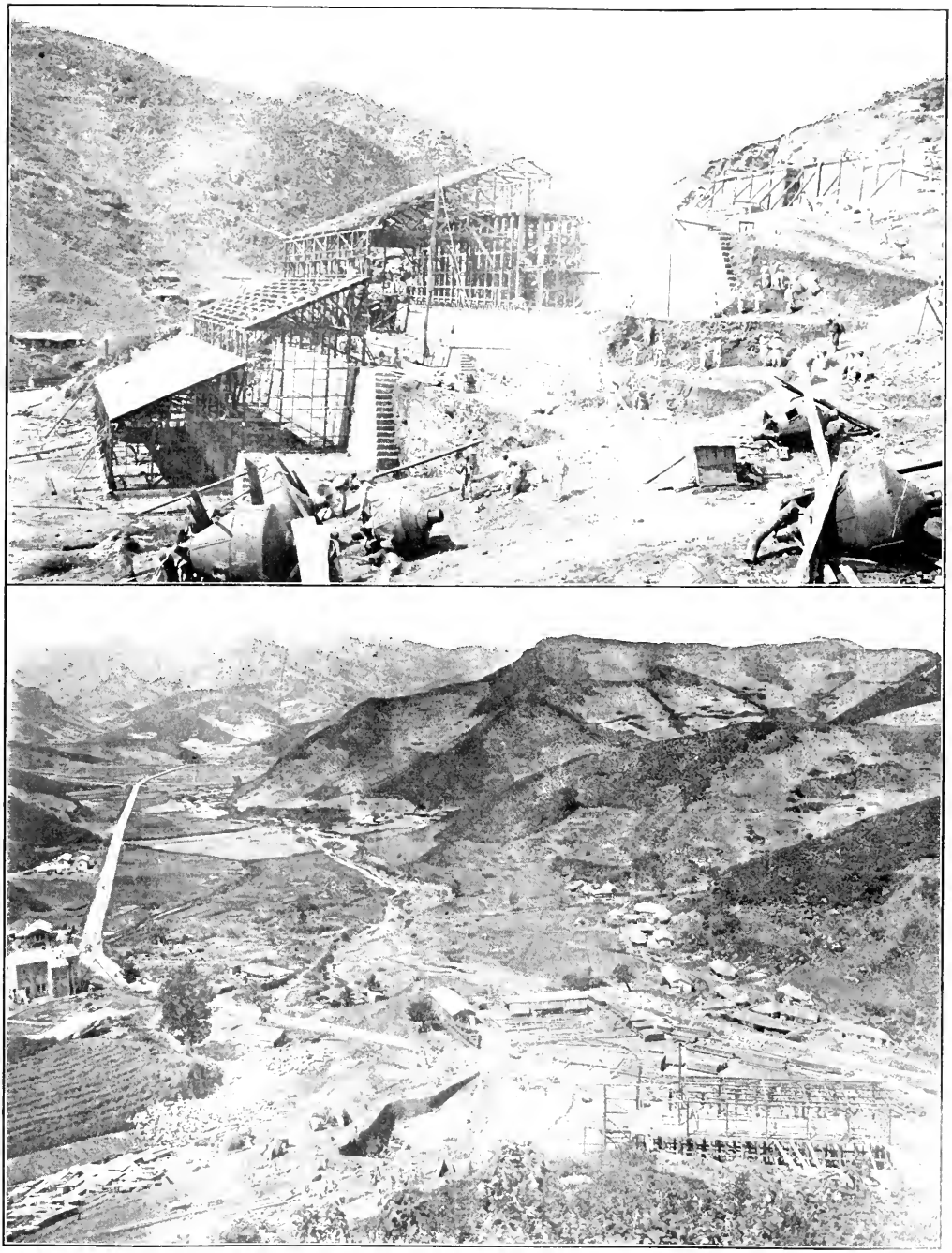
ZINC—Process for the Treatment of Zinkiferous Materials. H. Specketer, Griesheim-on-the-Main, Germany. (Brit. No. 20,039 of 1913.)

Photographs from the Field



SEOUL MINING CO.'S PROPERTY, HOLKOL, CHOSEN

Upper view shows grading operations in progress at the site of the new Tul Mi Chung mill. Lower view shows the placing of the concrete retaining walls and foundations



SEOUL MINING CO'S PROPERTY, HOLKOL, CHOSEN

In the upper view is shown the rapidly advancing mill construction with much of the machinery on the ground. In the lower view, taken from above the Tul Mi Chung millsite, is shown the mill under construction and a portion of the surrounding country.

Editorials

The Birth of a Myth

Those who want to take the trouble may witness the development of a myth from its beginning. This is the belief, already held more or less extensively in Great Britain and Canada, that the American zinc-smelting industry is controlled by Germans, that they boosted the price for spelter to four or five times the normal in order to penalize their enemies and thus carry on warfare in one way if they could not in another. Nothing could be any more ridiculous or contrary to patent facts, yet without any doubt this myth will live and grow. Merely for the sake of the accuracy of the records, however, it is worth while to state the facts. Here they are: The zinc smelters of the United States, together with the number of their retorts, are listed annually. Their relative importance and their producing capacity are about in proportion to the number of their retorts. On Jan. 1, 1915, the total number of retorts in American zinc-smelting works was about 120,000. The firm of Beer, Sondheimer & Co., of Frankfurt-am-Main, has a New York agency, and is interested in the National Zinc Co., which possesses two smelteries with an aggregate of about 7500 retorts. The American Metal Co. is an American corporation, whereof numerous of its important officers are American born, but it is no doubt affiliated with the Metallgesellschaft, of Frankfurt-am-Main. The American Metal Co. owns and controls the Bartlesville Zinc Co., the Lanyon Starr Spelter Co., and the American Zinc & Chemical Co., which possess four smelteries with an aggregate of about 17,500 retorts. Consequently, these interests at the beginning of this year had an aggregate of about 25,000 retorts, a trifle more than 20% of the American total.

We are not intimating that these concerns, either of them or both of them, ever had any idea of playing tricks upon the buyers for the Allies, but are stating the plain fact that the control of the zinc-smelting industry has never been centered in any one quarter. It always has been, and still is, divided among a good many independent interests. The other big interests in the business are: The American Zinc, Lead & Smelting Co. (of Boston), the Edgar Zinc Co. (U. S. Steel Corporation), the Granby Mining & Smelting Co. (of St. Louis), the Grasselli Chemical Co. (of Cleveland), the Hegeler Zinc Co., Illinois Zinc Co., and Matthiessen & Hegeler Zinc Co. (of Illinois), the New Jersey Zinc Co. (of New York), and the United States Zinc Co. (a subsidiary of the American Smelting & Refining Co.). Recently, the United States Smelting, Refining & Mining Co. (of Boston) bought three old works and entered the business. The pedigrees of these concerns are so well known that no restatement of them is necessary.

The British must look nearer home to find out why the price for spelter was rushed upward so extravagantly. They will find a large part of the explanation in their own policy of "muddling along." Among other exhibitions of the muddling that may be mentioned are the unnecessary refinement in the spelter specifications and the farming out of ammunition contracts in ways that caused buyers in the same ultimate interest to appear as competitors of each other and to figure as being in the market for a great deal more spelter than was really the case. As an exhibition of ignorance, muddled with stupidity, the buying of spelter during the second quarter of 1915 was preëminent; nor does any great light appear yet to have burst through the shells inclosing the official minds.

The Recession in Copper

There is now a good deal of talk in the newspapers about the greatly increased production of copper, the greatly diminished exportation as compared with corresponding periods of 1914, and the recession in the price of the metal. In the absence of any statistics the trade is now in the dark respecting the actual rate of production. However, there is no doubt that the present production is very large, perhaps the largest on record so far as the United States is concerned, inasmuch as all of the important mines are being operated as strenuously as can be done. Nor is there any doubt that the exportation of refined copper in bars, cakes and ingots is less than it used to be, for there are definite statistics upon that subject. However, those statistics do not give the quantity of copper exported in the form of brass and other manufactures, which exportation has lately increased enormously. It is well known that the brass makers of Connecticut are working overtime.

With respect to the recession in price, the previous exaggeration of the Wall Street papers is now coming home to roost. The copper market did not at any time rise to 20½c. The high point was 20¼c., regular terms, which corresponds to a trifle more than 20c. cash, New York, the customary discount of ½ per cent. amounting to 10 points, while the average freight rate on deliveries is probably in the neighborhood of 10 points, making a total of 20 points. Some sellers reckon the average cost of delivery a little lower, while others reckon the total differential a little higher, there being usually a loss of interest of about 15 days in addition to the regular allowance of 30 days. Therefore the price of copper has declined from the level of about 20c., not 20½c.

The decline started immediately after the cessation of the great buying movement about the middle of June. The principal producers were then sold well ahead, and, being busy with their deliveries, they were more or less indifferent as to whether buyers wanted to contract immediately for more copper or not. On the other hand, there are interests that contractually have to take in copper all the time and must either accumulate it at the expense of capital or credit, or must sell it for what they can get. There are numerous small producers of crude copper who are confronted by the same conditions. The

recent recession in the price for copper has come about naturally through the efforts of such interests to find a level upon which the metal would move. There has been no pressure on the market and the inauguration of a new buying movement of important dimensions would no doubt lead to a sharp rally.

Indeed the situation of copper appears to be fundamentally strong. In spite of the increased production, the refiners agree that the stocks in their hands have not increased. The consumption of copper for ammunition will continue to be large, but most important is probably the coming increase in domestic, peaceful, consumption which the revival in the iron and steel industry—now a well-established fact—is believed to foreshadow.

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Tin Smelting in the United States

According to British reports, a well-known metallurgical corporation—Williams, Harvey & Co., Ltd., of Bootle—has informed its Bolivian clients by circular that it is establishing a modern tin-smelting works on an appropriate site in the United States for dealing with Bolvian *barrilla*. Other reports have associated this statement with the plan of the American Smelting & Refining Co., previously announced. We are authorized by a high officer of the latter company to state that its tin-smelting enterprise is in all respects an independent one. We have been unable to learn definitely respecting the plans of Williams, Harvey & Co.

The American Smelting & Refining Co. is making excellent progress with its plant near Perth Amboy. It expects to be able to begin the refining of tin before the end of the fall, and it hopes that the whole of the plant will be in operation by the middle of the winter.

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The Directorship of the Bureau of Mines

A matter of great concern to the mining industry is the appointment of a director for the Bureau of Mines in succession to Dr. Holmes. A good man in that important position can be very helpful to the mining industry; a bad man can be very harmful; a mediocre man may be neither the one nor the other, but may be simply the holder of a job. According to all accounts, the job-hunters are already out in great force, and also there are prevalent some queer ideas as to what constitutes the proper qualifications for a director of the Bureau of Mines.

A Washington paper that has come to our attention tells of some conference that occurred in Philadelphia, and concluded its story with this paragraph:

> Among other names discussed at the conference either with the indorsement of one or more of the conferees or presented at the suggestion of friends were: Sheriff A. Lincoln Acker, E. T. Stotesbury, Charlemagne Tower, Justice Robert Von Moschisker of the Supreme Court, Common Pleas Judges Charles Y. Audenried and J. Willis Martin; William T. Tilden, former president of the Union League; Louis J. Kolb, Attorney-General Francis Shunk Brown and Assistant District Attorney William Findlay Brown.

No, readers in the mining districts, East and West, we do not think that this was intended as a joke. In the minds of many persons a sheriff of a county, or an assistant district attorney, would be just as competent as the director of the Bureau of Mines as any mining engineer, mine operator, or mining scientist. Nor is it a humorous suggestion that the appointment may fall to some mining walking-delegate. In the appointment of the directors of the Census and of the Mint the experts were passed by, and we must make up our minds to the chance that the same disagreeable thing may happen with respect to the directorship of the Bureau of Mines.

It is the hope of the *Journal* that the President will appoint to this important position a man of high professional attainments and great distinction in the mining industry. We pray that the President will thus limit his choice.

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A Reported Steel Combination

A Cleveland correspondent, apparently of an imaginative turn, last week sent out a dispatch announcing the preliminary organization of a new combination to rival the Steel Corporation. According to his statement the new concern was to include the Bethlehem, the Jones & Laughlin, the Cambria, the Pennsylvania, the Lackawanna Steel companies and the Colorado Fuel & Iron Co., together with several minor companies and probably the Republic Iron & Steel Co. In brief, it was to include all the prominent independent steel makers and as many of the smaller concerns as one might care to mention. The new combination was to be headed by Charles M. Schwab as manager and Henry C. Frick as financier.

The publication of the statement was met by a chorus of denials from all the parties concerned. It is claimed that, so far from such a combination being partly organized, it was not even contemplated or considered by the parties chiefly in interest; and that the larger independent concerns had no idea of giving up their individuality or of becoming members of a new combine. So far as can be judged these denials are sincere, and no one now has it seriously in mind to organize a new combination.

Somewhat similar rumors have been circulated before, but the formation of new combinations would hardly be considered while the Government suit to dissolve the Steel Corporation was pending. The recent decision in that suit might be thought to open the way for further amalgamations, but the time for floating such consolidations as those of 15 or 20 years ago is past. To say nothing of the difficulty of floating the great mass of securities required, public opinion on corporations has materially changed since 1900, and there would be strong and natural suspicion of an attempt to divide the steel trade between two great corporations.

It is quite possible that there may be some consolidations and combinations, but nothing on the scale of the Cleveland rumor is probable. Nor are all steelmen satisfied that the great combination is the wisest and most economical. Certainly it is not desirable from a technical point of view; a great corporation is not usually favorable to change or progress.

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An interesting development in the mining industry that heretofore has escaped general attention is the fact that the Bawdwin mine of Burma is already producing. During the first six months of 1915 they are officially

reported as having produced 6500 long tons of lead, which is a very respectable output. An increase in the lead production of this great mine is to be expected later, when provision for the utilization of the zinc content and other values of its ore shall have been consummated.

BY THE WAY

When it comes to handling a "real-estate proposition" apply to the Department of the Interior. Ninety days ago the town of Anchorage, Alaska, was merely public land at the southwestern terminus of the new Government railroad. Now it has a population of over 2500, and nearly all branches of business are represented. On July 15 an auction sale of lots was held by the Alaskan Engineering Commission, and Chairman Edes telegraphed Secretary Lane the next day as follows: "Just returned from Anchorage. Sale in every way a success and everyone satisfied. About four hundred and fifty lots sold for one hundred thirty-three thousand dollars." Nearly $300 a lot was thus realized. Most of the lots were 60x140 ft., and streets, parkings and playgrounds were provided. Watch Alaska grow!

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Never argue with an expert. It is useless. There is no way of making headway against him. Though you may know much more than he does, you can't possibly get him to admit it. His main defense lies in the possession of his own special vernacular. No expert, says *Life*, is complete without a vernacular. Many experts have nothing more. In arguing with an expert, he always begins by assuming: (1) that you don't know what you are talking about, and (2) that if you did know what you were talking about, you couldn't talk about it intelligently, because you lacked the specific vocabulary that the subject demands. As the argument proceeds he spends so much time asking: "Just what do you mean when you use the word —?" And you spend so much time explaining your terms that you totally forget what you are arguing about.

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Two German ex-soldiers, Emil Propelle and August Tischer, brought into this country last year two packages of uncut diamonds from German Southwest Africa. They did not declare the stones when they landed here and were later arrested on a charge of smuggling. While doing military duty in Africa, they said they had grubstaked an old prospector who gave them the rough stones, now valued at $57,196, as their share. The ex-soldiers were tried and acquitted of the smuggling charge, but the German Government alleged that the diamonds were taken from the Colonial Mining Co.'s sorting department, and civil suits were brought. Since the war the German Government ceased its action, and yesterday Judge Hand ordered the litigation discontinued. Propelle and Tischer will now be allowed to keep the diamonds on paying $8000 customs duties.

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The Similkameen Consolidated Copper Co., of Scranton, Penn., is circulating a prospectus about a group of copper mines at Voigt's Camp, near Princeton, B. C. In a quotation from a report on the property by J. C. Law it is said: "By process of computation, this area, reduced to square and cubic feet to the average depth of 500 ft. only, from which I deduct 10% as unmineralized (probably nearer 50%), resolves itself roughly into 815,000,000 tons of ore. Assuming that only 1½% of coarse copper is recoverable therefrom . . ." Continuation, in the familiar way. If the estimate of tonnage be anywhere near correct, Voigt's Camp has Chuquicamata "skinned to death" and Utah is merely an "also ran." But we're from Missouri.

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Scientists have their troubles as well as ordinary people. Edward Hicks, a night geologist, according to the *Tribune*, was arrested on Long Island recently on a charge of chicken stealing. Hicks is a negro and found the night light most appropriate for his complexion and occupation. Here is the address to the court by which Hicks gained his release: "Jedge, youah honah, Ah wants to ask you, sah, did you evah heah of a night geologist? Dat's what Ah am, sah. And, jedge, youah honah, Ah wants to ask you, sah, did you evah heah of a scientific gem'man bein' 'cused of chicken stealin'? Jedge, youah honah, dey's not 'nuff words in all de langwidges to give expressin' to mah indignation, sah! Dis charge am mos' humilitin' to a membah of dat honorable prefession of night geologists of which, sah, Ah have de honah of bein' a humble and undistinguished membah." He showed his outfit, consisting of a lensless telescope barrel, being a "blind telescope" to locate rocks, a rock-tapping device and a textbook on rock composition. The court discharged him with the admonition hereafter to keep away from Plymouth Rocks in his geological researches.

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The deepest gold mine in the world, the St. John del Rey in Brazil, is also one of the oldest. It has just paid a dividend of 1s. 3d. on its ordinary share capital, which makes a total of 10% for a year. The company earned more than 10%, but did not deem it desirable to pay a larger dividend at present. The reasons, explained Chairman Harris at the annual meeting of shareholders in London, were connected with the great object that they all had in view, namely, the prolongation of the life of the mine below Horizon 20, which meant that they would be working the mine at a depth greater than $1\frac{1}{10}$ miles under the surface. They were now working the lode at Horizon 18. Shaft G had been sunk to the level of Horizon 20, and crosscuts were being driven from the shaft to intercept the lode at Horizon 19 and Horizon 20. The time was therefore approaching when they would have to decide whether they should or should not take the necessary measures for working the lode below Horizon 20. Their decision would depend upon several factors, the most important of which were the size and value of the lode at Horizon 20. If the lode was as good as it was at the lowest horizon they were now working—Nos. 17 and 18—they would be encouraged to proceed. In regard to the ventilation of the mine, General Manager Chalmers had suggested that the air which was passed through the mine for the purpose of ventilation should first of all be cooled and dried, and then distributed through the workings. If the mine is to be extended below Horizon 20, considerable capital expenditure will be necessary.

PERSONALS

Howard W. DuBois, of Philadelphia, is in Alaska.

W. D. Pearce is in New York from Chihuahua, Mexico.

W. C. Weisbrod is expected in New York Aug. 10, on his return from Chile.

E. R. Eaton, of Greeneville, Tenn., is stopping at Crown Point, N. Y., for the present.

C. E. Drayer has been chosen secretary of the Cleveland Engineering Society, of Cleveland, Ohio.

C. A. Burdick has returned to New York from some professional work in the Province of Quebec.

Kirby Thomas has returned to New York from exploration work in the southwestern part of Virginia.

Dan C. Tobin, of Colorado, is in New York on business connected with the sale of the Midland mine.

E. O. Daue has severed his connection as manager of the Dolores Mines Co. at Madera, Chihuahua, Mex.

Clyde M. Pearce announces the opening of an office as mining engineer at Ironton, Minn., on the Cuyuna Range.

Prof. J. C. Gwillim, of Queen's University, Kingston, Ont., has been on a visit of inspection to the Porcupine camp.

John A. Rice, manager of the Curry mine, at South Lorrain, Ont., has gone to El Paso, Tex., on a short vacation.

A. R. Whitman, lately geologist of the McIntyre Co., has been engaged by the Peterson Lake Mining Co. to examine its property.

W. J. Dobbins, formerly superintendent of the Buffalo mill, Cobalt, Ont., who has been for some time in Florida, has returned to Ontario.

Dr. R. W. Brock, dean of the College of Applied Science, University of British Columbia, has returned to Vancouver from a trip to the East.

E. A. Ling, who has been for some time engaged on an asbestos property near Broughton, Quebec, has gone to South America for the National City Bank of New York.

George E. Farish is making a geological examination of the southern part of Rio Arriba County, New Mexico, for New York mining interests. He is assisted by H. Palsgrove.

Gerald Sherman, general superintendent of the mine department of the Copper Queen Consolidated, of Bisbee, Ariz., was a recent visitor at the Panama-Pacific International Exposition.

L. S. Blackman, who returned to the United States recently from Guanajuato, Mex., sailed on July 24 for Chile, having accepted an engagement with the Chile Exploration Co. at Chuquicamata.

E. Steidel, in charge of the Bureau of Mines mine exhibit and first-aid and rescue demonstrations at the Panama-Pacific International Exposition, has been advanced by the bureau from the position of junior to mining engineer.

M. F. Ortin, Minister of Commerce and Labor in Russia, recently visited the La Grange hydraulic mine in Trinity County, California, the largest hydraulic mine in the world. He was desirous of familiarizing himself with American hydraulic methods.

Dr. E. A. Schubert, of the commercial department of the Norfolk & Western R.R., has been investigating some iron deposits in Ashe County, N. C. The extension of the Virginia-Carolina R.R., now in progress, will furnish transportation for these deposits.

W. T. Partridge, who has had editorial charge of the iron and steel and metal market news of the "Journal of Commerce," New York, has resigned after a connection of a number of years, to devote himself to general writing in the lines in which he is well informed.

George W. Metcalfe, general manager of the Mammoth Copper Co., Kennett, Calif., has recently been a visitor to the Panama-Pacific Exposition, where he has installed a glass model of the Mammoth mine. This model is in the California exhibit in the Mines and Metallurgy Building, which was established by the State Mining Bureau.

M. S. Brandt has severed his connection with the Seneca Consolidated Gold Mines Co. and is returning to Boulder, Colo., where he will resume work for the White Eagle Mining & Smelting Co. He will also open an office for general mining work and will continue his operation of the Nil Desperandum mine on his own account.

Colonel Thomas Cantley, second vice-president and general manager of the Nova Scotia Steel & Coal Co., has been appointed president retaining the managership. The offices of first and second vice-presidents have been abolished. Governor J. D. McGregor, of Halifax, late first vice-president, and W. D. Ross, of Toronto, are made vice-presidents, Mr. Ross being constituted head of the financial department.

SOCIETIES

American Iron & Steel Institute—The fall meeting will be held at Cleveland, Ohio, Oct. 22 and 23, according to a decision of the directors at New York, June 25.

Arizona State Bureau of Mines—The formation of this body was authorized by the Legislature of the state at its last session and the appointment of the members has been announced by the Board of Regents of the University of Arizona. The director is Charles F. Willis, who has been for two years past director of the University Bureau of Mines, which has been merged with the new organization. The secretary of the Board is Miss A. M. Heckman, who was secretary of the University Bureau. The other members are E. K. Goettel late of the University of Illinois, V. A. Gleason, late of the University of Washington and J. D. Arozena, of the University of Arizona. Mr. Goettel will have special charge of the investigation of the rare metals; Mr. Gleason is a specialist in flotation and ore dressing and Mr. Arozena will have charge of assaying, mineralogical determinations and ore testing.

American Institute of Metals—Among the papers to be read at the annual meeting in September are the following: D. H. Newland, assistant state geologist, New York, "Albany Sand"; William W. Clark, Seymour Manufacturing Co., "Manufacture and Use of Alumino-Vanadium"; C. V. Powell, British Aluminum Co., Toronto, Ont., "Some Developments in Aluminum"; W. M. Corse, The Titanium Alloy Manufacturing Co., "Copper-Aluminum Alloys"; S. L. Hoyt, University of Minnesota, "Amorphous State of Metals"; S. W. Parr, University of Illinois (two papers), "Method of Analysis for Complex Alloys," "Development on Acid Resistance Alloys"; F. A. J. FitzGerald, FitzGerald Laboratories, "Electric Furnaces for Brass Melting"; H. T. Kalmus, Kalmus, Comstock & Westcott, Inc., "Cobalt in Non-Ferrous Metals"; Thomas F. Wettstein, United Lead Co., "The Effect of the Present European War on the Metal Industries"; Elwood Haynes, Haynes Stellite Works, "Stellite"; Prof. D. J. Demarest, Ohio State University, "Analysis of Babbitt Metals."

INDUSTRIAL NEWS

The Garfield Smelting Co., Garfield, Utah, is installing a 48-in. Symons disk crusher.

The Hardinge Conical Mill Co., announces that the Anaconda Copper Mining Co. is preparing to install 24 more of the 10-ft. diameter Hardinge mills. This makes a total of 44 out of a contract which they made early this year for 60 of these machines.

Morse Bros. Machinery & Supply Co., of Denver, Colo., has purchased the entire power plant recently erected near Wickenburg, Ariz. This plant was built to furnish power for the Octave Mining Co., 14 miles distant, the power being generated at the railroad and transmitted to the mine. The plant consisted of 200- and 550-kw. Westinghouse alternators driven by Corliss engines. The steam plant consists of B. & W. boilers, fired with oil. The transmission line was operated at 22,000 volts and is 14 miles long. All of this material will be dismantled and sold, or removed to Denver. The smaller unit was in use three weeks and the larger one was never used.

The present high price of zinc ore is having a stimulating effect in the Wisconsin zinc district. The Dings Electro-Magnetic Separator Co. of Milwaukee, Wis., has recently closed three contracts for magnetic separator equipment to be installed in that district. The Vinegar Hill Zinc Co., Platteville, Wis., continues to enlarge the National roaster at Cuba City and has just ordered another large battery of Dings magnetic separators. The Utt-Thorne Co., of Platteville, Wis., is overhauling the custom roaster at Benton, Wis., and has purchased considerable new machinery, including a battery of Dings magnetic separators. Kistler & Stevens, Platteville, Wis., is equipping a roaster plant and has ordered a Galena Iron Works roaster and Dings magnetic separators.

Editorial Correspondence

SAN FRANCISCO—July 21

The Bunker Hill Consolidated Mining Co. in the first half of 1915 mined and milled 42,087 tons of ore, producing a total value of $151,591, or approximate average of $3.60 per ton. The total value is divided as follows: bullion, $48,415; sulphurets, $100,608; rent of tailings, etc., $2568. Mill operated 175 days, 10 hours. The mining expense including payroll, supplies, power and water amounted to $85,113; milling expense including the same items, $8881; sulphurets expense, including assaying, freight and road repair, $5110; a total of $99,104. The general expense amounted to $9338, and a new drill sharpener, hoist control and office equipment added $1350 to the expenses. This makes an aggregate total expense of operation $109,792. In the period from January to June inclusive six monthly dividends were paid amounting to a total of $30,000. A significant fact is disclosed in the item of the net value of the bullion produced. The return of $48,415 from the crushing of 42,087 tons of ore shows a recovery value of $1.15 per ton. The return of $100,608 recovered from sulphurets shows the average value of the sulphurets to be $2.36 per ton. The tailing from the Bunker Hill mill is treated in a merry-go-round and cyanide tanks under a rental or leasing system. The exact value of the tailings is not stated in company reports but the value received from the rental, $2568, probably represents about one-half tbe total value. The Bunker Hill has paid dividends for several years under the mine superintendency of E. Hampton. Since the necessity arose for installation of a new steel hoist and development of new orebodies, the per share rate of the dividends has been reduced from 5c. to 2½c. The recent installation of Hardinge mills at the Original Amador mine, a neighbor of the Bunker Hill, is expected to prove decisively that regrinding and cyanidation may be as successfully applied to the characteristic Mother Lode ores in the Amador City district as in the Plymouth district, where the first Hardinge mills were installed.

Mine Rescue and First-Aid Training is being given mining men upon application to the United States Bureau of Mines at the Panama-Pacific International Exposition. The station is at the mine exhibit in the Mines and Metallurgy building, and is in charge of several competent men of the rescue force of the Bureau. The first-aid class has been in session from 9 to 11 a.m. daily excepting Sundays, each morning taking up a certain phase of the work so that an applicant would have to attend six classes to cover the entire course. Mine-rescue training is also given on request. This work is of such character that it cannot be done properly by special arrangement of courses, but every effort is made to suit the applicant. The demonstrator of rescue work will spend a good deal of his time in the field in August and part of September, so that the regular classes cannot be continued at all times during these months. Men desiring to take this course of training should make application about two weeks in advance so that they may be provided with competent instruction. A number of miners and mining engineers have taken these instructions and have greatly profited by them. The instruction has been extended to certain branches of the fire department in San Francisco. As a part of the exhibit of the Bureau of Mines, the various paraphernalia employed in rescue and first-aid work are on exhibition, competent men being engaged in giving information to all who ask it. The exhibitions including the mining and metallurgical divisions and the Mine, were awarded one grand prize, six gold medals of honor and two gold medals by the Superior Jury of the Exposition, and all the collaborators in these exhibits received silver medals.

Two Deputy Mine Inspectors, G. Chester Brown and J. W. Gebb have been appointed in the mine-safety department of the California Industrial Accident Commission. Mr. Brown is the senior member in point of time. Other deputies will be appointed from the available list of men who passed the civil-service examination, at such time as their services will be required. The organization of the mine-inspection department is not yet completed and will not be until the tentative mine-safety rules have been finally revised and put into operation. The progress of the inspection of mines under state and United States control has been as rapid as is consistent with the demand for thoroughness. The chief inspector, H. M. Wolfiin, continues to make visits into the mining districts pending the completion of the rules and this work will be augmented by the services of the two deputies. It is not unexpected that the rules may be in some respects materially revised, but as a basis for thorough organization and practical operation the tentative rules have served the purpose and with such revision as is deemed necessary will be put into operation under the provisions of the workmen's-compensation law.

BUTTE—July 22

The Passing of Amalgamated—The dissolution of the Amalgamated Copper Company, the last of this month, will mark the completion of an important and interesting chapter in the history of the copper and other industries. Under the fostering wings of this mighty corporation the Anaconda Copper Mining Co. grew to manhood, as it were, and to be old enough and big enough to take care of itself. The protector has outlived its usefulness and its protegee has grown so great that it is now about to absorb the holding company, awaiting merely the formal action of a board of directors to complete the consolidation. Although the early development of the Anaconda mines under the late Marcus Daly demonstrated the vast possibilities of this property, the launching of the Anaconda Copper Mining Co. in 1895 with a capitalization of $30,000,000 was received with amazement in Butte and Montana. Nothing like it had been experienced in the mining history of the state. Big as the Anaconda stock appeared to the people of Butte, it paled into insignificance four years later when the Amalgamated company was organized with a capital stock of $155,000,000 and with Mr. Daly as its first president. He was succeeded by H. H. Rogers who held the position until 1909 when John D. Ryan became the president. In 1910 Anaconda increased its stock to $150,000,000 and absorbed the properties of the Boston & Montana, the Butte & Boston, the Washoe, the Trenton and the Parrot and finally the Butte Coalition companies, the latter having acquired in 1906 the Butte properties of the late Augustus Heinze. This was followed by the purchase of the W. A. Clark properties, including the Original and West Stewart mines. Thus the Anaconda company grew by leaps and bounds into a concern as big and as influential as Amalgamated itself and in the 21st year of its existence it becomes its own guardian, a free agent, responsible to no other corporation. What this phenomenal growth of the Anaconda company means to Montana and to Butte in particular, is hardly appreciated to its full extent by those who live within its influence. At the present rate of production, Anaconda supplies the markets of the world with more than 300,000,000 lb. of copper per year. The company shares its prosperity with its employees, who receive the highest rate of wages paid to this class of labor anywhere in the world. The daily expenditures of the company for labor alone amount to $50,000. Its taxes reach the sum of $2000 a day. Thus the growing activity of the Anaconda Copper Mining company is a vital factor in the development and prosperity of Butte and the state as a whole, a prosperity that attracts attention throughout the country.

SEATTLE—July 11

A $100,000 Winter Dump was the result of the working last year on Ruby Creek, the largest cleanup ever made in the district. The cleanup, which was finished in June, more than filled a washtub with gold.

GALENA, KAN.—July 17

Promoter Mining Co. Under New Management—M. E. Kirsh has succeeded J. C. Welch as superintendent. The company is operating on a 40-acre lease which it has from the New Century, southwest of Galena. There are 10 shafts producing paying ore. This tract of land has only been opened up for about six months and is fast becoming a great producer. The company is preparing to build a new mill on the ground to enable it to handle the dirt that comes from the mines. Mr. Kirsh was formerly with the Cherokee County Supply Co., but resigned to take charge of the Promoter property. It is the intention of the company to push the development work as fast as possible in order to open up the land while ore prices are good.

Bailey Bros. & Co. on the Southside land is making about $10,000 a week from its mine. It has been in operation for about a year, but recently went to the 150-ft. level and encountered a rich run of ore. A year's cutting is already blocked out and the company is preparing to build a mill to handle the dirt, as the mine has become too large a producer to send the dirt to custom mills.

HOUGHTON—July 18

The Story that Henry Ford is putting considerable cash into several development properties in the vicinity of the White Pine, a subsidiary of the Calumet & Hecla, is vigorously denied by the officials of the companies so connected. There was one story to the effect that Ford had purchased heavily of Onondaga and another to the effect that he was interested in White Pine Extension. While it may be possible that Mr. Ford has bought stock in these companies the officers have no knowledge thereof.

SALT LAKE CITY—July 16

Mining Activity Is General throughout the state, and everybody is working. Attention is called by the National Copper Bank of Salt Lake City to the fact that it is more than five years since there has been anything like the lively interest in mining that prevails today. Many new prospects are being developed; new camps are being found; and old camps and mines are renewing their former activity. The change is not wholly due to the higher prices received for some of the metals, but in part to the restoration of confidence, which has been going on during the last year, and which would doubtless have caused money to be spent in mining development even without the stimulus of higher metal prices. Many lessees are working in Tintic, and Bingham and other camps and there is more activity in Big Cottonwood than ever before. In the south fork of the latter district 14 mines and prospects are working, and employing 130 to 140 men. These properties include the Cardiff, Maxfield, Kennebec, Day's Fork, Big Cottonwood Consolidated, Tar Baby, American Consolidated, Price, Carbonate, East Carbonate, Reed's Peak, Alta-Cottonwood, Baker Group, and Cardiff Extension.

Bingham & Garfield Railway has been assessed $24,000 per mile by the county assessor for Salt Lake County as compared to $13,000 last year. Efforts were made by the company to obtain a reduction before the county commissioners on July 9, when it was pointed out that the rate of assessment is much higher than that fixed by the state board of equalization on any other railroad in the county. At the hearing the commissioners declined to grant any abatement. The question of the rate of taxation of the railroad was made a political issue a year ago, and was one of the points raised at the fall elections.

DENVER—July 16

At Leadville, Pumping at the Penrose continues under the most favorable conditions. The cutting of the station has now been under way about a week, and it is thought that another equal period of time will see this part of the work completed. After that the station pumps will have to be installed, and it will probably be a couple of weeks before any effort will be made to lower the water past its present level. Some idea of the immense body of water that has to be drained may be derived from the task which the sinking pumps now have in keeping the water down below the station level. During part of one night last week one of the machines was shut down, and with the other working at full capacity it took the water only five hours to rise within a few feet of the station. With the two pumps running, however, it would be possible to drain the shaft still deeper with a lift of 470 ft. or more to throw the water. No trouble has been encountered in cutting the station. One side near the shaft was rather inclined to cave, but it proved more of a help than a hindrance to the work.

KNOXVILLE—July 12

The American Zinc Co. of Tennessee has begun work in the addition to its plant at Mascot. The company has within the last few months spent $75,000 to increase its concentrating mill so that increased output might be secured. The company recently purchased the Roseberry mill, and with a large force of hands is placing the old plant in condition to give an additional output of 400 tons daily. H. S. Kimball, president of the American Zinc Co.

FAIRBANKS—June 21

Tolvana Has 300 Prospectors Now. Owing to the lack of machinery and water the output for this season will probably not exceed $10,000. About $1000 has already reached Fairbanks. The gold from Livengood Creek assays from 905 to 920 fine and nets from $18 to $19 per oz. Olive Creek gold assays 903 and nets about $18 per oz. August Peterson has abandoned his lease on Olive Creek and will move his plant to McCord and McCarthy's ground on Livengood.

Tolovana Still Looks Good to the placer miners, although not enough has yet been found to prove that the camp will be more than a small one. Pay has been found at several points for more than a mile along Livengood Creek and on several adjacent creeks, of which the most important seems to be Olive. Among the more recent discoveries may be mentioned that of Sullivan & Johnson, who have found pay at a depth of 118 ft. on the fourth-tier bench claim, right limit of Livengood. This pay is 500 ft. toward the hill from that lined up by Cascaden, Wagner and others, and is held to indicate a very wide paystreak. Dollar ground has been found on Gertrude Creek, a small "pup" entering Livengood at 5 Above Discovery. This paystreak is said to be about 12 ft. wide. Teddy Hudson has bonded No. 5 Above to Tom Knowles for $12,000.

TORONTO—July 24

The Government of Ontario on July 20 announced the appointment of a commission to enquire into the feasibility of refining nickel ore entirely within the province. The committee consists of George J. Holloway, London, England, chairman; Dr. Willet G. Miller, provincial geologist, Toronto; James McGregor Young, K. C., Toronto; and Thomas W. Gibson, Deputy Minister of Mines, Toronto, Secretary. The appointment of Mr. Holloway, as chairman, was made as the result of a consultation with the British Government, which desired that a competent metallurgist should occupy the position. In taking steps to secure an entirely suitable man, the British Institute of Metals was approached and Mr. Holloway was recommended as in every respect qualified for the post. He is an associate of the Royal College of Science, London, examiner in metallurgy in the Institute of Chemistry and University of Birmingham, and vice-president of the Institute of Mining & Metallurgy, London, in addition to holding other responsible positions. James McGregor Young is professor of constitutional and international law at Toronto University. No time will be lost in beginning the investigation. The Commission or some of its members will probably go to Norway to investigate the refining process employed in that country, and it is expected that at least one of the commissioners will visit New Caledonia to examine the methods in use there.

GUANAJUATO—July 15

Difficulty of Getting Supplies of any kind into the mines, or of shipping bullion from them, has necessitated a considerable curtailment of operations. It was intended to discontinue operations entirely on July 1, but it is not certain whether or not this has been done. Supplies of cyanide and other essentials to operation have been divided among the mills in order to postpone cessation as long as possible. If operations could be continued, that is, if supplies could be obtained, the operating companies would earn more money than in normal times, since they are purchasing ore on extremely favorably terms, and holding bullion until the proper opportunity appears to ship it out of the country and obtain payment in gold, or credit on that basis. About 100 Americans are still in the camp, but most of those having families have left or sent their families away. One recent arrival reports that it took him about 12 days to make the trip from Guanajuato to Vera Cruz, a journey which ordinarily can be made in 24 hours.

Pinguico Mine and Mill of the Guanajuato Development Co. has been abandoned some time ago due to the working out of the orebody. This property had a meteoric existence, having been discovered only since the operation of foreign companies on a large scale in Guanajuato. The Development company took over the mine, opened it up and milled ore averaging more than one kilo in silver for some years. The mill was a modern sand and slime installation of 200 tons daily capacity, but since the exhaustion of the mine, has been dismantled and used in other places. The San Matias mill and the Peregrima mill of the Development company have been worked as long as supplies could be obtained.

Guanajuato Reduction & Mines Co. has been operating the mill as long as supplies lasted, extracting some ore from the mines and filling up the remainder with purchased ore. Guanajuato has been annoyed by descent of large bands of the armed followers of one or another of the forces now combatting for power but has not been subjected to systematic looting as has been the case at Leon, the largest city in the state of Guanajuato. General Obregon, upon his entry into Leon, granted his soldiers a 3-hr. privilege of looting indiscriminately. At the end of that time little of value remained in Leon.

The Mining News

ALASKA

BONANZA COPPER MINING CO. (Valdez)—Ore on this property is now running about 70% copper and shipments so far average about $1,500,000 per month.

AMERICAN SMELTING & REFINING CO. (Tacoma, Wash.)—Copper refinery here, following a conference of this company and the Tacoma Smelting & Refining Co., will be doubled in capacity this summer.

NEW PLACER STRIKE has been made on Hadxana River opposite mouth of Birch. Find made on Trout Creek, but ground has not been sufficiently prospected to demonstrate extent of pay. Discoverers found 3 oz. of gold in the bottom of their first hole.

McWHORTER and ARTHUR (Stewart River)—New and permanent quartz camp has been established on Stewart River by development of this mine on Galena Creek in Mayo district. Shipment of 1500 tons silver ore recently made from mine to Tacoma smeltery and is expected to return $300 per ton.

THREE-MAN MINING CO. (Valdez)—Shipments of 800 tons made from this property on Landlock bay so far this year, and from 200 to 400 tons of picked ore will be shipped to smelter each month during balance of year, with larger shipments as facilities for handling are bettered. The present high price of copper is making the ore particularly valuable.

GRAFTER MINE (Whitehorse)—Closed down several years ago, is to be reopened and shaft, partly filled with water, now being pumped dry. Approximately 200 tons high-grade copper ore on dump now from old workings. With high price of copper many of the other copper properties of this district will start operations. J. P. Whitney, E. A. Dixon and George Armstrong are the owners of the Grafter.

THE MOST VALUABLE CARGO LEAVING ALASKA in the history of territory has recently cleared from Cordova on Steamer Mariposa of Alaska Steamship Co. carrying a cargo valued at $1,600,000, which consisted of 1200 tons of copper ore, $840,000; gold dust and bullion, $700,000; and raw furs from interior, $60,000.

ALASKA TREADWELL MINING CO. (Juneau) — Power plant for the Alaska Mexican claim of this company has been completed and is now in operation. Consists of one 750-kw. turbine and one 2000-kw. turbine, which are in addition to the former two units of 1000 each. A small log-crib dam was constructed during the winter at one of the power plants in order to increase the head with a corresponding increase in power. Lower part of mine is now being opened up by levels driven into it from 700-ft. level of Alaska United Co.

READY BULLION (Juneau)—Work started on a new incline shaft equipped with electric man- and ore-hoists, with steel headframe which will open up mine at a depth of 200 ft. below present level (2200 ft.). Old incline shaft started in footwall, but owing to unexpected straightening up of vein, is now well in the hard, greenstone hanging wall. The new shaft will keep entirely in the footwall slate, and will release large bodies of ore now remaining in the mine to support the old incline shaft where it crosses from the foot to the hanging wall.

NO. 13 ABOVE, FAIRBANKS CREEK (Fairbanks)—Allis-Chalmers 5-stamp mill shipped into Fairbanks district by Edward McConnell several years ago has been bought by Thomas Gilmore, who plans to erect it on No. 13 Above Discovery, Fairbanks Creek, adjoining Steilig custom mill.

RHOADS-HALL (Fairbanks)—J. H. Patterson plans to recrush accumulated tailing from Rhoads-Hall mine in tube mill that he is building in Fairbanks at shops of Samson Hardware Co. Mill is an experiment but Patterson hopes to recover several dollars a ton from tailings, and prove feasibility of undertaking.

GREAT INTEREST IN STIBNITE is being shown by Fairbanks quartz miners since Silas Scrafford shipped 120 tons of hand-picked antimony ore from the property of the Chatham Mining Co. Many gold-quartz veins carry stibnite, chiefly as isolated bunches comparatively free of quartz and barren of gold. Smith & McGlone plan to make test shipments from head of St. Patrick's Creek and Thomas Lloyd plans to send a small lot from Kantishna. Transportation companies have reduced rates to encourage industry.

ARIZONA

Maricopa County

BUFFALO-ARIZONA (Hot Springs)—Harry J. Bennett, of Phœnix, and associates have begun shipping copper ore to smelter at Humboldt. Considerable 15% ore on the dump.

Mohave County

CHARCOAL CAÑON (Kingman)—A. W. Clapp carrying on development work. Good orebody uncovered. Ore is lead carbonate mostly, but in shallow shaft a fine body of galena has been struck.

Cochise County

NEW CORNELIA (Ajo)—It is estimated by President Charles Briggs of the New Cornelia Copper Co., which is a subsidiary of the Calumet & Arizona company, that the pit equipment, power houses and other necessary works for the proposed 4000-ton leaching plant will cost over $3,000,000.

Yavapai County

ANTELOPE PARK (Rich Hill) — Dan B. Genung purchased mineral holdings of Harrison Yarnell. Preparing to develop the property on a large scale.

CALIFORNIA

Sierra County

MONARCH and CLEVELAND (Sierra County) — Quartz mines, being developed by R. G. Gillespie, of Pittsburgh, Penn. Mill running steadily on good ore.

PLUMBAGO (Alleghany)—Fifteen-stamp mill to replace plant destroyed by fire was built in less than one month and is running on rich ore, many hundred tons of which are blocked out and in sight. Owned and operated by Croesus Mining Co., of New York. W. B. Pearson in charge.

SACRED MOUNT (Sierra City)—Cyanide plant completed and in operation on tailings which assay over $9 per ton. Jay C. Folsom in charge.

SOUTH FORK (Forest)—Gravel and quartz. Vein has been encountered which is believed to be same as that in famous Tightner mine at Alleghany. Splendid returns being received. C. Weeks, of Los Angeles in charge.

SIERRA BUTTES (Sierra City)—Oldest quartz mine in Sierra County, and second oldest in California, operated continuously since 1851, has developed a new ledge 6 ft. wide, with 1100 ft. of backs, containing a payshoot that will practically make a new mine of the property. Hayes Brothers, of San Jose, owners. J. E. Westall in charge.

Shasta County

SALE OF ASBESTOS CLAIMS, 44 in number, and located on Mears Creek west of Sims, made recently to San Francisco men.

DREDGE INSTALLATION ON COTTONWOOD CREEK, near Gas Point, being made. Dredge of large capacity. Quarters for employees also being built.

NOBLE ELECTRIC STEEL CO. (Heroult)—Daily production 10 tons ferromanganese being made with one furnace. Second furnace to be started within few days. Ore is supplied by mines in Modoc county. Force of 80 men employed at plant.

MAMMOTH COPPER MINING CO. (Kennett)—Mine and smelting plant operating steadily. In addition to copper ore smelted, large tonnage 40% zinc ore being shipped to Oklahoma smelting plants.

MOUNTAIN COPPER CO. (Keswick)—New 250-ton concentrating plant put into operation recently. Only low-grade ore of mine concentrated; this is pyrite and chalcopyrite in silicified ground mass. Jig concentration used. On July 10, Shay locomotive of down-coming company ore train jumped track at trestle. Engineer and fireman killed.

BALAKLALA (Coram)—Prominent metallurgical men visited smelting plant recently. Statement given out by Mr. Newhouse indicates plans being made for resumption of operations at Balaklala smelting plant, Coram, after installation of some fume-precipitation process, probably latest Cottrell improvements. Smelting plant was closed July 1911 by "smoke suit" brought by farmers of valley.

Amador County

SOUTH EUREKA (Sutter Creek)—June dividend was paid July 15. Eighty-stamp mill in regular operation and 250 men employed. William H. Schmal is superintendent.

Butte County

EUREKA (Magalia)—This mine, on Little Butte Creek, has been purchased by Frank E. Whitlock and associates. Property was a good producer in early days.

SUCCESS & RUSSELL (Oroville)—G. W. Rumble, of Berkeley, made defendant in damage suit for $25,000, brought in Superior Court in Oakland by Barton Pitts, of Oroville. Pitts charges he was falsely accused by Rumble and arrested on a charge of stealing ore. Rumble was later arrested on a charge of perjury in connection with suit brought by B. J. Coglan to collect $5000 commission. Rumble has been in similar troubles connected with mining operations.

STEIFER MINING CO. (Chico)—Stockholders filed amended complaint in Superior Court asking that $51,000 assessment, recently levied by the directors, be declared invalid and directors restrained from selling stock for nonpayment of assessment. There are 530,000 shares, of which Steifers owns 209,064. Amended complaint alleges these shares were given Steifer by directors and that P. B., H. M., M. V., and Mary Steifer form majority of the directorate. The other members are J. M. Cline and Erasmus Wilson. It is also recited that two mortgages totaling $89,000, held by Mary Steifer against company are fictitious and that thousands of dollars expended in construction was done merely to make a showing and not for benefit of mine.

Eldorado County

RYAN (Shingle Springs)—Machinery being assembled for installation at this mine at Frenchtown, recently purchased by N. B. Ryan, of Manhattan, Nev. A 100-ton crusher will be installed.

COFFIN & REED (Placerville)—San Francisco men are negotiating for purchase of property and also Linden mine, owned by Stricker Co. Linden has been a producer. A 1400-ft. tunnel has been driven to work both mines, from which upraises will be run.

Kern County

WERINGER (Woody)—High-grade copper ore reported in addition to large body of medium-grade ore. This encourages contemplated installation of a 200-ton John D. Fields leaching plant. Plant will be electrically operated and will cost $35,000.

COLORADO

Boulder County

HERALD (Boulder)—R. M. Davis received settlement for lot weighing 8 tons. Net returns, $1287.50 assay showing 9.73 oz. gold and 5.50 oz. silver. Has wide vein from which he will be able to make similar shipments while reserving ore suitable for milling later.

FOREST HOME (Nederland)—While sinking shaft in this property of Boulder Tungsten Production Co., miners broke into flooded workings of Cold Springs No. 2 mine of Wolf Tongue Co. Nobody injured, but incident has aroused a question as to apex rights that may result in litigation. Cold Spring vein being one of best producers of Wolf Tongue Co. During past two years, leasers Munson and McKensie have shipped good tungsten ore from this vein. William Barnett, 82, while trench-mining, was killed by cave-in, on July 12.

San Miguel County

TOMBOY (Telluride)—New electric hoist installed at the Cincinnati shaft, to raise ore from Montana property to mill level. During June 100 cars of ore and concentrates were shipped from Telluride to the smelters. Shipments include 24 cars from Smuggler-Union, 12 cars from Liberty Bell, and 55 cars from Tomboy to the Durango smelter; and 8 cars of zinc concentrates from Colorado-Superior Mining Co. to Blende.

Teller County

LAST DOLLAR (Altman)—Contract has been awarded to sink the shaft 100 ft. to total of 1480 ft. Probable that sinking will be continued after completion of contract. Development operations in progress on 900-ft. level on company account, and four sets of lessees carrying on exploratory work in other parts of property. Much payable ore opened. M. B. Rapp, manager.

JERRY JOHNSON (Cripple Creek)—Cripple Creek Deep Leasing Co. has outlined plans for extensive campaign of development in this Ironclad Hill property. Lease has been secured on all ground below 650-ft. level and sinking will begin within a few weeks. The company proposes to sink shaft another 500 ft. Working fund of $25,000 has been provided to carry on work. New 100-ton cyanide mill nearing completion and will probably be ready for operation within next 30 days.

San Juan County

EMMA (Silverton)—J. A. McCrimmon is having a carload of heavy lead ore packed on burros from this mine in Ice Lake basin.

BIG GIANT (Silverton)—Peter Orella has developed a large shoot of milling ore and is shipping stuff from the high-grade streaks.

SILVER LEDGE (Silverton)—Louis Bonavidi, operating the mill under lease, is running steadily and making lead concentrate and zinc concentrate.

PRIDE OF THE WEST (Silverton)—John B. Giono is shipping small tonnage of high-grade while developing large body of low-grade milling ore.

MICHIGAN

Iron

WHITE PINE (White Pine)—Question of railway connections seems unsettled at present time.

PEWABIC (Iron Mountain)—Management has given orders to work on full time. Men have been working four days per week for a number of months. The mine will soon be exhausted of merchantable ore. Fifty miners have been added.

NORTH LAKE (Houghton)—Is sinking at the rate of 50 ft. a month on the way from the 340-ft. level to 800-ft. depth. Osceola lode at any time now.

NEWPORT (Ironwood)—New record for loading iron ore on Gogebic range made few days ago at Newport. In 10 hr. one shovel loaded 162 cars from stockpile. Nearly 8000 tons handled by one shovel. The best previous record held by Colby at Bessemer. That mine loaded 150 cars in same time.

SOUTH LAKE (Houghton)—New compressor is in operation and four more drills will start at work Tuesday, making 12 machines in all at work in this mine. They are increasing the stock pile to good size and shipments of rock will start very soon.

NEW ARCADIAN (Houghton)—Will probably make another shipment of rock before the end of this month. This rock will come from the south drifts and will be sent to the mill and smelter for the purpose of getting a good line on results that can be expected from southern openings. At the present all energies underground are directed to the development of the amygdaloids. No drilling is being done at present on the conglomerate recently opened.

FRANKLIN (Houghton)—Crosscut expects to hit the orebody and plans for further development depend on its character where cut. In the meantime the showing in the Allouez conglomerate continues rich. Eighteen machines are in operation and most openings are in better character rock than expected. Electric haulage will be installed immediately, meaning a saving in rock handling underground and an increase in rock shipments to 1200 tons per day.

HANCOCK (Hancock)—Is shipping 400 tons per day, average, but working 30 machines. Four of the Pewabic series are being opened, Nos. 3, 4, 8 and 9. This latter is the richest of the series and No. 4 is next in copper content. Good-grade rock is coming out and increase in shipments can be figured shortly. To date there are no smelter returns on the limited shipments already made. Work through the Quincy shaft likely to commence soon.

COPPER RANGE CONS. (Painsdale)—In addition to fact that both Baltic and Champion mines today are turning out richest continuous production of high-grade copper in their history fact also is generally known that all of development work underground is showing better-grade of rock than average in lives of these two mines. Trimountain continues to improve materially. From 20 to 27 levels of No. 2 good ground is developing. In Baltic, shoot from 28 to 29 levels in No. 3 is showing good ground.

MONTANA

Granite County

BOULDER MINING DISTRICT—Bond and lease has been taken by Butte parties on Bluebird group of mines, six miles above Princeton. Group consists of eight claims on which about 2200 ft. of tunneling has been done. Ore on different claims runs on an average of $67 a ton in gold and silver, copper and lead. The Butte men will start development work within a few days.

Mineral County

IRON MOUNTAIN MINE (Missoula)—Federal Mining & Smelting Co. bought this mine at a sheriff's sale, with mill and equipment for $111,000; 10% down, balance on delivery of deeds and possession. Company also owns power line, 11 miles long to Paradise, fully equipped power plant and substantial buildings. Mine located about three miles from Superior, the county seat. It is a silver-lead producer and hundreds of thousands of dollars were taken from it in the early days. Production began 14 years ago and lasted for 8 years, during which company paid more than $500,000 in dividends besides building a 250-ton mill and 15 miles of mountain road.

BUTTE & SUPERIOR MINING CO. (Butte)—Concentrates valued at $118,787 per ton recovered by oil-flotation process in company's mill during June, according to monthly statement filed in Federal court in compliance with order of court made in suit brought by Minerals Separation Co. Assays are highest recorded in mill in months, 36,206 tons of ore were treated in June and 8397 tons of concentrates were recovered at a cost of $4.08 per ton.

BULLWHACKER COPPER CO. (Butte)—Company is taking out ore at present from its property at rate that warrants fair profits from now on. During June, 37 cars of ore were shipped, for which a total of $3651 was received. June pay roll was $2748; net profits after paying all expenses were over $500. During July tonnage is being increased gradually and it is probable that there will be a profit of from $2500 to $3000 or close to $100 per day.

RAVEN COPPER CO. (Butte)—Notices have appeared in the daily papers that on Aug. 4, 1915, this company will sell at public auction to highest bidder, at Centerville, near Butte, all of its property in Silver Bow County, consisting of Raven lode-mining claim and interests in other smaller ones. Also town lots, mining and surface rights together with all buildings and improvements, all machinery and equipment. Sale to be held at shafthouse on Raven claim. Deposit of cash to the amount of $25,000 or a certified check for that amount, will be required before a bid will be accepted. J. A. Poore, Butte, is authorized to give further particulars. Raven is one of the older properties on the Anaconda hill and has been a large producer in days gone by. It has been idle for several years.

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—Crosscutting to central veins has been started from 2000-ft. point of the big main tunnel, and it is expected that one of them will be reached within a distance of 300 ft. depending on dip of veins. Good reports of developments and mineralization are being made to Butte office by Superintendent Hopkins.

ARGENTA MINING DISTRICT—A deal has been closed involving Lewis Phillips and Rittenhouse claims, and Rittenhouse millsite in this district. Property turned over to Alexander Walker of the National Oil Co., who represents outside interests who contemplate the development of large orebodies exposed in present workings and on surface. Ore exposed in said workings as high as 60% lead, 50 oz. silver and $7 in gold. On south end of property opencut work has shown good values in copper, gold and silver.

Silver Bow County

BUTTE DULUTH (Butte)—Captain Wolvin has been in New York for several months trying to raise funds to relieve financial situation. Now stated that he has been partially successful and will soon be back in Butte.

DAVIS-DALY (Butte)—Stoping begun on new orebody on the 2500-ft. level of Colorado mine. Orebody opened for 150 ft. and is reported to have average width of about 5 ft. and carry 4% copper.

ALICE MINE ORDERED SOLD BY COURT—Judge Bourquin in United States Court at Helena signed interlocutory decree July 3, under which property of Alice Gold & Silver Mining Co. will be offered for sale. Order made in action brought by Peter Geddes and other minority stockholders in Alice, who wanted sale to Anaconda company set aside. John Lindsay of Butte named as special master for purpose of carrying out decree. No bid for property below valuation at which property was taken over by Anaconda company will be considered. If no sale is made, then previous sale to Anaconda company will stand. Fifteen hundred dollars for 45 tons of ore taken from lease in Alice mine is the amount paid recently to mining man of Walkerville. Price averages $33.33 a ton and is for silver ore. There are number of leasers on Alice, as well as in other properties in Walkerville district. Unpatented claims to north of Walkerville for distance of two miles present busy outlook. More assessment work being done this month on over hundred claims. Tom Weber, one of leasers on West Salvador, has struck 6-in. silver vein at depth of 75 ft. Dave Davis has lease on same claim; is sinking 90-ft. shaft.

BUTTE-BALLAKLAVA (Butte)—Anton Donati and others have started suit against company to recover profits on lease of portion of company's mine. It is claimed plaintiffs and company entered into an agreement Feb. 1 last, in which former were to mine on 1600 level of property; that work was started on Mar. 17 and continued until Apr. 5, when plaintiffs were ordered to quit and surrender possession of place. It is alleged that company shipped ore from portions of which plaintiffs should have received $575.84. It is also claimed that 50 cars of ore were left in place from which they should receive as their share $5500. They say contract called for 30 days' notice before it could be terminated.

ACTIVITIES IN DISTRICTS TRIBUTARY TO HELENA—About 50 tons of ore are being treated daily and force of 25 men is employed in mine and mill of York Mining Co. whose property is located across Missouri River near Helena. L. D. Armstrong who is working two claims in Minnehaha gulch two miles above Rimini, started tunnel, last 60 ft. of which has been in ore running from $30 to $40 in gold and silver. Frank Jama, who is working prospect at head of Lump Gulch, struck vein of galena and lead-silver ore running $80 per ton. Ed. Hersky and associates of Helena have promising property in Centralia group, two miles south of Blossburg whence they are shipping ore every month that averages from $700 to $800 per car.

BUTTE-ALEX SCOTT (Butte)—Has declared dividend of 15c. per share. Local shareholders had expected 50c. New hoisting engine has been ordered and will be installed by Sept. 1. New headframe will also be built during August. Shaft will soon reach the 2200-ft. point and a new level will be opened. New cages and 3-ton skips also to be installed, all proposed improvements to cost about $25,000. About 200 tons ore per day hoisted. Will be increased to 300 and 350 tons. June production about 500,000 lb. copper.

TUOLUMNE (Butte)—Officers of company are still urging shareholders to "come through" with loans with which to provided a fund for resumption of operations, but responses are not very general. About $20,000 pledged and about $15,000 more is wanted to pay running expenses for a month or two until returns from ore shipments come in. There is a large quantity of ore in the upper levels of the Tuolumne that can now be mined at a profit. Years ago, when present management worked mine to make a showing, when insiders waived dividends and public was paid from the profits of high-grade ore that was mined, this low-grade was left undisturbed. In those days stock, on the company's fine showing and dividends, went to $5 per share, and when some facts became public it dropped to about 25c. per share. Now around 45 cents.

NEVADA

Esmeralda County

TONOPAH BELMONT (Tonopah) has cut 6 ft. of rich ore in raise above 1100-ft. level.

RESCUE-EULA (Tonopah) has broken through wall of main ledge on 900-ft. level.

MONARCH-PITTSBURG (Tonopah)—Northeast crosscut on eighth level has broken into commercial ore. Ledge cut is farthest west in district.

WEST END (Tonopah)—Is installing electric hoist below 600-ft. level in Butler ground, and will immediately begin extraction of ore under stipulations entered into recently.

Storey County

UNION CONSOLIDATED (Virginia City)—West crosscut on 2650 level extended to 710-ft. point, the face being porphyry and quartz.

OPHIR (Virginia City)—Saved 280 cars of mill ore from Central tunnel and milled 270 tons. Favorable indications throughout tunnel level in development work.

MEXICAN (Virginia City)—From 2300 level delivered to the mill bins 390 tons of ore, average assay value $8 per ton. Reopened main Comstock lateral drift on 2500 level. Crushed 135 tons of ore, averaging $8.26 per ton.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Received at mill 668 tons of dump rock and 199 tons of mine rock; shipped bullion to smeltery. New stope being opened in Belcher 1200 level, and 67 cars of mill ore saved.

UTAH

Summit County

PARK CITY SHIPMENTS for week ended July 9 amounted to 3,276,197 lb., by five shippers, the output being lessened somewhat by Fourth of July holiday.

MINES OPERATING (Park City)—Machinery from company's property being shipped to Tintic to be used at new plant to be constructed by Tintic Milling Co. Contract for excavation and building will be hurried so as to have plant in operation by Jan. 1, if possible. Geo. H. Dern is general manager.

Salt Lake County

SELLS (Alta)—Eight or 10 in. of sulphides carrying lead and silver being followed in south drift. Mineral-bearing ground opened for 150 ft. Two shifts being worked.

BINGHAM-NEW HAVEN (Bingham)—Parr lease at this property reported to be making money.

SOUTH HECLA (Alta)—Wedge orebody being prospected for on the 500 level, and 200 ft. additional work will be necessary to reach it.

CARDIFF (Salt Lake)—New equipment, including electrically-driven compressor, being installed. Surface improvements also are being made. Fifty-five teams hauling ore.

WASATCH MINES (Alta)—Zinc ore being shipped from the deposit on the hill, and lead-silver-copper ore from No. 5 stope of main workings. Indebtedness has been reduced to about $5000.

UTAH COPPER (Bingham)—Now operating at 100% capacity for first time in its history. Stripping is now so far advanced that mine can produce tonnage as rapidly as any increase in milling capacity can be constructed. One day, recently, 28,000 tons of ore were treated in mills whose original capacity was figured at 21,000 tons. It is believed that this can be increased to 30,000 tons per day without further construction cost.

UTAH-APEX (Bingham)—Some changes being made at the mill. Settling cones being taken out, and large shallow tanks installed, possibly also flotation machinery. Electromagnetic process may be employed later to separate lead and zinc. Daily shipments of 125 tons of lead ore and 100 tons of concentrates being made. Two miners caught in between Minnie and Andy tunnel levels were rescued after 20 hr. of imprisonment.

Iron County

SILVER PEAK (Lund)—Articles of incorporation have been filed by this company owning six claims in Blair district, 25 miles south of Lund. Capitalization is $10,000. R. B. Shepherd is president. Development consists of several shafts, and property has been opened to depth of 175 ft. There are about 60 tons of silver-copper-gold ore on dump.

COPPER ZONE (Lund)—This company, recently organized, will work claims in south Bullion Cañon, about four miles from Silver Peak. Capitalization is $10,000. There are two shafts, one 100 ft. deep, and one 200 ft. W. W. Wiscome is president.

Box Elder County

GRAND VIEW MINING (Ogden)—This company has been incorporated to develop zinc ore in neighborhood of the recent strike on Promontory Point. Capitalization $500,000. Incorporators are Chas. H. Smith president; O. H. Mohlman; G. Vaughn; W. P. Watson; G. Manning. Zinc ore of good grade opened recently on Promontory point, and is being shipped at a profit.

Juab County

GODIVA (Eureka)—Lead-silver ore with some gold being mined by lessees, from four blocks of ground.

RIDGE & VALLEY (Eureka)—Lessees mining lead-silver ore from 900 and 1100 levels. Work being done through the Gemini.

TINTIC SHIPMENTS FOR WEEK ended July 9 amounted to 131 cars by 21 shippers, as compared to 169 cars the week preceding. Lessened output being due to closing down of most of the mines over the Fourth.

LOWER MAMMOTH (Mammoth)—Ten blocks of ground are being worked under lease, from one of which—on 1500 level—car of 40% zinc ore was shipped week ended July 2. Company is producing silver-copper ore from 1000 level.

IRON BLOSSOM (Silver City)—Quarterly dividend of 5c. per share, or $50,000, declared, payable July 26. Heretofore regular rate has been 10c. per share, and thus far in 1915 $200,000 has been paid. Total to date amounts to $2,420,000. June shipments were 86 cars.

McINTYRE MILL (Silver City)—Several thousand tons of tailings from one of early mills on McIntyre ranch are to be marketed. These will be loaded on cars of S. P., L. A. & S. L. railroad near ranch, and shipped to Garfield. Value is principally copper, with some silver and gold.

GOLD CHAIN (Mammoth)—Ore carrying lead, silver and gold has been opened from 1500 level of Lower Mammoth, and shipment has already been made from this strike, considered one of most important in over a year. When orebody has been further developed connections will be made with main Gold Chain workings. Ore is being mined on 300-, 400-, 500- and 700-ft. levels. Eight cars were shipped in June.

CHIEF CONSOLIDATED (Eureka)—Dividend of 5c. per share been declared, payable Aug. 2 Rise in the price of lead added materially to earnings. Property is one of heaviest shippers in Tintic. Extensive leasing operations recently been inaugurated. Several additional mining claims in North Tintic lately acquired. Water secured for Scotia mine in West Tintic under lease to Chief, and pipe-line about a mile in length being laid so that this can be pumped over to mine and do away with hauling water from Cherry creek.

CANADA

Ontario

SCHUMACHER (Timmins)—Shaft down 440 ft. and being put down to 600-ft. level. Wide quartz vein has been cut at 300-ft. level.

TRETHEWEY (Cobalt)—Directors have been authorized by shareholders to purchase a controlling interest in the Rochester mine, on which work has been suspended for some years.

DOME LAKE (Porcupine)—Weekly cleanup July 15 realized over $5000. Vein on 400-ft. level 18-in. wide, said to run $20 per ton. Good ore also encountered in winze being put down from 180-ft. level.

VIPOND (Porcupine)—Strike recently made on 400-ft. level shows rich ore. Another find made on 200-ft. level. Management decided to issue a regular monthly statement.

HAYDEN (Timmins)—Camps for accommodation of 80 men have been erected. Plant comprising a compressor and hoisting outfit will be put in. Shaft down 100 ft. and two orebodies have been encountered. Ore growing richer with depth.

McINTYRE (Porcupine)—Has purchased controlling interest in Pearl Lake and new company will be formed to operate it, to be known as McIntyre Extension. Deal gives McIntyre use of the Pearl Lake shaft, 600 ft. deep, close to their boundary, and economies can be effected by joint operation.

PORCUPINE-CROWN—Between 50 and 60 tons of tailings already treated by amalgamation is being put through cyanide plant daily to extract residue of gold. Tailings have average gold value of $3.15 per ton and company has 15,000 tons on hand.

TEMISKAMING (Cobalt)—Statement for June shows bullion in storage and bagged ore amounting to 730,270 oz., valued at $350,000. In new vein system opened up on 400-ft. level there is vein 5 in. wide of 3500-oz. ore, which has been drifted on 135 ft. and is now within 20 ft. of Beaver line. New hoist being installed to reach lower contact between diabase and Kewatin at depth of about 1600 ft.

SOUTH AMERICA

Colombia

NECHI MINES (COLOMBIA), LTD. (Zaragoza)—Oroville Dredging Co., Ltd., parent company, reports that Nechi dredge is expected to be ready by the end of August to start work on San Francisco property, opposite the Pato.

The Market Report

Metal Markets

Again all of the principal metals were weak and reactionary, the declines in copper and spelter being considerable, while those in tin and lead were relatively slight.

Copper, Tin, Lead and Zinc

Copper—The market was dull and quotations throughout the week are essentially nominal, the producers transacting scarcely any business. Many of them were, however, trying to find a level upon which copper would move, and in their efforts they were more active than in the previous week. The transactions reported among dealers were devoid of significance, for the producers would not show their hands on relatively trifling business. All through the week copper was obtainable in round lots at sharp concessions, and during the latter part was to be had at 18@18¼c., regular terms, equivalent to about 17.80@18c., cash, New York. At the close of our week of record there were indications that domestic consumers would become interested at the existing level, or a shade lower.

The British Government decided to release raw copper for export with certain stipulations and guarantees, as we indicated last week. Some of such copper is now on the way to American refiners.

Copper Sheets have brought 25@26c. per lb. The principal manufacturer makes no base quotations. Wire is quoted at 21@21½c. per lb. at mill.

Copper Exports for the week ending July 10 are reported by the Department of Commerce at 5,934,615 lb., the larger items being 2,240,939 lb. to Russia, 1,612,389 lb. to France, 976,576 lb. to Italy and 922,763 lb. to England. Imports for the week were 6,742,089 lb. metal and 3,232,545 lb. in ore and matte; 9,974,634 lb. in all, from Japan, Canada, Chile and Cuba.

For the week ended July 17 the total exports were 6,361,262 lb. Imports were 6,021,033 lb. metal and 2,065,286 lb. in ore and matte; 8,086,319 lb. in all.

Tin—The price for this metal declined owing to continued lack of demand. Deliveries for July will be large, explaining to some extent the recent absence of buying.

Exports of tin from the Federated Malay States in June were 4048 long tons. For the half-year ended June 30 the totals were 24,902 tons in 1914, and 23,318 in 1915; a decrease of 584 tons this year.

Lead—The same conditions continued to exist as we reported last week. Producers firmly maintained their price of 5.75c., New York, and did some business thereat, while second-hands sold lead as low as 5.50c., New York. If a manufacturer desires to buy he is apt to find that he must go to the producers and pay their price, while if a trader has to sell, he is obliged to take what he can get. In other words, the lead market has been extremely narrow. There appear to be some signs of revival of buying for ammunition, and there are no discoverable signs of weakening on the part of the producers. On the contrary, the opinion is expressed that the maintenance of a price of 5.75c. is necessary in order to keep production up to the required level, which is considered to be necessary in view of the continued idleness of one of the large Coeur d'Alene producers. There is no reason to believe that the stocks of lead in the hands of smelters and refiners are increasing.

Spelter—The price declined from day to day upon offerings by smelters who were anxious to sell and consumers who had overbought their requirements and were desirous of disposing of their surplus. There seems to be considerable tonnage of spelter available for prompt delivery, and the difference in the prices for such and for fourth-quarter contracts is narrowing. The reported transactions for the week amounted to several thousands of tons, the aggregate being larger than in the previous week. Galvanizers were buyers to a small extent. A small tonnage was reported sold for export at the beginning of the week, but later there were no buyers either in England or France. Brass special spelter was sold at a relatively small premium over prime Western, transactions being reported at 19@19½c., including prompt delivery.

Zinc Sheets are strong, base price $27 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged. The demand is steady and business is good.

Exports from Baltimore for the week included 254,580 lb. zinc dross to Liverpool.

Other Metals

NEW YORK—July 28

Aluminum is rather quiet though there is a fair amount of business forward. Prices are just a shade easier at 31@33c. per lb. for No. 1 ingots, New York.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
July	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
22	4 7650	47⅛	*18 55 @18 80	36¼	5 55 @5 75	5 50 @5 55	17 00 @18 50
23	4 7638	47⅛	*18 30 @18 55	36½	5 55 @5 75	5 50 @5 55	16 50 @18 00
24	4 7650	47¼	*18 00 @18 25	36½	5 55 @5 75	5 50 @5 55	16 50 @18 00
26	4 7638	47⅞	*17 80 @18 00	36¼	5 50 @5 75	5 40 @5 50	16 25 @17 75
27	4 7650	47½	*17 80 @18 00	36	5 50 @5 75	5 40 @5 50	16 00 @17 50
28	4 7644	47¼	*17 80 @18 00	35⅞	5 50 @5 75	5 40 @5 50	15 75 @17 00

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6 3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
July	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
22	22 7/16	75¼	76¼	90½	19 27	165	162	24½	5 24	96	20 44
23	22½	74½	75⅝	89½	19 05	162½	160¼	24½	5 22	96	20 44
24	22 7/16	...	...	...	...	...	...	...	...	...	...
26	22½	71½	72⅞	88½	18 85	161½	159½	24½	5 22	93½	19 91
27	22½	72¼	73¾	87½	18 64	161¼	160	24⅜	5.19	92½	19 70
28	22⅜	72	73¼	87½	18 64	160¾	160	24⅜	5.19	92½	19 70

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15. = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Antimony—The market has been quiet with a small business reported, and buying rather slow. Ordinary brands bring 35½@37c. per lb. Cookson's is held nominally at 48c. per lb., but is being small.

Quicksilver—The market is strong but with less active demand than there has been. Prices show no material change. New York quotations are $92@94 per flask of 75 lb. for large lots, while $95@99 is paid for small orders. San Francisco reports by telegraph $92.50@95 per flask, on a quiet market. London price is £18 5s. per flask, with £18 2s. 6d. quoted from second hands.

Nickel is steady and unchanged at 40@50c. per lb. for ordinary forms, according to size of order. Electrolytic 3c. per lb. higher.

Minor Metals—Current sales of **Bismuth** are at $2.75@3 per lb. New York. The London price is quoted at 10s., or $2.40 per lb. there—**Cadmium** is quoted at 6s., or $1.44 per lb. in London; $1.50 per lb., New York.—**Tellurium** is reported sold at 80s., or $19.20 per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50@5 for retail lots.

British Imports and Exports of Metals other than iron and steel, six months ended June 30, in long tons:

	Imports		Exports	
Metals:	1914	1915	1914	1915
Copper	85,321	115,806	32,282	16,931
Tin	24,013	22,229	22,241	22,867
Lead	110,101	134,723	27,227	30,692
Zinc	65,266	52,163	5,673	1,543
Quicksilver	1,178	792	401	151
Minor metals	4,822	2,561	13,732	9,531
Ores, etc.				
Tin concentrates	19,799	25,158	.....	.....
Pyrites	419,493	493,300	.....	.....

Copper imports include metallic contents of ore, matte, etc. Exports include reëxports of foreign material.

Gold, Silver and Platinum

NEW YORK—July 28

Gold Imports in Great Britain six months ended June 30 were £6,010,211; exports, £5,530,544; excess of imports, £479,667. Comparisons with 1914 are of no use, as imports from South Africa, Australia and India have ceased, the gold produced being held in those countries subject to order, to avoid shipping risks.

Platinum shows slightly more demand with some signs of increased activity, but no material change in the market. The quotations continue about $37@39 per oz. for refined platinum and $41@44 per oz. for hard metal.

Silver—The tone of the market is without animation. London advises, if it were not for the scantiness of supplies, it would be difficult to maintain prices. At the same time a revival in demand would cause a rally in prices.

The London quotation for silver on July 16 was 22⅝d., instead of 22½d. as given in our table. The error was caused by a mistake in transmission.

Silver shipments from London to the East Jan. 1 to July 14, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£3,946,000	£2,800,000	D. £1,146,000
China	40,000	5,000	D. 35,000
Total	£3,986,000	£2,805,000	D. £1,181,000

Imports of Silver in Great Britain six months ended June 30 were valued at £5,725,215; exports, £4,280,369; excess of imports £1,444,846, which compares with an excess of exports of £1,452,529 in 1914. Of the imports this year £4,171,755 were from the United States.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 24

The base price this week was lowered to $105 per ton for 60% zinc ore. The base price paid for 80% lead ore was $60 per ton.

SHIPMENTS WEEK ENDED JULY 24

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,721,500	89,700	439,480
Year	105,762,220	4,083,160	15,201,650

Shipped during week to separating plants, 4,267,300 lb. zinc ore.

JOPLIN, MO.—July 24

Blende, high price $117.50; base per ton of 60% zinc, premium ore $115; medium $105@95, and $90 was as low as was paid for the lowest grades in carlots. Calamine base per ton of 40% zinc, $56@60 in ton and up to $80 in carlots. Average price, all grades of zinc, $107.06 per ton. Lead, high price $61.50; base, $60 per ton of 80% metal content; average, all grades of zinc, $59.59 per ton.

SHIPMENTS, WEEK ENDED JULY 24

	Blende	Calamine	Lead	Values
Totals this week	11,266,740	715,980	1,554,990	$687,730
Totals this year	322,177,000	27,801,370	48,763,180	13,790,670

Blende value, the week, $618,580; 30 weeks, $11,901,190.

Calamine value, the week, $22,820; 30 weeks, $600,290.

Lead value, the week, $46,330; 30 weeks, $1,289,190.

Mining operations have resumed an entirely normal stage again, and the shipment is above an average one. The two weeks of the strike gave the miners a rest and they returned to work in better spirits and with more action than had been displayed for two months.

Iron Trade Review

NEW YORK—July 28

The iron and steel markets continue to advance, though this month is usually about the dullest of the year. Domestic as well as export orders are in evidence.

A good increase is evident in structural steel, which has been rather slow. New orders are being closed and there is an evident increase in building activity.

There has been enlarged inquiry for foundry and basic pig iron, and prices generally are firmer, even showing some increase.

Imports at Baltimore for the week included 1403 tons ferromanganese from Liverpool and 9700 tons manganese ore from Brazil.

Exports from Baltimore for the past week included 12,021,292 lb. miscellaneous iron and steel products to Great Britain.

The United States Steel Corporation reports for the quarter ended June 30 that net earnings, after deducting expenses for renewals, repairs, maintenance of plants, interest on bonds and fixed charges of subsidiary companies, were as follows:

	1914	1915
April	$6,920,879	$7,286,409
May	6,845,823	9,320,576
June	6,690,894	11,343,070
Quarter	$20,457,596	$29,950,055
Depreciation, reserve fund, etc.	.....	$6,031,013
Interest and sinking fund	.....	7,346,478
Dividend, 1¼% on preferred stock	.....	6,304,919
Total charges		$19,682,410
Surplus for the quarter		$8,267,615

No dividend was declared on the common stock. The increase in net earnings over the quarter ended Mar. 31 was $15,492,246, showing the great improvement in the steel trade during the past three months. For the half-year ended June 30 the net earnings amounted to $38,451,977 in 1914 and $40,407,864 in 1915, an increase of $1,955,887. The large earnings of May and June more than offset the heavy decrease in the first quarter as compared with 1914. The surplus shown was made notwithstanding an increase of $1,800,000 in the depreciation and replacement funds.

Foreign Iron Trade of Great Britain, six months ended June 30, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£17,771,936	£4,177,263 Exp.	£13,594,733
Machinery, hardware, etc	14,869,771	7,140 804 Exp.	7,728,967
Totals	£32,641,767	£11,318,067 Exp.	£21,323,700
Totals, 1914	54,574,872	16,221,953 Exp.	38,352,919

Quantities of iron and steel exported, 2,376,264 tons in 1914 and 1,448,502 in 1915; imported, 1,170,989 tons in 1914 and 511,012 this year.

The British Iron Market is reported quiet, with fair production. Some current quotations for pig iron are: East Coast hematite (bessemer) pig, $24 per ton; Cleveland No. 3, $16.32. Some prices for finished iron and steel are: Steel plates, $48 per ton; steel angles, $46.80; iron ship plates, $48; iron ship angles, $52.60; iron bars, $52.80, less 2½%; steel rails, $42 per ton, net.

PITTSBURGH—July 27

The steel mills are rapidly filling up with orders. In bars the earliest delivery promise on new specifications is about six weeks, while on some sizes the time is much longer. Even plates and shapes, the demand for which has been relatively light, are not being promised earlier than Sept. 1 by the Carnegie Steel Co. In wire the demand is well above normal, in blue annealed it is quite heavy while in sheets it is

improving. Galvanized sheets have declined to 4.25c., but merely on account of the decline in spelter.

Openhearth steel has become scarce, although the full capacity is productive. Full employment of bessemer capacity depends upon whether enough buyers will be content to accept that description of steel, prospects being that they will have to lay aside their scruples.

A considerable part of the steel buying of the past fortnight has been due to buyers endeavoring to lay in stocks since they can no longer depend upon practically immediate shipments from mill and there is every reason to expect this demand to set the mills much farther behind in deliveries, so that it is universally believed the steel industry is booked for capacity operations for a period of months at least, and probably of years.

The Steel Corporation's earnings in the second quarter, announced this afternoon at $27,950,055, prove slightly larger than was expected in Pittsburgh steel circles. Earnings not far from $35,000,000 are now expected for the current quarter.

Steel bars are strong at 1.30c., with plates and shapes at 1.25c. to 1.30c. Sheets are 4.25c. for galvanized, 1.75c. to 1.80c. for black and 1.35c. to 1.40c for blue annealed

Pig Iron—The local market is quieter again, but is regarded as very firm. Sales of bessemer of 1500 tons and 450 tons respectively are reported at $14.25, Valley, an advance of 25c. over the market quoted a week ago. We now quote: Bessemer, $14.25; basic, $13; foundry and malleable, $12.75@13; gray forge, $12.50@12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Sales of prompt continue to be made at $100@105, while the contract market is $100, Baltimore, with not much activity.

Steel—Quotations on openhearth steel are largely nominal, while bessemer quotations have not been seriously tested, the current demand being almost wholly for openhearth. We quote: Bessemer billets, $21; bessemer sheet bars, $21.50; openhearth billets, $22; openhearth sheet bars, $22.50, f.o.b. maker's mill, Youngstown, and $1 higher delivered Pittsburgh. Rods are firm and scarce at $26, Pittsburgh.

United States Foreign Trade in iron and steel and manufactures thereof is valued by the Department of Commerce as below for the five months ended May 31:

	1914	1915	Changes
Exports	$84,151,409	$107,348,938	I. $13,197,529
Imports	13,142,197	8,046,871	D. 5,095,326
Excess, exports	$81,009,212	$99,302,067	I. $18,292,855

The increase in exports this year as compared with 1914 was $4,863,080 in March and $6,802,567 in April. In the month of May the quantity of those exports which are reported by weight was 246,530 tons, against 134,605 tons in May, 1914. The larger increases were in billets, bars, sheets and wire.

FOREIGN IRON

Pig Iron Production in Germany, as reported by the German Iron & Steel Union, was 985,968 metric tons, which is 47,289 tons more than in April, and 621,243 tons less than in May, 1914. For the five months ended May 31 the total was 7,756,901 tons in 1914, and 4,540,841 tons in 1915; a decrease of 3,216,060 tons, or 41.5%, this year.

German Steel Production in April is reported by the German Iron & Steel Union at 1,012,334 metric tons, which is 85,977 tons less than in March. For the four months ended Apr. 30 the make was:

	Basic	Acid	Total
Converter ingots	2,049,649	49,650	2,099,289
Openhearth ingots	1,676,394	64,717	1,701,111
Direct castings	120,199	34,485	154,675
Crucible steel		33,015	33,015
Electric steel		32,498	32,498
Total	3,846,223	214,365	4,020,588
Total, 1914	5,983,589	248,749	6,232,329

The total decrease this year, as compared with 1914 was 2,211,741 tons, or 35.5%. There are 234 steel works reported in operation this year.

IRON ORE

Eastern Pennsylvania furnaces have purchased some trial lots of the off-grade Lake Superior ores which have been offered recently at attractive prices. These purchases have consisted chiefly of an old-range nonbessemer of 48% iron and 13% silicon content, which have been taken at about 7.1c. per unit of iron delivered to the furnaces, or on the basis of about $1.80 at lower lake ports.

Imports and Exports of Iron Ore in the United States, five months ended May 31, in long tons:

	1914	1915	Changes
Imports	520,398	432,766	D. 87,632
Exports	15,396	22,290	D. 137,106

Imports of manganese ore were 112,120 tons in 1914 and 27,137 in 1915; decrease, 84,983 tons.

French Imports and Exports of iron ore for two years, in metric tons.

	1913	1914	Changes
Imports	1,410,424	698,319	D. 712,105
Exports	10,066,627	4,767,194	D. 5,299,433

The heavy decreases shown were due entirely to the war, which has closed the most productive iron-ore mines and a number of furnaces.

Imports of manganese ore were 258,929 tons in 1913, and 153,449 in 1914; decrease, 105,480 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 371,144 short tons; shipments, 365,615 tons. Production in the Greensburg and upper Connellsville districts was 42,067 tons.

Connellsville—The prompt furnace coke market has been unable to stand the recent increase in production, coupled with orders from five consumers to curtail shipments on contracts temporarily, and the market has broken from $1.70 to $1.60, with no takers at the lower price. There are no negotiations of importance for contract coke. We quote: Prompt furnace, $1.60; contracts over third quarter, $1.75; contracts over second half, $1.85@2; prompt foundry, $2.10@2.40; contract foundry, $2.25@2.60, per net ton at ovens.

Coal and Coke Tonnage, Pennsylvania R.R. lines east of Pittsburgh and Erie, six months ended June 30, in short tons:

	1914	1915	Changes
Anthracite	5,560,680	5,423,467	D. 137,213
Bituminous	21,973,572	20,261,777	D. 1,711,795
Coke	5,196,084	4,998,919	D. 197,165
Totals	32,730,336	30,684,163	D. 2,046,173

The total tonnage for the month of June this year was 5,498,232, an increase of 181,576 tons over June, 1914; the gain being chiefly in coke.

Foreign Fuel Trade of the United States, five months ended May 31, as reported by the Department of Commerce in long tons:

	Exports		Imports	
	1914	1915	1914	191
Anthracite	1,439,402	1,371,955	4,291	222
Bituminous	4,564,531	4,427,832	567,173	604,337
Coke	305,611	242,151	38,387	14,900
Bunker coal	3,157,120	2,963,277		
Totals	9,466,664	9,005,215	609,851	619,459

The bunker coal, or coal furnished to steamers in foreign trade, is practically all bituminous. Exports of bituminous coal in May increased 320,464 tons, chiefly in shipments to Brazil and Argentine.

Chemicals

NEW YORK—July 28

The general market is quiet; indeed no great activity is to be expected at this season, when midsummer dullness is the rule.

Arsenic—Very little is doing in this article. The market is dull, but not especially weak. Prices are unchanged at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—There is nothing new. On a quiet market prices are steady. The current quotations are $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is fair for the season, and is steady, with prices unchanged. Quotations are 2.35c. per lb. for spot and for all positions this year.

Pyrites—Imports at Baltimore for the week included 4[illegible] tons pyrites from Huelva, Spain.

NEW CALEDONIA

Exports of minerals from New Caledonia for four [illegible] past have been as follows, in metric tons:

Ores:	1911	1912	1913	1 [illegible]
Nickel	120,059	74,312	93,190	[illegible]
Cobalt	[illegible]	[illegible]	[illegible]	[illegible]
Chrome	32,806	51,516	63,370	71 [illegible]
Mattes:				
Nickel	2,993	5,098	5,893	[illegible]
Cobalt	[illegible]	[illegible]	[illegible]	25

In 1914 the exports included 305 tons nickel matte and 25,102 tons chrome ore to the United States direct

Assessments

Company	Delinq.	Sale	Amt.
American, Ida	Aug. 7	Sept. 2	$0 001
Blue Bell, Ida	July 5	Aug. 4	0 003
Challenge Con., Nev	July 12	Aug. 4	0 05
Con. Virginia, Nev	July 19	Aug. 10	0 05
Contact Copper, Mich	May 15		0 50
East Hercules, Wash	Aug. 10	Sept. 10	0.0015
Eastern Star, Ida		Aug. 24	0 002
Four Timbers, Ida	July 28	Aug. 28	0 001
Hancock Cons., Mich	Sept. 1	....	1.00
Hancock Cons., Mich	Jan. 3	......	1.00
Houghton, Mich	May 25		1.00
Idaho-Nevada, Ida	July 14	Aug. 6	0 001
Iron Mask, Ida	July 1	Aug. 10	0 002
Ivanhoe, Ida	July 12	Aug. 12	0.002
Majestic-Idol, Nev.	Dec 15	July 20	0 005
Mayflower, Ida	June 15	July 17	0 005
Michigan Copper, Mich	July 19	....	1.00
Mineral Range, Utah	May 24	....	0 003
Monarch Pitts., Nev.	June 14	July 14	0 01
Moonlight, Ida	June 5	July 8	0 005
Nabob, Ida	July 5	Aug. 2	0.005
New Arcadian, Mich	June 1		0 50
New Arcadian, Mich	Dec. 1	...	0.50
New Baltic, Mich	July 15		0.50
New Baltic, Mich	Jan. 15		0 50
New Yerrington Cop., Nev	July 9	July 27	0 01
Nevada Douglas, Nev.	July 21	Aug. 18	0.10
North Bunker Hill, Ida	June 12	July 17	0 002
Old Veteran, Ida	July 5	July 31	0 002
Oreano, Ida	Aug. 2	Sept. 2	0 0015
Rainbow, Ida	July 7	Aug. 7	0 002
Rescue-Eula, Nev.	July 14	Aug. 19	0.01
Revelator, Utah	Aug. 17	Sept. 3	0.00½
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Rhode Island, Ida	June 24	July 24	0 001
Sierra Nevada, Nev.	July 27	Aug. 16	0.05
Sonora, Ida	July 23	Aug. 31	0.004
Springfield, Ida	July 30	Aug. 30	0.002
Sunrise, Ida	July 17	Aug. 17	0 002
Sunset Dev., Ida	June 30	July 24	0 0025
Tarbox, Ida	July 17	Aug. 7	0.0025
Tonopah Gypsy Queen, Nev	July 12	Aug. 17	0 00½
Umatilla Tonopah, Nev.	July 12	Aug. 16	0 01
Virginia, Ida., (post.)		July 29	0 02
West Tonopah Con., Nev	July 10	Aug. 10	0.01
Wyandot, Mich	July 28		1 00

Stock Quotations

Among sales at auction during the week were: New Mexico-Colorado Coal & Mining Co. 2½ com. trust certs., $4 lot; same company, $750 Series A income bonds, 1941, $12 lot.

COLO SPRINGS July 27 Name of Comp.	Bid.	SALT LAKE July 27 Name of Comp.	Bid
Acacia	03	Beck Tunnel	03
Cripple Cr'k Con.	0095	Black Jack	10½
C. K. & N	‡ 03	Colorado Mining.	08½
Doctor Jack Pot	10	Crown Point	01½
Elkton Con	33	Daly-Judge	7 50
El Paso	90	Gold Chain	20
Findlay	04	Grand Central	60
Gold Dollar	01	Iron Blossom	71
Gold Sovereign	03¼	Little Bell	10
Golden Cycle	1 78	Lower Mammoth	03
Isabella	15¼	Mason Valley.	2 00
Jack Pot	07	May Day	21
Jennie Sample	‡ 02	Opohongo	00½
Jerry Johnson	05¼	Prince Con	75
Lexington	004	Seven Troughs	01½
Mary McKinney	57¼	Silver King Coal'n	3 52½
Pharmacist	‡ 005	Silver King Con	2 00
Portland	1 43	Sioux Con	02½
Raven B. H.	02	Uncle Sam	03½
Vindicator	1 75	Yankee	.08

TORONTO July 27

Bailey	‡ 02	Dome Exten	18
Coniagas	4 00	Foley O'Brien	28
Peterson Lake	21	Hollinger	25 00
Right of Way	03	Imperial	06
Seneca Superior	‡.90	Jupiter	10
Silver Queen	‡ 01	McIntyre	48
T. & Hudson Bay	18 00	Pearl Lake	01
Timiskaming	34	Porcu. Crown.	90
Wettlaufer-Lor	02	Preston E. D.	03
Dome Mines	23 75	Rea	‡ 10

SAN FRANCISCO July 27

Comstock Stocks		Misc. Nev. & Cal.	
Alta	07	Belmont	3 55
Andes	07	Jim Butler	83
Belcher	25	Lone Star	04
Best & Belcher	06	MacNamara	01
Caledonia	20	Midway	10
Challenge Con	07	Mont.-Tonopah	35
Confidence	10	North Star	12
Con. Virginia	10	Rescue Eula	07
Gould & Curry	03	West End Con	65
Hale & Norcross	04	Atlanta	.10
Julia	01	Booth	49
Mexican	42	C. O. D. Con	03
Occidental	79	Comb. Frac	08
Ophir	16	Jumbo Extension	1 52
Overman	07	Pitts-Silver Peak	10
Potosi	02	Round Mountain	45
Savage	03	Sandstorm Kendall	07
Sierra Nevada	09	Silver Pick	09½
Union Con	14	Central Eureka	16
Yellow Jacket	30	So. Eureka	‡1 50

N. Y. EXCH. July 27 Name of Comp.	Clg.
Amalgamated	71¼
Am.Sm.&Ref.,com	77¾
Am. Sm. & Ref., pf.	106½
Am. Sm. Sec., pf. B.	80
Anaconda	66½
Batopilas Min	1⅛
Bethlehem Steel	247
Bethlehem Steel, pf.	140½
Chino	44
Colo. Fuel & Iron.	36
Federal M. & S., pf.	46
Great Nor., ore., ctf.	37½
Guggen. Exp	59½
Homestake	117¼
Inspiration Con	29¾
Mex. Petroleum	73½
Miami Copper	26½
Nat'l Lead, com.	62
National Lead, pf.	108½
Nev. Consol	14
Ontario Min	2½
Quicksilver, pf	4
Ray Con	22¾
Republic I&S, com.	37
Republic I&S, pf.	93¾
SlossSheff'd, com.	39
Tennessee Copper	36½
Utah Copper	64
U. S. Steel, com	65¾
U. S. Steel, pf.	111½

N. Y. CURB July 27	
Alaska Juneau	11⅞
Alta Con	.82
Beaver Con	.30
Big Four	05
Blue Bell	‡ 02
Braden Copper	6½
Buffalo Mines	⅞
Can. Cop. Corpn.	13/16
Can G. & S.	‡.05
Cashboy	‡.05½
Chambers Ferland.	.14
Chile Cop.	18¼
Con. Ariz. Sm.	⅛
Con. Coppermines.	‡2½
Con. Nev.-Utah	5/16
Davis-Daly	1 7/16
Diam'field-Daisy	.04
Dia. Black B	.03
Florence	50
Goldfield Con.	1 5/16
Goldfield Merger.	21½
Greene Cananea.	40½
Kennecott Cop.	32¼
Kerr Lake.	4
La Rose	7/16
McKinley-Dar-Sa	20
Majestic	.70
Mines of Am.	2¼
Nevada Hills	17
New Utah Bingham	3⅛
Nipissing Mines.	5⅝
Ohio Copper	.21
Oro.	.08
St. Joseph Lead	12¼
South Utah	‡.25
Stand'd Oil of N.J.	400
Standard S. L.	1 9/16
Stewart	1¼
Tonopah	5½
Tonopah Ex.	2 9/16
Tonopah Merger	.23
Tribullion	⅛
Tularosa	‡ 3/16
Yukon Gold	2¼

LONDON July 13	
Alaska Tre'dwell	£7 7s 6d
Cam & Motor.	0 14 0
Camp Bird	0 4 6
El Oro.	0 7 3
Esperanza.	0 8 0
Mexico Mines.	3 7 6
Oroville.	0 14 6
Santa Gert'dis	0 7 6
Tomboy	1 1 3
Tough Oakes	0 5 6

BOSTON EXCH July 27 Name of Comp.	Clg.
Adventure	2
Ahmeek	395
Alaska Gold M	33
Algomah	2
Allouez	51½
Am. Zinc	55
Ariz. Com., ctfs.	7
Bonanza	.35
Butte-Ballaklava	3¼
Butte & Superior	69½
Calumet & Ariz.	62½
Calumet & Hecla	551
Centennial	17
Cliff	1
Copper Range	52¾
Daly West	2½
East Butte	12¾
Franklin.	8¼
Granby	81
Hancock	16¼
Hedley	28½
Helvetia	35
Indiana	3¼
Island Cr'k, com.	47½
Island Cr'k, pfd.	89
Isle Royale	26½
Keweenaw	1½
Lake	13½
La Salle.	6¼
Mass.	11½
Mayflower	4
Michigan	2½
Mohawk	69
New Arcadian.	9¼
North Butte.	29¾
North Lake	1¼
Ojibway.	2½
Old Colony.	3¼
Old Dominion	52
Osceola	75
Quincy	80
Santa Fe	2½
Shannon.	7½
Shattuck-Ariz.	25¼
Superior.	25¼
Superior & Bost.	2½
Tamarack	40½
Trinity	4
Tuolumne	45
U. S. Smelting	39¼
U. S. Smelt'g, pf.	46½
Utah Apex	3¾
Utah Con	11¼
Victoria	2½
Winona	3¾
Wolverine.	59
Wyandot	.65

BOSTON CURB July 27 Name of Comp.	Bid.
Alvarado	70
Bingham Mines.	8½
Boston Ely.	.29
Butte & Lon'n Dev	22
Calaveras	1¾
Calumet-Corbin.	04
Chief Con	85
Corbin	‡.50
Cortez	40
Crown Reserve	.45
Eagle & Blue Bell	1¾
First Nat. Cop.	2⅛
Houghton Copper	3⅝
Iron Cap Cop., pf	5½
Majestic	70
Mexican Metals	20
Nevada-Douglas	70
New Baltic	3
Oneco	1
Raven Copper	.11
Smokey Dev.	15
So. Lake	‡6½
Tonopah Victor.	.28
Trethewey	11
United Verde Ext	5¼

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62 938	57 572	48 85	28 983	26 553	22.731
February	61 642	57 506	48.477	28 357	26 573	22.753
March	57 870	58 067	50 241	26 669	26 788	23.708
April	59 490	58 519	50 250	27 416	26 958	23.709
May	60 361	58 175	49 915	27 825	26 704	23 570
June	58 990	56 471	49 034	27 199	25 948	23.267
July	58 721	54 678		27 074	25 219	....
August	59 293	54 344		27 335	25 979	.....
September	60 640	53.290		27 986	24 260	.....
October	60 793	50 654		28 083	23 199	.....
November	58 995	49 082		27 263	22 703	.....
December	57 760	49.375		26.720	22 900	....
Year	59 791	54 811		27 576	25 314	..

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	13.641	64.304	60. 756	69.488	65.719
February	14 49	14 394	65.259	63. 494	70.188	*
March	14.131	14.787	64.276	66. 152	69 170	*
April	14.211	16.811	64.747	75. 069	69.313	*
May	13.99	18.506	63.182	77. 600	67.786	*
June	13.603	19.477	61.336	82. 574	66 274	95.333
July	13.223	....	60.540		64 955	......
August	*	....	‡	..	‡	......
September	*		‡	.	‡	......
October	*		‡	.	‡	......
November	11.739		53. 227	..		......
December	12 801		56. 841		*	.....
Year	...			...	....	......

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37 779	34. 260	171.905	156.550
February	39.830	37. 415	181.556	176.925
March	38.038	48. 426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33 360	38. 790	150.702	162.675
June	30 577	40. 288	138.321	167.636
July	31 707		142 517	......
August	*		‡	......
September	32.675		‡	......
October	30.284		‡	......
November	33.304		1 9.391	......
December	33.601	. .	147.102	......
Av. year	34 301		....	..

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3.970	4.053	3 850	3.997	19.651	21.883
April	3.810	4.221	688	4.142	18.225	21.094
May	3 900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3 810	5.836	19.411	25.170
July	3.891	...	3.738	.....	19.051	......
August	3.875	......	3 715	.....	‡	......
September	3.828	.....	3 658	....	‡	......
October	3.528	.....	3.384	.....	‡	......
November	3.683	......	3.585	...	18.500	......
December	3.800	.....	3.662	......	19.097	......
Year	3 862	.	3.737	.. .	....	... ..

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4 967	9.837	21.569	49.888
May	5 074	14.781	4 924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	.....	4 770	.....	21 568	....
August	5 568	.....	5 418	....	‡	....
September	5 380	.....	5.230	....	‡	....
October	4.909	.....	4.750	..	‡	....
November	5.112	......	4.962	....	25.016	....
December	5.592	......	5.430	.	27.369	....
Year	5.213	....	5.061	.. .	....	....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14 94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13 91	13.45	14 10	13.95
April	14.90	14.55	13 [illegible]	13.45	14 13	13.95
May	4.90	14.61	13 [illegible]	13.60	14 27	13.83
June	14.[illegible]0	14.70	13 90	13.67	13.96	13.77
July	14 90	....	13.90	....	13.90	......
August	14.90	.....	13.90	...	14 08	......
September	14.90	.....	13 90		14 03	......
October	14.84	......	13 75	...	13.97	......
November	14.59	.....	13 43	...	13.83	.....
December	14.70	......	13.45	.	13.83	......
Year	$14 88	....	$13 78	..	$14.01	......

Mining Journal

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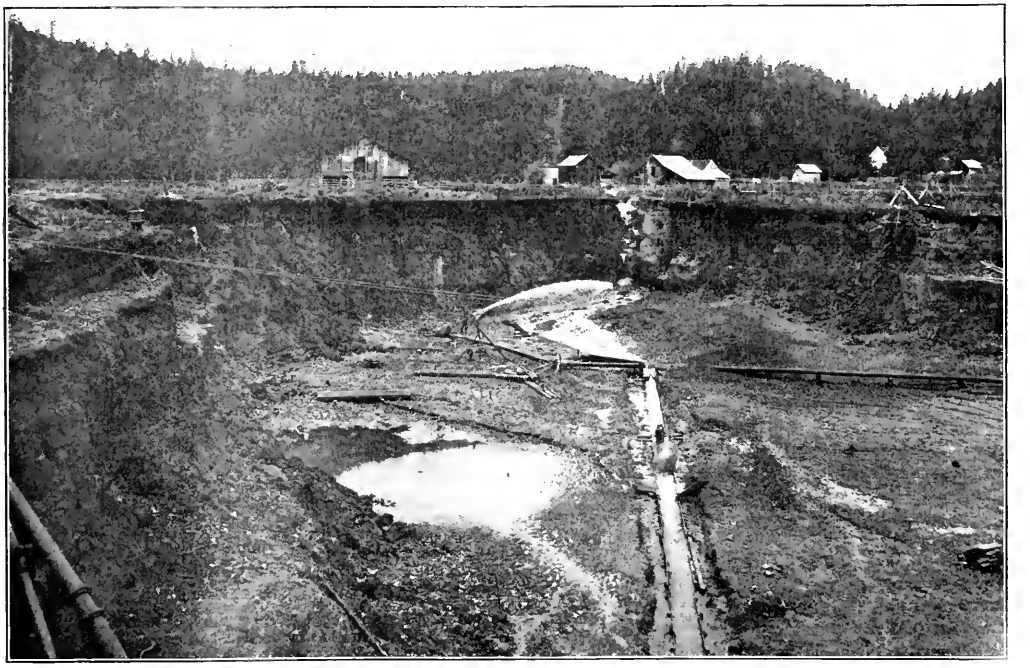
Hydraulicking at Waldo, Ore.

By W. H. Wright*

SYNOPSIS—The Waldo placer field is in southern Oregon, only seven miles from the California line. Hydraulic elevators are required for most of the deposits on account of lack of grade for disposal of tailings. Some interesting details of the operations and equipments are given. Besides the gold, a little platinum is recovered.

The visitor to the placer fields of the Waldo district, Oregon, is at once impressed with the importance of the part played by the hydraulic elevator in mining operations. In March, 1915, three mines were active—the Logan, the Osgood and the Deep Gravel. Waldo district is situated in the southwestern part of Josephine County, seven miles north of the Oregon-California line and 40 miles west of Grants Pass, a station on the Southern Pacific R.R. It is reached by daily automobile stage running between Grants Pass, Ore., and Crescent City, Calif. The town of Waldo, from which the district takes its name, is situated in the center of the placer field 1500 ft. above sea level.

The commonly accepted story of the first discovery of gold in the district is that in 1851 a party of sailors, deserting their ship, made their way inland and found gold in a ravine, which thereafter took the name of Sailors Gulch. This ravine heads on the east side of the ridge on which the Osgood mine is situated. The usual rush followed and the surrounding territory was thoroughly worked as far as the depth of gravel and crude methods would permit. Later, ditches were dug and water brought in from a distance of 3 to 11 miles for hydraulicking the deeper gravels.



PIPING IN THE PIT OF THE LOGAN MINE, WALDO, ORE.

Hydraulic elevators are necessary at most of the mines in this district, the grade of the bedrock being insufficient to dispose of the tailings

*Mining engineer, 5494 College Ave., Oakland, Calif.

For the most part the bedrock at the Logan and the Deep Gravel mines is Cretaceous sandstone and conglomerate, but some serpentine occurs at the upper end of the Deep Gravel mine. The conglomerate is composed of rotten, rounded pebbles and boulders of greenstone, with some granitic rocks. In places it has a reddish color, but the freshly exposed portions observed have a purplish tint. The conglomerate is gold bearing and is soft enough to be piped, but with the exception of the Osgood mine none of it is rich enough for profitable hydraulicking. This conglomerate is of marine origin, having been deposited about the shores of a Cretaceous island and is considered[1] the source of the later gravels being washed at the Logan and the Deep Gravel mines.

The Logan mine, operated by J. T. Logan, is situated one-half mile north of Waldo. It consists of 1000 acres and has an average depth of 35 ft. The gravel is easily piped and is all put through a Joshua Hendy hydraulic elevator, the largest boulders being 6 in. diameter. The first work done on this mine was through a race one mile north of the present workings. Then a pit was opened on French Flat, not far from the schoolhouse and just east of the pit now being worked. The tailings were elevated and stacked with giants. Tailings from the present pit are deposited in the old pit and two giants are employed in the distribution. Mr. Logan purposes reclaiming the old workings for farming as the work progresses.

Water for the present work is obtained from the east fork of Illinois River, across the state line in Del Norte County, California. One ditch, 11 miles long, with capacity of 13 cu.ft. per sec., gives a working head of 340 ft. A second ditch, 5 miles long, supplies 33 cu.ft. per sec., at a working head of 125 ft. The first ditch is used for the elevator exclusively. The second ditch supplies the four giants, two in the pit and two on the tailings dump and the top lift of the elevator. The two giants in the pit are used to wash down the bank. The gravel is carried by a bedrock sluice to the hydraulic elevator which raises it to a height of 49 ft. and into a flume which passes it into the old pit. Accompanying illustrations plainly show the method of working at the Logan, and interesting features at the Osgood and the Deep Gravel.

Details of the Logan Mine Equipment

The bedrock sluice is 200 ft. long and 30 in. wide. No riffles are used. High-carbon steel plates, ½x20x30 in., are placed on 2x4-in. wooden crosspieces standing on edge. The crosspieces are usually set 2 in. in from the ends of the plates and as the plates are placed 1½ in. apart there is a clear space of 4x5½ in. under the ends of the plates. Occasionally the crosspieces are placed at the center of the plate only. This arrangement is varied at intervals by laying the long dimension of the plate lengthwise of the sluice, giving a 5-in. space each side of the plate. The plates greatly facilitate the passage of the sand and gravel through the sluice. The wear is slight. No other gold-saving device is used here, but Mr. Logan states that 93% of the gold recovery is made in the sluice.

The elevator has the following dimensions: Entrance section, 20 in.; throat, 9 in.; inside diameter of upraise pipe to top lift, 13 in.; inside diameter of upraise pipe from lift to flume, 15 in. The water for the top lift comes into the elevator through a needle valve about 10 ft. below the discharge. It is used only when there is a scarcity of water in the high-line ditch. The elevator handles from 15,000 to 30,000 cu.yd. per month, the grade of the bedrock sluice governing the yardage. The flume into which the elevator discharges is 40 in. wide and 340 ft. long. In this flume are 200 ft. of Hungarian riffles made up of ½x2x2-in. angle iron; then 40 ft. of 8-lb. rails with ⅜-in. steel plates for the remaining 100 ft. Besides the four giants and elevator mentioned there is a water lift used to keep the pit dry when no piping is being done. Altogether, there are 1500 ft. of pipe, ranging in diameter from 15 in. to 24 in., of 14- and 16-in. gage.

Water is taken from the pipe lines to generate the electricity used in lighting the mine and buildings. It also furnishes power for various electrical appliances, such as the blower for the bullion furnaces and electric range and heaters in the residence. During the idle months the water is used for irrigating the farming land.

While the gold has a fineness of 975 it is rusty and does not amalgamate easily, that observed having a purplish coating of oxides. However, it is coarse and is not hard to save. A considerable amount of platinum is obtained. The black sand is concentrated by working it over with a square-pointed shovel in a smooth, wide sluice, with a flat grade and a small amount of water. The concentrate is shipped to a smeltery. The operating expenses are between $600 and $700 per month and the cleanups, including gold and platinum, run between $8000 and $10,000 per month. Eight months is the average length of the season.

Elevating Not Necessary at Osgood Mine

The Osgood mine is situated about one mile southeast of Waldo on a ridge running north and south which forms the divide between the east and west forks of the Illinois River. The summit of the ridge is about 300 ft. above the east fork and about one mile distant. The gravel that is being hydraulicked is Cretaceous conglomerate, which caps the summit of the ridge. The conglomerate lies on greenstone which is very uneven. It is decomposed, fissured and veined and has a decided purple color due to iron oxides. The property embraces an area of 636 acres. It is being operated under lease by J. T. Logan.

Piping has been done for 1000 ft. along the ridge and at the present site a width of over 100 ft. is exposed. The present bank is 90 ft. high. The deposit is cemented, but gives no great difficulty in piping. Water at 125-ft. head is supplied by a ditch 11 miles in length, from the east branch of the Illinois River. The mine is equipped with one No. 2 and one No. 3 giant; 1500 ft. of pipe 11 to 15 in. diameter; and 300 ft. of 40-in. flume. Steel plates are used as at the Logan mine, but are separated at intervals by sections of Hungarian riffles made of ¼x2x2-in. angle irons and steel rails. The gravel is piped directly into the flume, the great amount of fall giving no occasion for elevating the gravel. The gold content runs between 12c. and 15c. per cu.yd. One feature of this mine is that the gold is very black. Mr. Logan reports great difficulty in saving it, which, however, he is successfully doing. The gold fineness is 930.

[1]Diller, J. S., Bulletin 546, United States Geological Survey.

In Frye Gulch, which heads on the west side of the ridge near the Osgood mine, A. H. Gunnell, of Grants Pass, and associates are doing some prospecting by sinking shafts with the view of developing dredging ground. The work was just starting at the time of my visit in March, 1915, so that no results were obtainable.

The Deep Gravel Mine Sometimes Has Water Enough to Work Entire Year

The Deep Gravel mine, owned by W. J. Wimer of Waldo and A. E. Reames of Medford, Ore., under the name of Deep Gravel Mining Co., is worked under lease by H. L. Herzinger. The property contains 530 acres, of which two-thirds is mining ground. Forty acres have been worked since Mr. Wimer became the owner in 1873. It extends from the west fork of the Illinois River to within half a mile of Waldo, and is situated northwest of the town and separated from the Logan mine by a low ridge. The depth of the gravel to bedrock varies from 12 ft. at the upper end of the property to 120 ft. at the lower end on the Illinois River.

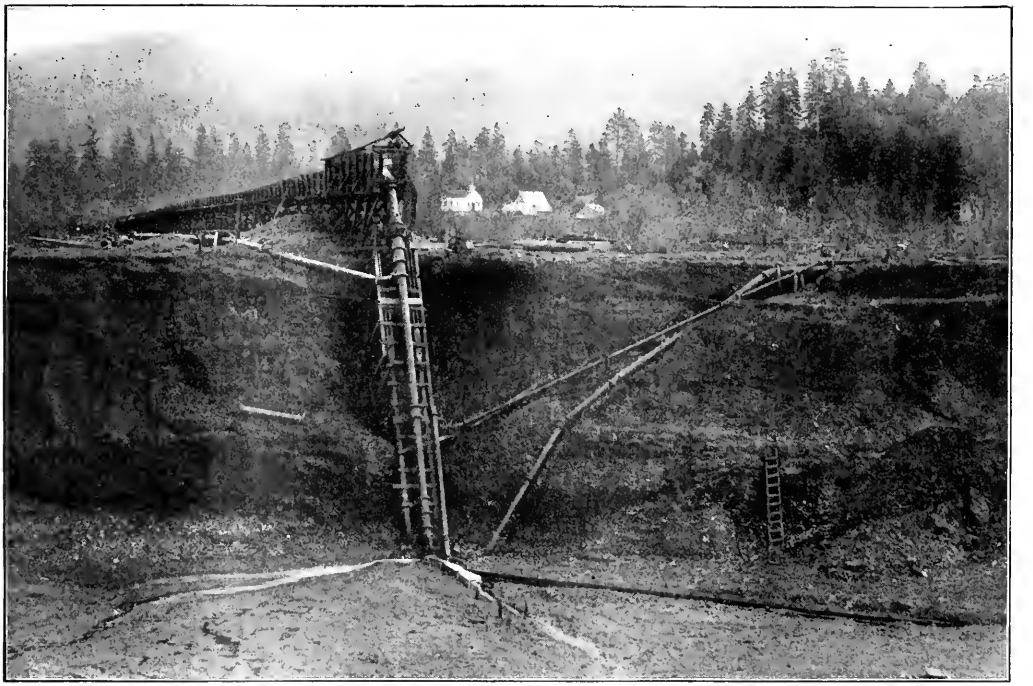
The greatest depth the ground has been worked is 80 ft., and to do that it was necessary to elevate the gravel 49 ft. That there is some rich ground on bedrock has been proved by two shafts of 122 ft. and 120 ft. The output since 1878 has been more than $350,000 at a cost of $150,000. It is said that much of the cost was due to litigation, which has now been settled.

Water is obtained from the east fork of the Illinois River by a ditch 3 miles long, which carries 2800 in. of water and gives a working head of 140 ft. to 202 ft., depending on the part of the property being worked. Another ditch gives 500 in. of water. For six months in the year the total amount of water available is 10,000 in. Mr. Wimer states that some years it is possible to operate the full 12 months.

Equipment of the Deep Gravel Mine

The property is equipped with a No. 2 hydraulic elevator; a sand and gravel elevator; water lift; two No. 1, one No. 2, and one No. 4 giants; 80 ft. of 40-in. flume with 50 ft. of undercurrent; 120 ft. of bedrock sluice 22 in. wide; and 5000 ft. of pipe from 11 to 24 in. in diameter. A tailrace 7000 ft. long discharges into the west fork of the Illinois River.

The riffles in the bedrock sluice are made of 2x4-in. lumber, in sets of six, and connected at each end by strap-iron-covered cleats. The riffles are 5 ft. long and are placed lengthwise of the sluice with the 2-in. side uppermost. This side is sharply beveled and covered with $\frac{3}{16}$x2-in. strap iron. The bevels alternate to the right and left on the successive sets in order to prevent scouring currents. In the first 20 ft. of flume 12x12-in. blocks are placed, which are followed by 30 ft. of heavy pole riffles. At the end of the poles the undercurrent runs off at right angles to the flume. The screen for the undercurrent is formed by 8-lb. rails set with $1\frac{1}{4}$-in. openings. From the undercurrent to the end of the



RAISING GRAVEL TO THE FLUME WITH HYDRAULIC ELEVATOR, LOGAN MINE, WALDO, ORE.

Note the auxiliary lift about 10 ft. below the top of the elevator. This is only used when the supply of water for the main line is low. The elevator handles from 15,000 to 30,000 cu.yd. of gravel per month, the grade of the bedrock sluice governing the yardage.

ne, a distance of 50 ft., pole riffles are used. Hungarian riffles are used in the undercurrent, the size of the iron being ¼x2x2-in. angle.

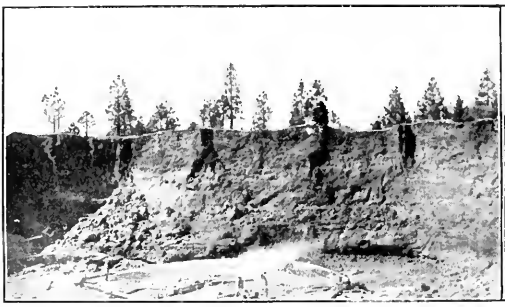
The system of mining is essentially the same as that employed at the Logan mine. The gravel is much more compact, however. The bank is difficult to pipe, but readily crumbles up under weather and moisture. A small charge of powder will loosen a large area. The two large giants are set up on the bedrock at the bottom of the pit. They wash the gravel into the bedrock sluice, from the end of which the elevator raises it 27 ft. to the flume. The coarse material is carried through the flume into the race, while the fines pass through the screen into the undercurrent. At the present point of operations the bank is about 45 ft. The elevation at the Wimer mine is 65 ft. lower than at the Logan. By tunneling the ridge the two properties could be worked conjointly.

The gold is coarse and bright. With the gold some platinum is also saved. The largest amount of platinum recovered in one year was 20 oz. and Mr. Wimer estimates that 120 oz. was lost in the cleanup. Mr. Wimer has made a special study of the problem of saving platinum and was awarded the highest honors at the Lewis & Clark Exposition for his exhibit. He found in his experiments that only one-seventh of the platinum was recovered by the ordinary cleanup methods. He increased the recovery of platinum sevenfold by simply using great care in handling the cleanup. When the gold and amalgam is picked up no mercury leaves the sand is collected with it. The amalgam is separated from the sand by ordinary panning and the pannings saved. These are worked down by a careful forward-and-back motion of the pan. It is found that the whirling motion ordinarily given the pan in washing the sand was responsible for a great part of the loss, as was also the custom of washing all the sand possible from the amalgam when picking it up in the sluices.

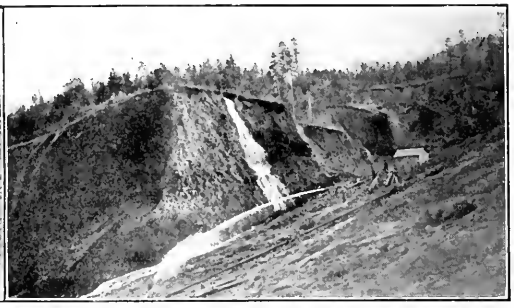
The platinum occurs in small, bright scales, but some nuggets are found. Mr. Wimer exhibited one the size of a large wheat grain and stated that he had found one as large as a pea. An analysis of the platinum cleanup gave the following results: Gold, 0.4%; platinum, 70.5%; osmiridium, 20.5%.

Mineral Production of Hungary in 1913

The mineral production of Hungary in 1913, as officially reported, was as follows (*Montanistische Rundschau*, July 1, 1915)—the items, except those of gold and silver, being given in metric tons, and arranged in order of descending values: Lignite, 8,801,166; pig iron, 608,966; salt, 301,806; coal, 1,058,878; gold, 2924 kg.; iron ore for export, 551,734; coke, 160,073; briquettes, 117,186; pyrites, 106,629; silver, 8696 kg.; antimony, crude and refined, 1048; copper, 404; ammonium sulphate, 2122; lead, 1136; copper cement and ore, 1679; quicksilver, 89; coal tar, 7193; manganese ore, 19,006; petroleum, 2105; silver ore, 204; zinc ore and residue, 407; alum stone, 1792; sulphur, 41; sulphuric acid, 555; antimony ore, 28.

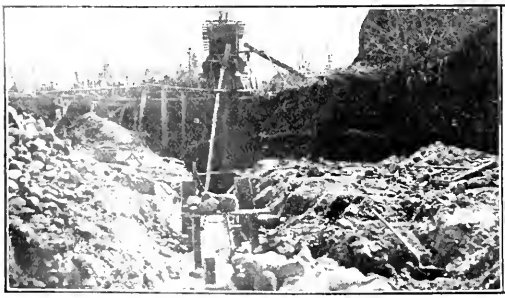


Piping in the pit of the Deep Gravel Mine at Waldo. See view of sluice and elevator below



The Osgood is the only mine at Waldo having sufficient grade to dispense with elevators for disposing of tailings

HYDRAULIC MINING AT WALDO, ORE.



BEDROCK SLUICE AND ELEVATOR AT THE DEEP GRAVEL MINE

GIANTS DISTRIBUTING TAILINGS AT THE END OF THE LOGAN FLUME

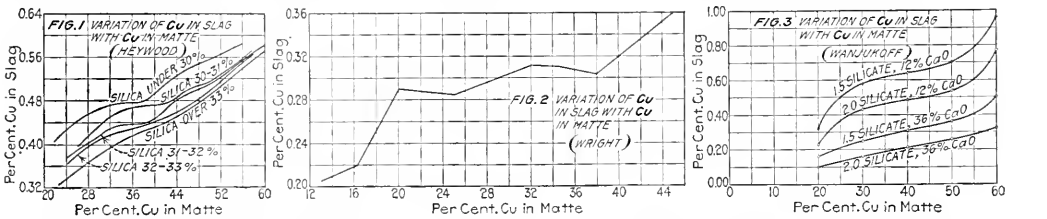
Metal Loss in Copper Slags--I

By Frank E. Lathe*

SYNOPSIS—The first of three articles discussing copper losses in slags. The introductory article presents a résumé of the most important literature on the subject and diagrams showing the variation of copper in slags under different conditions.

In his endeavor to reduce slag losses to the lowest possible point the metallurgist often finds himself limited by local conditions. Thus in the early days of the Southwest, in smelting oxidized copper ores with high-priced coke, it was sometimes found economical to waste in the slag more copper than a few of our present-day companies find in the ore itself. Even now, in districts where cheap fluxes are not available or other conditions are adverse, valuable metals in quantities which could be saved are allowed to pass into the slag; the metallurgist—perhaps an ardent conservationist—consoling himself for the sacrifice of his ideals with the thought that more dollars are nevertheless going into the pockets of shareholders.

Until recently, little was known concerning the chemical combinations of the copper, gold and silver lost in copper smelting, and the methods adopted to keep these losses down have not been discussed as fully as their importance deserves. In this paper I shall review some of the more recent articles on slag losses, give in detail the results of my own investigations and conclude with a general consideration of the whole subject.



VARIATION OF COPPER IN SLAG WITH TENOR OF MATTE—AFTER HEYWOOD, WRIGHT AND WANJUKOFF

Review of Slag Literature

William A. Heywood (*Engineering and Mining Journal*, 1904, Vol. 77, p. 395, and "Pyrite Smelting," p. 231—Mr. Heywood, relating his experience at the Tennessee Copper Co.'s smeltery, showed graphically the effect of variations in the composition of the slag and in the grade of matte on the percentage of copper lost. He plotted the copper content of 2590 slags, representing the average of two furnaces for a period of 2½ years, against the copper content of the matte for curves of (1) under 30% SiO_2 in the slag (2) 30-31%, (3) 31-32%, (4) 32-33%, (5) over 33%. These curves (Fig. 1) show an increase of slag loss with the grade of matte, and also indicate the decidedly lower losses with increasing acidity of the slag. Even though the higher percentage of SiO_2 was due to the addition of barren quartz to the charge, Mr. Heywood found a decrease in the total amount of copper lost except with mattes of more than 50%, when the totals were approximately equal. The average decrease of copper appears to be about 1% of the increase in SiO_2.

Lewis T. Wright (*Trans. of A. I. M. E.*, 1909, Vol. 40, p. 492)—Mr. Wright expressed his disbelief in the common theory that all the copper in slags existed as prills of matte, giving several reasons:

1. That matte did not separate from slag kept in the molten state even for a long time.

2. That no concentration of the valuable metals was possible by elutriation after fine grinding.

3. That the proportions of gold, silver and copper in slag were often different from those in the accompanying matte. This was illustrated by four examples from Mr. Wright's experience. The amount of gold in his slags varied from 31-69% (average 58%) of what might be expected if all the copper in the slag were present as mechanically suspended matte, while for silver the corresponding amounts were 76-93% (average 81%). From these data Mr. Wright concluded that probably a part of the matte was chemically dissolved in the slag; hence copper sulphide, presumably more soluble than gold or silver, was found there in greater proportion than those metals.

4. He then plotted a curve (Fig. 2) of the copper in slag against that in matte, as found in his experience, showing between 15% and 45% matte, an average increase of 0.005% copper in the slag for each per cent. of copper in the matte. He remarked that the curve showed depressions at 25% and 37%. He thought that if metallic copper separated from matte in quantities increasing with the grade of the latter, the tendency of this copper to settle out might prevent the observed increase of copper in the slag with the higher mattes.

5. His experience also showed that the copper in slags decreased about 0.01% for each increase of 1% in the silica content. This he thought indicative of solution rather than mechanical suspension of matte.

6. In conclusion, Mr. Wright stated that if a slag made with a matte of certain gold and silver content were afterwards left in contact with a different matte it would itself assume different metal ratios to correspond to the changed conditions. This fact he had made use of to great advantage in smelting, and in explanation of it he suggested that the matte and slag were both acting as solvents, dividing the metals between them.

*Chief chemist, Granby Consolidated Mining, Smelting & Power Co., Ltd., Grand Forks, B. C., Can.

J. Parke Channing (*Trans. of A. I. M. E.*, 1910, Vol. 41, p. 485)—Commenting on Mr. Wright's paper, Mr. Channing stated that he had discussed this question with J. E. McAllister, and they were both of the opinion that a considerable part of the copper entered the slag as oxide or silicate and not as sulphide, either suspended or dissolved. This theory appeared to explain why the amounts of gold and silver Mr. Wright had found in the slag were smaller than the calculated contents. In support of it Mr. Channing stated that when they were using an oxidized charge (roasted ore) at the Tennessee Copper Co.'s smeltery, the slags contained 0.5% Cu, as against 0.3% in pyritic smelting at the same plant. (It was not stated whether the grade of matte and composition of the slag remained the same in pyritic smelting.)

C. A. Ueberlein (*Engineering and Mining Journal*, 1910, Vol. 89, p. 617)—Mr. Ueberlein, recounted his experience in blowing in the furnace of the Maine & Nebraska Mining Co., using an ore with only 0.3% copper, but carrying considerable gold and silver. The slags produced averaged about 0.09% copper, or a recovery of 78%, while that of the gold was nearly 96%, the silver being somewhat lower. (This gives the ratio of gold to copper about 18% of that calculated from the matte, as against 58% found by Mr. Wright.)

F. A. Sundt (*Engineering and Mining Journal*, 1910, Vol. 89, p. 1097)—Mr. Sundt gave the results of his work at different smelteries in Chile, and from these he concluded that the percentage of copper in a slag depended, in part at least, on that in the charge. Rich charges in general gave slags carrying more copper, though percentage recoveries were better. He also derived a formula for finding the recovery efficiency of smelting under various conditions.

Determining Oxide Copper in Slag

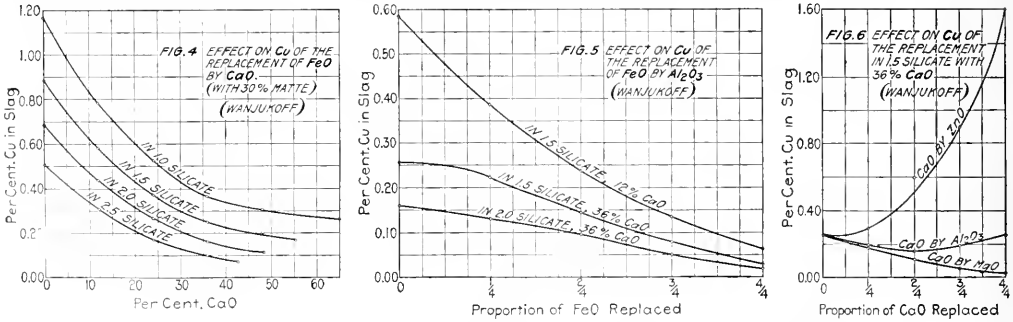
Thomas Kiddie (*Journal of C. M. I.*, 1911, Vol. 14, p. 487)—Mr. Kiddie stated the results of some laboratory experiments performed under his direction. By actual determination of the oxide of copper present he learned the percentages formed under normal conditions. The laboratory method (private communication) was as follows:

A sample of finely ground slag was digested at 80° C. with 5% H_2SO_4, two treatments being desirable; the insoluble was filtered and washed, and copper was determined in the filtrate by electrolysis. The residue was then treated with strong HNO_3 and H_2SO_4, and copper also determined in that solution by electrolysis. The former result represented all the copper present as CuO and half of it as Cu_2O, according to the equations:

$$CuO + H_2SO_4 = CuSO_4 + H_2O$$
$$Cu_2O + H_2SO_4 = CuSO_4 + H_2O + Cu$$

The percentage obtained by HNO_3 and H_2SO_4 (sulphide) was checked by determining the total copper in another portion by usual methods.

In this way the copper present as oxide in a normal slag of 0.22% was found to be about 55% of the total copper, while in one carrying 0.455%, due to excessive furnace oxidation, it was 66%. (It is worthy of note that there was also more sulphide in this slag.) Mr. Kiddie found that these ratios agreed with the gold-copper ratios of slag and matte, assuming that the sulphide alone carried gold into the slag. He also fused a quantity of the 0.455% slag with some ferrous sulphide in a crucible, and the resulting slag carried only 0.05% Cu. (Even if all the oxide were reduced and settled in this case, there must in addition have been two-thirds of the sulphide settled.) From these results Mr. Kiddie concluded that if the copper present as sulphide in any slag was as high as 66% of the total it would be advisable to employ a second settler, while if the same amount existed as oxide additional settling capacity would be of no avail. In this latter case he said some of the oxidized copper would be recovered if the slag were passed over a bath of low-grade matte in a second settler.



VARIATION OF COPPER IN SLAG WITH CHANGE OF SLAG COMPOSITION—AFTER WANJUKOFF

C. A. Grabill (*Engineering and Mining Journal*, 1910, Vol. 89, p. 776)—Mr. Grabill classified the losses as physical and chemical. The former consisted of those due to poor settling, insufficient difference of specific gravity of the matte and slag, and gas flotation; but he considered that all of these were small under normal conditions. The chemical losses might be due to the formation of copper oxide or to solution of metals and sulphides. The former he believed to be small in matte smelting, owing to the instability of copper oxide in the presence of sulphides, but of more concern in the production of black copper from oxidized ores. The loss as dissolved metal or sulphide he thought the most serious of all, and suggested that there might be a dissociation of the dissolved matte at high temperatures, like that observed for the slag itself, thus resulting in solution of the separate constituents of matte rather than for the latter as a group.

Owing to the difficulty of carrying out laboratory experiments under commercial conditions he did not place

much faith in results thus obtained in the settling of matte from slag. He thought that in a general way any conditions in the furnace tending to the production of metallic copper would probably raise the copper content of the slags.

W. Wanjukoff (*Metallurgie*, 1912, Vol. 9, pp. 1 and 48)—In an elaborate series of experiments Mr. Wanjukoff investigated the losses of copper in artificial slags of different degrees of acidity, with the oxides FeO, CaO, MgO, ZnO and Al_2O_3 replacing one another in varying proportions, as well as in contact with mattes of all ordinary grades. Some of his curves are reproduced in Figs. 3-6, replotted from the author's data.

He investigated also the relation of copper and sulphur in slags, but found little regularity. The amount of sulphur carried by the slags depended largely upon their pyrite. His conclusion was that much of the copper had been present as oxide or silicate, owing to the contained sulphur being insufficient in amount to unite with all the copper as cuprous sulphide. As a regular treatment for molten converter slag—if iron flux were not desired for blast furnaces—he suggested pouring it into an externally fired settler through the roof of which pyrite was dropped in small quantity. This would require little fuel, and would save the copper without the usual re-smelting of slag.

H. O. Hofman ("Metallurgy of Copper," opp. p. 174 and p. 257)—The analyses of blast-furnace slags in Table 1 are given in Doctor Hofman's book, and have been rearranged in the order of increasing copper content. The names of companies have been omitted, as the only comparison desired is that of the conditions under which

TABLE 1. BLAST-FURNACE SLAGS ARRANGED IN ORDER OF INCREASING COPPER CONTENTS—AFTER HOFMAN

	Matte			Slag					
No.	Cu	Sp.G.	Sp.G.	Cu	SiO_2	FeO (+MnO)	CaO (+MgO)	Al_2O_3	ZnO	BaO
1	30	5.0	<3	0.14	48.5–49.0	16.0	18	12	3.5–4.5	..
2	12–38			0.15	38.2	38.5	12.5	6.0	..	..
3	10–14			0.15–0.20	49	16	29–30	3–5	..	..
4	35–38	4.64–4.71	2.81–2.84	0.19	48.09	5.95	21.84	16.02	..	..
5	42–46	4.64–4.71	2.81–2.84	0.19	48.56	2.78	24.81	17.60	..	(K,O 4.5)
6	20+			0.2	33.6–29	19.9–23.1	15.4	8.2–7.2	1.31	9.1
7	10	4.6	3.34	0.21	44.5	39.7	9.9	6.2	1.5	..
8	40			0.23	42	22	26	3.5	..	..
9	33	5.12	3.2–3.4	0.24	45–47	16–18	22–26	7–9	..	..
10	40–50	5	3.2	0.2–0.3	40–45	20–24	23–26	6–8	..	..
11	18–22	4.62	3.54	0.29	42.2	39.4	7.0	4.0	..	..
12	43	5.2	3.3	0.3	39.3	24.8	25.2	6.2	..	..
13	30			0.3	30	27	12	11	..	..
14	20	4.6	3.55	0.31	35.9	43.1	7.6	4.6	..	..
15	31.4	4.8	3.5	0.35	36.2	45.0	10.8	4.3	1.5	..
16	13–20			0.35	39.31	38.74	12.88	0.43	2.87	..
17	45–52	4.7–5.0	3.6–3.75	0.4–0.3	35–38	48–40	3–3.5	0.5–8.3	1.2–1.5	2–3
18	40–21	4.386	3.66	0.36	36.25	19.26	3.4.7	10.03	7.41	23.7
19	33.7			0.36	37.5	33.2	13.7	9.1	..	..
20	49.37	5.0	3.2	0.37	37.7	26.2	24.4	8.0	..	..
21	20–50		3.50	0.40	40.6–44.1	30.6	23.6	3.1	..	..
22	40–50	4.9	3.4	0.40	42.5	26.1	25.5	4.6	..	..
23	45–50			0.52–0.58	36.3–40.5	28.8–35.2	19.2–24.0	7.1–9.3	..	..
24	62.16	5.25	3.60	0.69	34	46	11	5	..	..
25	45			0.77	32.47	56.83	2.57	1.67	1.87	..
26	35	4.75	4.0	1.10	23.0	29–31.5	2.8	5.6	23.0	8.0

composition, certain metals under favorable conditions passing in as sulphides to a much greater extent than the copper.

In his attempt to find a reagent which would dissolve either the oxide or the sulphide from a slag and leave untouched the other combination, most of the promising chemicals were tried, including H_2SO_4 of moderate strength (temperature not given), HCl, NH_4OH and NH_4Cl, $AgNO_3$ and KCN. H_2SO_4 (1:3) attacked the copper sulphide only slightly, as did HCl (1:7), but all the other reagents appeared to be quite unsatisfactory. His conclusion was that the relative quantities of copper sulphide and oxide could not be even approximately determined.

Metals with High-Sulphur Affinities Carry Copper into Slag

He noticed that slags containing metals with a strong affinity for sulphur were more likely to contain considerable copper than those with metals which did not so readily form sulphides. He gave the following as the order of some of the common metals with reference to their affinity for sulphur, in descending scale: Cu, Ni, Co, Fe, Mn, Zn, Ca, Mg, Al.

John W. James (*Engineering and Mining Journal*, 1914, Vol. 97, p. 1114)—Mr. James told of passing into a reverberatory furnace molten converter slag which by settling had been reduced in copper content to 1.25-1.50%. After a treatment with green poles and charcoal the copper was 0.75-0.85%. Half of this residual quantity was reduced in a few minutes by throwing in a little

certain amounts of copper enter the slag. Table 2 gives similar analyses of modern reverberatory slags.

TABLE 2. REVERBERATORY SLAGS ARRANGED IN ORDER OF INCREASING COPPER CONTENTS—AFTER HOFMAN

	Matte			Slag					
No.	Cu	Sp.G.	Sp.G.	Cu	SiO_2	FeO (+MnO)	CaO (+MgO)	Al_2O_3	ZnO
1	35			0.36	36.8	35.1	9.3	10.5	3.0
2	46			0.37	37.8	38.6	4.0–4.5	6.0	
3	45	4.85	3.35	0.40	45	29	17	6	1
4	33–48	4.85–4.56	3.40	0.41	43.4	33.5	12.8	5.8	
5	35–45	5.0–5.6	3.21	0.45	41.9	33.6	7.4	10.6	
6	45–48		3.3–0.40–0.52	44		29–30	6	6–8	
7	37.27	4.60	3.52	0.51	35.5	33.4	1.8	11.15	1.0

A. J. Bone (Private Communication)—Reference has already been made to the practice of the Tennessee Copper Co. Mr. Bone has kindly supplied the information in Table 3, showing the varying losses as changes were made in the smelting practice there. The saving in copper by adding limestone to the matte-concentration charge is seen to be a striking one, and the greater quantity of slag produced would not materially change these proportions.

TABLE 3. COPPER LOSSES IN SLAGS RESULTING FROM CHANGE IN SMELTING PRACTICE—AFTER BONE

Date	Charge	Matte Cu	Slag Cu	Slag SiO_2	Slag FeO
1901–1904	Rough-roasted ore	41.12	0.474	32.9	50.7
1905–1907	Low-grade matte and ore (No limestone)	38.4	0.662	37.4	51.8
1907–1908	Raw pyrite	31.0	0.420	39.8	44.0
1909–1912	Low-grade matte, with limestone	31.9	0.347	37.4	44.7

Comparing the raw-pyrite smelting and recent limestone smelting it appears that the greater quantity of copper in the charge in the latter case did not raise the copper in the slag materially, being more than balanced by other conditions—(limestone ?).

(To be Continued)

Potash Deposits in Chile

By Severo Salcedo*

Potash was discovered in Chile many years ago, but for reasons too many to enumerate these salts have not attracted the attention of Americans, even though two magnificent samples with 16 and 28% of potassium chloride respectively were exhibited in 1901 at the Chilean pavilion in Buffalo.

The potash salts are found in the Province of Tarapaca, Chile, in Pintados and Bella Vista Lakes, which together have an area of about 10,000 acres. The deposits are only about three miles from the railroad that runs from Iquique to Lagunas.

The potash occurs as chloride in a crust at the surface, samples of which vary from 3 to 36% of KCl. The density of the bed is about 1.352. This superficial crust varies, having an average thickness of 20 cm., but this is only a part of the potash contained in these lake beds, as the water underlying the crust contains the same salts (8 kg. of potassium chloride per cubic meter of brine), which by evaporation and capillarity have formed the salt crust; when the salt bed is removed it is again formed—in 8 to 12 years—by the same process. The data on which this article is based are taken from the reports of Chilean engineers, and especially from the report of an investigation by Messrs. Lemetayer, Martens and Vasques, and of Enrique Taulis.

P. Lemetayer, professor of chemistry in the University of Chile, in company with the chemists, P. Martens, chief of the Government Chemical Laboratory at Iquique, and Doctor Vasquez, made an examination of the Pintados and Bella Vista Lakes in 1905, at which time they calculated a KCl content of 2,037,948 tons in a salt bed, ranging from 3 to 12% of potassium chloride. Up to the present no soundings have been made deeper than 3 or 4 ft. Enrique Taulis, director of the Agricultural College in Santiago, who made a study of the Stassfurt deposits in Germany, also reported on the Guaica deposits of Pintados Lake. He reported in 1901 the following analysis of a sample from a representative shipment of Pintados (Guaica) salts:

	%
Moisture (at 110°)	5 000
Insoluble in water	1 324
Chlorine	37 961
Sulphuric anhydrid	15 334
Calcium	0.272
Carbon dioxide	0 134
Sodium	29.533
Potassium	7 409
Magnesium	trace
Oxygen of the sulphates	3 066

This elementary composition corresponds according to the laws of chemistry to the following:

	%
Calcium sulph	0.925
Sodium carbonat	0.323
Sodium sulphat	28.392
Sodium chloride	51 447
Potassium chloride	14.151

Having crystallized a solution of these salts, he concluded from a study of their crystallographic character that none of the potash was present as sulphate. Hence, all of the potassium is calculated as chloride. It is important to note the absence of magnesium salts, as well as that of bromides or iodides, which have a toxic action on plants. Mr. Taulis determined that the calcium salts existed in the form of sulphates, and that the deposit might be considered as consisting of sulphate of sodium and chlorides of sodium and potassium, which fact simplifies the economical extraction of concentrated salts. In normal times the Pintados salts would have to compete with the Stassfurt products, and he made the accompanying comparison of the Pintados salts with that of carnallite and kieserite, the Stassfurt salts which most nearly approximate the Guaica deposit. Magnesium chloride, having a high solubility, increases the cost of purification on account of the complicated procedure required for such salts.

COMPARISON OF STASSFURT AND PINTADOS SALTS

Composition	Carnallite	Kieserite	Pintados
Potassium chloride	15.5	11 8	14.15
Magnesum sulphate	12.1	21.5	none
Magnesium chloride	21.5	17.2	none
Sodium chloride	22.4	26 7	51.45
Calcium sulphate	1.9	0.8	0.93
Sodium sulphate	none	none	28.29
Insoluble in water	0.5	1.3	1.32
Moisture	26.1	20 7	5.00

Taking the composition of the Pintados salts as sulphate of soda and chlorides of soda and potassium, and keeping in mind that the maximum solubility of sulphate of soda is reached[1] at a temperature of 20° C., at which the chloride dissolves only to a small extent, it will therefore suffice to submit these salts, suitably ground, to a lixiviation with water at this temperature to dissolve the whole of the sulphate and only a part of the chlorides. The residue of this first washing will consist of a mixture of chlorides. The solubility of the chloride of potash increases with rise of temperature, while that of chloride of soda remains constant.

On the other hand, since the solubility of sulphate of soda decreases with increase of temperature, if the water from the first lixiviation be heated the sulphate will be partly eliminated and all of the chlorides retained in solution. Since the potassium chloride is more soluble than the sodium chloride, the crude salt can with a single lixiviation be exhausted completely of its potassium chloride, obtaining a product with a concentration of more than 40% of chloride of potassium. By means of lixiviations successive to those already indicated, the concentrated salts can be produced with a content of 90% potassium chloride, if necessary.

One-third of all the chloride of potassium sold in Europe is used for the manufacture of potassium nitrate from the nitrate of soda imported from Chile. These two salts being only a few miles distant in the Province of Tarapaca, the benefits that can be derived are obvious. To make 100 kg. of potassium nitrate it is necessary to use 73.95 kg. of chloride of potassium and 84.15 kg. of nitrate of soda (Chile saltpeter). Hence it would be easy to undertake this manufacture in Chile. A freight of 58 kg. on inert substances would be eliminated for each 100 kg. of nitrate of potash exported.

It is worth noting that the pipe line supplying potable water to Iquique passes across the Pintados properties. This pipe line, or the wells situated in the vicinity, can supply sufficient water for an extraction plant.

It is to be hoped that in the near future the world will not have to depend exclusively on the European monopoly which has for so many years dominated the potash market. An engineer left New York on July 24 to examine the Pintados deposit for American interests, which will immediately undertake the exploitation of the Chilean potash if the representations of the local engineers can be substantiated.

*149 West 35th St., New York.

[1] Given by other authorities as 32.3° C.

Orebodies of the Mesabi Range--IV

By J. F. Wolff*

SYNOPSIS—Previous theories as to ore formation correct in main features. Three types of bodies related. Relation between folds and orebodies. Fracturing permitted entrance of groundwater, leading to iron concentration. Function of the Intermediate slate was to control water circulation. Western Mesabi sandy ores due to lack of vigorous circulation and of transportation of silica. Discussion of probability of correctness of conclusions.

In the preceding parts of this series the structure and exploration of Mesabi range orebodies were discussed for the particular assistance of engineers in the district. This part will present additional data from which, together with what has gone before, conclusions will be drawn as to the geological conditions under which these orebodies have developed. Of course it is impossible to prove absolutely that any one set of causes governed the formation of the ore but I believe that sufficient positive information is at hand from which to draw valid conclusions.

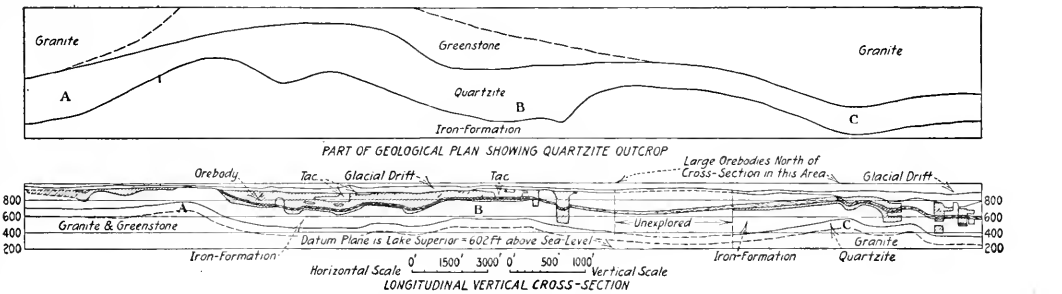


FIG. 28. LONG PLAN AND SECTION SHOWING RELATION OF ORE TO STRUCTURE

In the first article, the process of actual formation of the ore by the leaching out of the silica, the oxidation of the iron and the compacting or slumping of the iron in place was described. All mining engineers and geologists who have had anything to do with the Mesabi range in recent years are agreed upon this process of formation. It was simple, and ordinary close observation is all that is necessary to establish it; but the geologic conditions which allowed this leaching and oxidation in certain places and not in others are not directly observable and have been worked out only after the study of the great mass of information available to me which was mentioned near the end of the first article.

Previous Theories

In 1894 in Minnesota Geological Survey Bull. 10, "The Mesabi Range Iron-Bearing Rocks," J. E. Spurr presented the theory that the orebodies were formed in zones of weakness produced by faulting or fracturing of the rocks. He inferred that the fracturing occurred for the most part along the axes of anticlines. In U. S. Geological Survey Monograph 52 Van Hise and Leith present the theory that the orebodies have occurred in gently folded synclines and anticlines, which were produced by the slight warping or folding of the iron-bearing rocks. In neither of these publications was there presented any direct evidence in support of these theories other than a discussion and statement of general field observations. It is proposed here to present geological plats and structural sections to show that in the main both of these theories are correct. Spurr's observations were made upon the orebodies from Mountain Iron east, because at this time little work had been done west of Mountain Iron, and his theory has application mainly to the orebodies now included in the Virginia, Eveleth, McKinley and Biwabik districts. Van Hise and Leith had practically the whole Mesabi range as a field for their investigations and their theory is applicable broadly to the entire range. It is a matter of considerable satisfaction to find that theories based upon broad field observations are so closely in accord with facts worked out from detailed explorations. Spurr probably emphasizes faulting more than the facts as now known will warrant, but his principal idea, that the orebodies from Mountain Iron east have formed in zones of fracturing and consequent weakening of the iron formation layers, seems to be substantiated. From a practical standpoint the theories of Spurr and Van Hise and Leith are essentially the same.

Three Types of Orebodies

The Mesabi orebodies, as previously noted, may be divided into three types, viz., trough bodies, flat-layered bodies and fissure bodies, named in the order of their importance. The structure of the trough bodies has been described and emphasized in the preceding articles as being the typical structure, because by far the larger part are of this type. The flat-layered bodies are generally continuations of the trough bodies and some of them are extensive laterally but of moderate thickness, about 50 ft. being a maximum. The fissure bodies generally occur along the limits of larger trough bodies. They are simply narrow vertical fissures of ore which are the alteration of the taconite on vertical cracks in it. They really represent a step in the formation of trough bodies, being incompletely formed orebodies. There are a few bodies of this type

*Mining engineer, Oliver Iron Mining Co., Duluth, Minn.

, but these apparently are the remnants left by the erosies but these apparently are the remnants left by the erosion of former large bodies. This type of orebody will be understood better by reference to Fig. 36. The second stage *B* in the formation of a trough body is a good cross-section of a fissure body. It remains to explain what probable geological conditions controlled the formation of these three types.

Structural Sections

In order to determine whether or not any relation exists between the positions of the orebodies and the general structure of the iron formation, a longitudinal section 30 miles long, parallel to the strike of the iron formation and taken approximately midway between the limits of the iron-formation outcrop, was made for that part of the range between Sections 17, 58-19 and 24, 56-24. This sec-

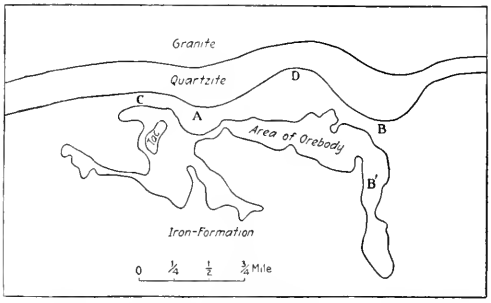


FIG. 29. OREBODY CORRESPONDING TO STRUCTURE SHOWN BY QUARTZITE OUTCROP

tion reveals some interesting facts. A part of it is shown in Fig. 28. It was prepared from all of the drill information available. Examination of Fig. 28 shows that the orebodies conform closely to the major structure of the iron formation and the quartzite, i.e., they occupy the troughs of the synclines and the crests of the anticlines (it should be noted that the vertical scale is 3⅓ times the horizontal). The section shows two main troughs in the quartzite between the anticlines marked *A*, *B* and *C*. Between the points *A* and *C* are the most extensive orebodies of the range and the great size and lateral extent of these are directly connected with the major folding of the iron formation as shown on the section. The plan in Fig. 28 shows the quartzite outcrop and its relation to the underlying granite and greenstone, and to the overlying iron formation. Attention is called to the relation between this outcrop and the quartzite shown in the section. Casual observation shows that the embayments in the quarzite line on the plan correspond to the troughs or synclines in the quartzite on the section. Letters *A*, *B* and *C* on the plan correspond to letters *A*, *B* and *C* on the section and indicate the axes of gentle anticlinal folds. The distance between *A* and *B* appears greater on the plan than on the section, because the section is taken about a mile south of the quartzite outcrop and the axes of the anticlines *A* and *B* converge toward the south. This general relation between the shape of the quartzite outcrop and the structure of the formation is an important one to recognize and it will be referred to later. Of course, minor irregularities in the quartzite line may be due to irregularities of erosion. It may be thought also that the irregularity of the quartzite outcrop simply represents the contour of the shore line upon which the quartzite was laid down, but this is hardly probable because the original shore line must have been several miles north of the present outcrop and progressive erosion has steadily moved the outcrop southward. There is so direct a relation between the outcrop and the section shown as to make the conclusion irresistible that the large bends in the outcrop correspond to the structural folds in the formation. Indeed it seems impossible that there should not be such flexures in a sedimentary series as extensive as the Mesabi. Structural study of the part of the range represented in Fig. 28 reveals many minor folds in the major folds and field observations show minute warping and bending of the taconite and ore layers. Thus there are gentle folds of all orders from extremely large ones down to those of small dimensions in the iron formation. Similar study and observation confirm this fact for all parts of the range.

A further interesting fact revealed by this 30-mile section is that on the western end of the range, where the sandy ores exist, no marked folding of the series has occurred. The deformation has been so slight that the quartzite line is practically flat.

Areas of Orebodies

Figs. 29 to 35 inclusive show the areas of different orebodies and their relation to the general surface geology. By applying the fact above established regarding relations between quartzite outcrop and structure of the formation, the relation between the locations of orebodies and the general structure of the formation can be inferred. For example, Fig. 29 shows an orebody which corresponds roughly to the general structure shown by the quartzite outcrop. It occupies the axes of two antielines *A* and *B* and the troughs of two gentle synclines *C* and *D*. The part of the orebody *B'* is evi-

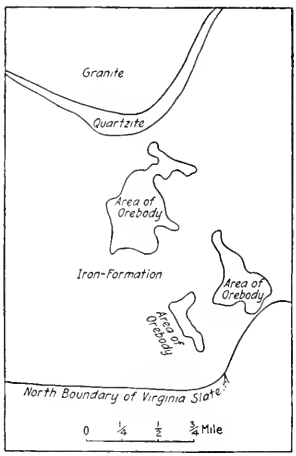


FIG. 30. OREBODIES ON AXIS OF ANTICLINE

dently on the axis of the anticline *B*. Fig. 30 shows orebodies which have been formed on the axis of a pronounced anticline. On this plat both the quartzite and the Virginia slate lines indicate the location of the anticlinal axis. Figs. 31 and 32 show other orebodies which are formed on the axes of antielines. Fig. 33 shows an orebody which has no apparent relation to any structural feature of the formation. It has pronounced sharp walls and is comparatively deep. From the general shape and direction of the orebody one would infer that it had formed on the locus of fissures or cracks cutting across the strike of the formation at angles

of 20° to 80°. Fig. 34 shows an orebody, part of which, *A*, occupies a structural basin in the formation while the other part, *B*, apparently occupies the axis of an anticline. A careful structural study of the drilling in this area proved that these inferences are facts, because there is a marked flexure down to the east, in the layers of the iron formation just east of orebody *B*. Fig. 35 shows an extremely large orebody and one which is somewhat exceptional. Apparently it occupies a general synclinal fold. The three lobes *A*, *B* and *C* unite to form the major trough *D*. From their relations to the quartzite outcrop the branches *A* and *B* seem to be on either side of the axis of a small anticline and the branch *C* appears to be directly on the axis of another small anticline. This body is the best example on the range of two or more troughs uniting to form a larger one. It is a large body, as can be seen by reference to the scale on the plat, while the ore is deep and has sharp rock walls. Parts of this body were explored in the early days and from the information gathered in this and in orebodies represented in Figs. 30 and 34 Spurr drew his conclusions regarding the geological conditions which allowed the formation of Mesabi ore. The orebodies represented in these figures are from the most important producing parts of the range. They are the smaller of the principal bodies. Those shown in section in Fig. 28 and those on the western part of the range are so extensive in area that they are not included here nor would their representation be of more value to the present purpose. From what has been presented some definite conclusion can be drawn as to the geological conditions governing the formation of the ore.

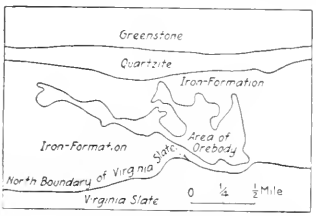


FIG. 33. ORE FORMED AT LOCUS OF FISSURES

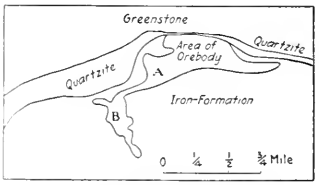


FIG. 34 A IN BASIN, B ON ANTICLINE

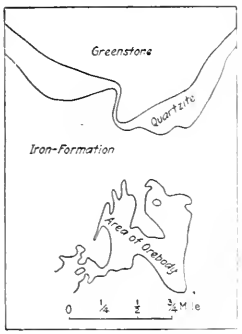


Fig. 31

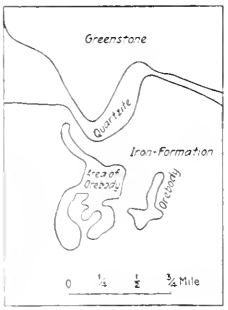


Fig. 32

OREBODIES ON AXES OF ANTICLINES

Geologic Conditions under Which Orebodies Formed

The evidence already presented in this and preceding parts shows conclusively that the sedimentary rocks of the Mesabi range have been gently folded and fractured and in a few places faulted by the earth movements which have occurred since their deposition. Because of its brittle nature, the iron formation yielded to this folding by fracturing and by slight bending of the layers. A great deal of gentle major and minor folding has been disclosed by close structural study of exploration and mining work. Almost everywhere the taconite is found to be broken into parallelopiped rocks by at least two sets of fractures, the directions of which are not the same in all areas. In some places, particularly on the axes of anticlines and synclines, this fracturing has been pronounced and in these localities groundwaters found their way into the formation most readily. In other places, such as the large areas represented in Fig. 28, the fracturing must have been general rather than localized. In such an area the penetration of groundwaters must have been extensive, and therefore orebodies extending over large areas have been formed. The gentle rolls in the formation made natural structural channels, controlling the flow of underground waters. The smaller bodies formed where the cracking was localized. The process of leaching out the silica and the concentration and slumping of the ore need not be described again here, since it was discussed in part I. However, Fig. 36 is presented to show the probable development of one of the smaller bodies on a series of parallel fissures. The successive stages shown illustrate the progressive development of the orebody better than would a long description: this is not the mere expression of a theory but is well founded on fact. All four stages shown, and even intermediate stages, can be observed in the orebodies themselves. In Fig. 36, *A* represents tension cracks in the iron formation on the axis of a gentle anticline: *B* represents the formation of ore by the alteration of the taconite on the vertical fissures and along bedding planes: *C* represents the process of alteration well advanced: and *D* represents the present condition of the average orebody. Surface erosion of taconite and ore is shown also. This illustration refers particularly to the deep, sharp-walled trough bodies from Mountain Iron east. The same process has operated, but over large areas, in the Hibbing, Chisholm and Western Mesabi districts. The rock horses and rock pillars found in the lower blue ore in every deep-trough orebody are simply incompletely altered blocks of taconite. In many bodies, in which mining has progressed far enough, stringers of ore can be followed out into narrow fissures in the rock until they finally give way to decomposed taconite which in turn gives way to solid taconite. On the edges of a few orebodies these stringers or vertical fissures of ore are so numerous that they constitute what have been referred to previously as a fissure type of orebody. The orebodies formed by the complete alteration of the fractured areas or zones as above described are characteristic trough bodies (*D*, Fig. 36). The origin of the third type of layered body will be discussed now.

From the persistence of the altered Intermediate slate layer or the paint-rock layer (Parts I, II and III) it

must be evident to the reader that this layer has had a marked influence in the formation of the ore, otherwise the paint-rock layer would not be found so universally in the ore. One would expect to find alteration of the taconite immediately above the quartzite or of the taconite immediately below the Virginia slate as frequently as one finds alteration of the part of the formation both above and below the Intermediate slate layer. It remains therefore to secure an explanation of the presence of the Intermediate paint-rock layer in almost every orebody of any size and importance. When erosion started to truncate the Mesabi series, surface waters flowing over the top of the iron formation seeped into it in fissured areas. The waters flowing down the greenstone and granite flowed first on the iron formation below the Intermediate slate layer and entered this formation wherever possible. The waters which flowed across the outcrop of the Intermediate slate layer entered the fractured upper taconite wherever it was sufficiently broken up. The Intermediate

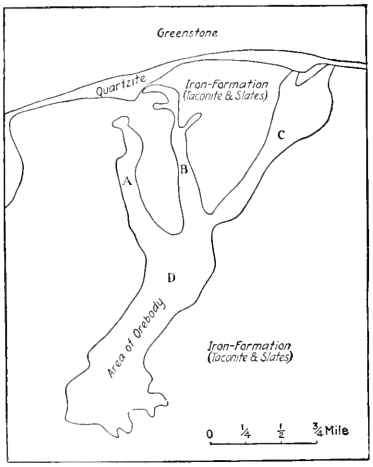


FIG. 35. LARGE OREBODY FORMED OF SEVERAL JOINED TROUGHS

slate itself is relatively impervious to water except for the cracks which traverse both it and the taconite above and below it, and which allow water to penetrate into it and through it. It is not so permeable as the taconite in any sense. Therefore the waters in the taconite underneath it were considerably ponded. The waters in the taconite above the Intermediate slate flowed down under the Virginia slate until they became ponded under it The Intermediate slate thus acted as an impervious basement for the upper waters and ponded the lower waters; together with the folds in the formation it controlled the circulation of the groundwaters. Fig. 37 is a diagram illustrating the probable circulation of water within the iron formation. Above the Intermediate slate layer an artesian circulation must have been set up by the ponding of water under the Virginia slate. Evidence of this is to be found in the flowing wells which have been developed in several places by drilling through the Virginia slate into the iron formation beneath it. Further evidence is found in the existence immediately beneath the Virginia slate of a layer of almost pure chert or extremely cherty taconite, 5 to 20 ft. thick. This layer is badly broken up and is always difficult to drill through. Its exceptional chertiness may be the result of deposition of silica out of the waters ponded under the slate (Fig. 37). The diagram shows the circulation of the waters beneath the Intermediate slate as finding its way through cracks in the slate up into the upper taconite. Immediately below the slate layer there may have been a return current making its way to the outcrop. Evidence of this is to be found in the incomplete alteration of the lower yellow taconite in most of the orebodies in the eastern part of the district and in the excessively sandy layer found in

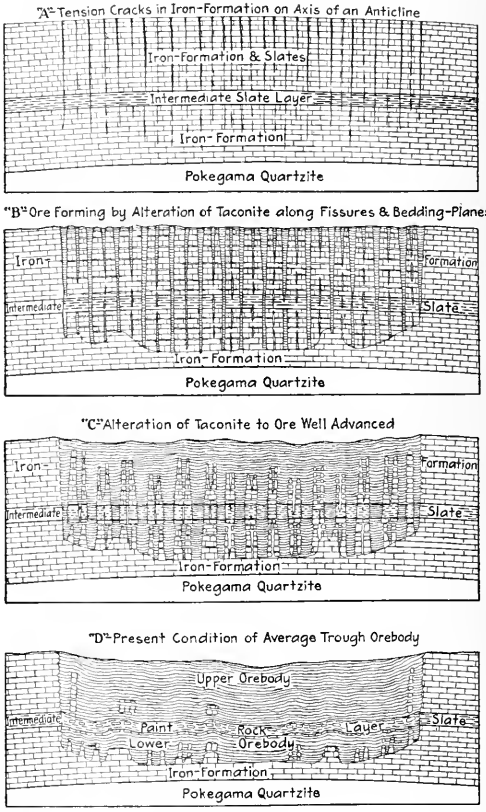


FIG. 36. DEVELOPMENT OF OREBODY THROUGH FISSURE TYPE TO TROUGH TYPE

the bodies from the Hibbing district west. This evidence means either that there was incomplete circulation and consequent solution and transportation of silica from the formation immediately below the Intermediate slate layer or else that this sandy ore and rocky layer under the slate represents precipitation of silica out of solution, due either to the ponding of water or to a reaction with the alumina in the slate layer. There is good evidence that the escape of the waters beneath the Intermediate slate was through cracks or fissures extending from the upper taconite down through the slate. In several flat-layered orebodies beneath the slate, where no extensive

body occurs above this layer, individual drill holes or a few drill holes show that fissures or chimneys of ore extend from the surface down to the slate layer. Since the ore in these drill holes is not connected with any large orebody the inference seems reasonable that the ore in them was caused by waters ascending from beneath the slate layer rather than from descending surface waters. There is no other explanation for the outlet of these waters ponded underneath the Intermediate slate and the evidence of these chimneys or fissures of ore in the upper taconite suggests directly the explanation just given.

Flat-Layered Bodies

In Fig. 12, Part II, there is shown a section of a flat-layered body which is the continuation down the bedding of the iron formation from a trough body. This flat-layered body is derived from the lower yellow taconite. The occurrence of extensive flat-layered bodies as extensions of trough bodies immediately underneath the Intermediate slate is so common all over the range as to attract immediate attention. The explanation seems simple enough. The waters ponded underneath the slate layer sought escape laterally along bedding planes and their flow was directed by the gentle folds in the formation until they found outlet through fissures extending from the

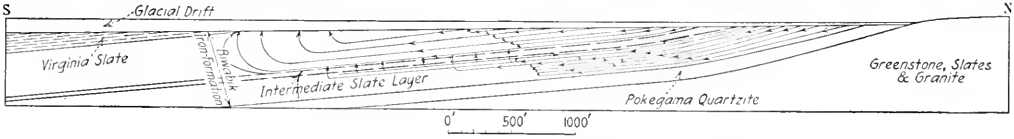


FIG. 37. DIAGRAM OF PROBABLE WATER-CIRCULATION

upper taconite down through the Intermediate slate. As previously indicated, these orebodies are not thick or of exceptional richness. Down the slope of the bedding some of them grade into lean ore or decomposed taconite. Parts of them are not of merchantable grade.

There are other flat-layered bodies in the upper taconite. For the most part these are extensions down the dip of trough bodies. Some of them may be the remains of larger bodies which have been removed chiefly by preglacial erosion.

Alteration of Intermediate Slate

Although the Intermediate slate layer has been spoken of as an impervious layer this term, of course, is a relative one. The tremendous length of time during which alteration has proceeded has caused even this layer to be partially or completely altered by the solvent and oxidizing effect of groundwaters. In many places the upper and lower parts of this layer are well altered and a slate core remains. This is further direct evidence of circulation both above and below the layer. In other orebodies or parts of orebodies this layer is completely altered and is now a soft clayey material infiltrated with iron precipitated out of solution. Its moisture content is much higher than that of the altered taconite.

This member is so dense and homogeneous that the only alteration which has occurred in it has been at its contact with the iron formation. In some places the upper 5 or 10 ft. of it has been decomposed into a sand and in one place it is known to be so saturated with iron from the orebody above as to be practically an ore. Aside from this alteration the quartzite apparently has been impervious to groundwaters.

The Sandy Western Mesabi Ores

The best explanation known to me, of the occurrence of large amounts of low-grade ores and sandy washable ores on the Western Mesabi is the one suggested by the longitudinal section referred to above, part of which is shown in Fig. 28. As already stated, this section reveals no structural basins in the quartzite in the Western Mesabi district. Therefore no natural underground water channels have controlled the circulation. The waters simply seeped into the iron formation, having no definite drainage courses as in the central and eastern part of the district. Moreover the dip of the formation is extremely gentle, being only about 4% or 5%. Therefore, while decomposition of taconite and oxidation and concentration of iron have been quite complete in this area, the solution and transportation of silica out of the orebodies have not been complete.

Summary

In order to emphasize the essential facts set forth in these articles a general summary seems not out of place. In Parts I and II the general structure of the Mesabi range and its orebodies was pointed out and exceptional structural features were described and illustrated. It was shown that all orebodies on the range from one end to the other have a uniform structure. They occupy irregular trough-shaped basins in the taconite or country rock. They consist of an upper and a lower high-grade member separated by a low-grade member which is the alteration of an interbedded slate layer. Ordinary close observation of exploration and mining work will disclose to the engineer or mining man this characteristic structure of a typical orebody.

In Part III the method of exploring Mesabi range orebodies was described and illustrated. The best known method for determining the structure from the exploration records was presented in detail and illustrated with a complete set of structural vertical sections of an orebody as I actually worked it out for commercial purposes.

In Part IV additional data have been given from which, together with those presented in the first two articles, well defined conclusions have been drawn as to the geological conditions under which the Mesabi range orebodies have developed. I have shown that exploration and mining work and particularly close structural study of all parts of the range substantiate the theories which J. E. Spurr in 1894 and the geologists of the U. S. Geological Survey since 1903 proposed regarding the geological conditions determining the formation of the orebodies, viz., that they formed in zones or areas where the iron formation was much cracked or broken up, due principally to gentle warping or folding and slight faulting of the Mesabi series of ore formations.

I have presented these articles in order to diffuse among engineering and mining men particularly on the Mesabi range a knowledge of a great many facts valuable to them in their work. All of this information represents results of several years' observation and study, but it is not presented as being the last word on the subject by any means. Rather it is presented as an outline on which others may work.

It is hoped that the present articles will instigate and stimulate work in this direction, so that there will be uniformity of effort along these lines and eventually the structure and geologic history of the Mesabi range will be known more completely than that of perhaps any other mining district in the country.

Forfeiture of Placer Locations

By A. L. H. Street*

In affirming a decree quieting title to a placer-mining claim as against a junior location, the Supreme Court of Oregon decided the following principal points related to forfeiture of such claims:

Clearing brush and trees from the surface of ground located constitutes such assessment work as prevents forfeiture of a claim, when it is done for the purpose of enabling the claim to be worked by dredging.

When a junior locator asserts forfeiture of the claim by the senior locator through failure to do annual assessment work, the burden is on the former to establish such failure, rather than on the latter affirmatively to show performance of the work.

Resumption of work by a senior locator before relocation by another defeats a relocation.

Since it is only against intervening rights that a resumption of work by a locator does not revive the possessory rights of the claimant, it must be held that where the senior locator of a placer claim failed to do required assessment work, a relocation of the claim by another person, who also failed to perform assessment work for a succeeding year, does not forfeit the right of the senior locator to resume work thereon, so as to authorize a third person to relocate the claim after the senior locator had done the assessment work for a succeeding year. (Richen vs. Davis, 148 Pacific Reporter, 1130.)

Electric Steel Production

There were, at the beginning of 1914, according to the *Elektrotechnische Zeitschrift*, 138 arc furnaces and 35 induction furnaces in operation for the production of steel. The arc system is thus far more generally in use, though judged on the basis of steel output the advantage would appear to be with the induction system. The opinion expressed in recent years that the induction furnace would prove the better of the two, has given place to the conviction that each system has its own special field of operation. So far as the sizes of the furnaces are concerned the problem of a construction for a capacity over 15 tons has yet to be solved. Larger furnaces than the 25-ton Heroult have not yet been constructed, and the practicability of this dimension has not been demonstrated as yet. The Girod system has attained the 15-ton margin, the Nathusius and Röchling-Rodenhauser 12 tons, while the production of castings on the Stassano method is limited to small units of no more than two tons. Nevertheless, units of 30 tons are still being built on the Heroult system and 20 tons on that of Frick. During 1913 the output of the electro-thermic steel works increased in Germany, Austria-Hungary and France, though the increase was less than in previous years. The total production in North America remains nearly stationary. On the whole, it is the general belief now—as against previous opinions to the contrary—that the electro-steel industry has a long period of development still confronting it, and that the experimental stage is far from having been passed.

Herewith is given a list of the several systems and their development in 1913 and 1914. Arc furnaces working and under construction: Heroult 67, Girod 27, Nathusius 9, Stassano 10, Keller 6, Chaplet 8, others 11; total 138. Induction furnaces working and under construction: Kjellin 10, Röchling-Rodenhauser 17, Frick 6, others 2; total 35. There are therefore 173 electric furnaces altogether.

Extracting Potash from Salines of Low Potash Content

While the admixture of previously cooled solutions of nitrate of soda and of chloride of potassium results in the formation of a precipitate of nitrate of potassium, the sodium chloride remaining in solution, if the product to be treated contains slight amounts of chloride of potassium mixed with, for example, large quantities of salt, the reaction may be invisible. It is not possible to secure the precipitation of the potassium nitrate, because its solubility is increased by the presence of the salt. M. M.-E. Pichard proposes to turn this to account in the extraction of potash from saline deposits poor in potash, the method of working on the industrial scale being given thus by the *Chemical Trade Journal*:

In a saturated and cooled solution of NaCl is dissolved the small quantity of nitrate of soda necessary for the conversion of the KCl contained in the crude salt to be treated, over which this solution is passed, keeping the whole at a low temperature. KNO_3 is formed and is carried away by the solution of NaCl. The foreign elements of the crude salt, NaCl, Na_2SO_4, $CaSO_4$, remain insoluble. The potassium solution containing KNO_3 in presence of NaCl is evaporated down, and deposits a mixture of these two salts. Separating them is most easily effected by warm water, which dissolves the potassium nitrate and leaves undissolved the sodium chloride which has acted as a vehicle, and is used again. The residuary salts are dissolved, and the cold produced by their solution is utilized in the application of the process.

The Philippine Bureau of Science Reports that examinations have been made of the discoveries of iron ore recently reported from Surigao Province. Samples were taken by drilling over an area of 100 sq.km. The deposit was found to be singularly like the Mayari iron ores near Nipe Bay, Cuba, in its occurrence; that is, it is a great surface blanket of iron-bearing clay, which has resulted from the weathering and decomposition of the original rock. In the case of the Surigao deposit the parent rock is made up principally of the mineral serpentine. The ore deposit is of varying thickness, in many places entirely carried off by erosion. Further investigations are being made; also analyses of the iron ore samples.

*Attorney, St. Paul, Minn.

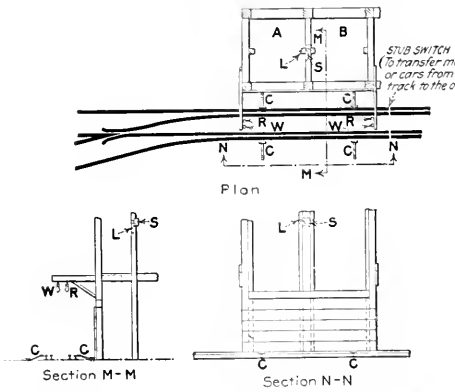
Details of Practical Mining

Automatic Signal System Used in Stockpiling Iron Ore

By John F. Murphy*

During the winter operations of underground iron mines in the Lake Superior district, it is necessary to stockpile ore until shipping begins in the spring. With usual practice, shafts have two hoisting compartments where the skips are hoisted in balance. The ore is dumped directly from the skip into a car on the stockpile trestle. Consequently, the hoisting engineer must know that the skip is loaded and also that a car is in the proper place on the trestle.

At one of the large underground mines on the Mesabi Range in Minnesota the following signal system was used for this purpose: A bell operated by the underground skip-tender indicated to the hoisting engineer that the skip was ready to be hoisted. A red electric light, operated by a man on the trestle, showed in the engine house that a car was correctly spotted under the skip road. This system was used only during the first winter of operation—an unusually cold winter. Work was plentiful, so that all the experienced men found employment underground. Only an inferior class of labor could be procured to work on the trestle. It was unusual for work to be carried on continuously for two weeks without hiring a complete new trestle crew. Thus, because of the inexperience and negligence of the trestle gang, several times each day the spotter would spot the car under the wrong skip road, signal the engineer, and the skip would be hoisted and its load dumped on the rails, usually between two cars or between a car and the motor. This spilled material was difficult to remove on account of the limited space between the cars. Often so much time was lost that all available underground storage room would become filled and mining operations delayed until hoisting was resumed.



DETAILS OF AUTOMATIC SIGNAL SYSTEM

The following automatic-signal system was devised and installed to eliminate the man employed as car-spotter and signalman on the trestle, and also the trouble resulting from cars being spotted incorrectly. A red light on the trestle in front of each skip road indicated to the motorman the next skip to be hoisted. These lights were operated automatically by the skip. A white light at the side of each red light indicated that a car was spotted correctly under the skip road. Each of these white lights was operated by a spring which closed a circuit with the car wheel. A red light and a white light burning side by side showed the motorman that the car was in the proper place to receive ore from the next skip to be hoisted. Two red lights in the engine house on either side of the indicator disk showed the hoisting engineer that the car was in place and which skip it was under. The red lights in the engine-house were on the same circuit as the white lights at the trestle.

The accompanying diagram, with description, illustrates more clearly the manner in which the system operates: An electric switch S controlled by the lever L is located between the two adjacent skip guides. When the skip A is at the bottom of the shaft a red light R burns in front of the A-skip road. When the A skip strikes the triangular lever L the switch S is pushed over on the other line, extinguishing the red light in front of the A-skip road and lighting the one in front of the B-skip road, thus showing that the skip B is at the bottom of the shaft.

The white lights W are controlled by the springs C, which complete a circuit through the car wheel to the rail. Springs C are so located that when a wheel is in contact the car is correctly spotted to receive the ore from the skip. The red lights for A and B skips in the engine-house are operated by the connection C.

The advantageous results of this system were at once apparent. Work on the trestle ran smoothly and steadily. Cars were spotted quickly and in the proper place. Signals from the trestles were received by the engineer the moment the cars were spotted. A man was required at the shaft only an hour or so a day to remove the small amount of ore spilled over the tops of cars while loading. Loss of time by contract miners was thus eliminated.

*Civil engineer, University of Minnesota, Minneapolis, Minn.

Rubber Belting Briefs

A Goodyear trade publication gives the following suggestions regarding the care and use of rubber belts:

Belts should not run less than 200 ft. per min.

Average velocity of belts should be 2000 ft. per min.

Maximum velocity of belt should be between 5000 and 6000 ft. per min.

When running at high speed the centrifugal force of the belt has a tendency to remove it from contact with the pulley, thereby lessening the horsepower transmitted.

All animal oils and grease are injurious to rubber belting.

Shifters should not be used on rubber belting. Once the edges are worn through the plies readily separate.

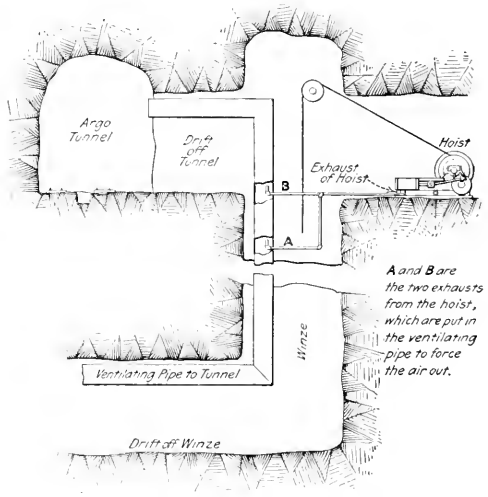
Large face pulleys and normal speeds, proper tension and plies of fabric give best service.

Vertical belts require extra tension to obtain sufficient friction on the lower pulley.

Ventilating a Dead Heading

By P. Ruth, Jr.,*

Having bad air and rock gas at the end of a drift from the bottom of a winze, a 10-in. ventilating pipe was installed from the breast of the drift to and up the winze and connected with the main tunnel above. The natural circulation of air through this ventilating pipe, contrary to expectations, would not move the gas and bad air,



VENTILATING A DEAD HEADING

which were as troublesome as before. At the top of the winze was a small hoist operated by compressed air. By running the exhaust from this air hoist into the center of the ventilating pipe a draft was created which did the work as well as a blower and gave satisfactory results in the way of ventilating the drift below. The hoist is working almost all of the time, so that the benefit is continuous. The exhaust from an air-driven mine pump could also be used for the purpose.

Rate of Hand Tramming

At the Colby iron mine, Bessemer, Mich., when tramming was done on straight company account the trammers were handling on an average 12½ tons per man per shift. This system was changed to a straight contract system, with a fixed price per ton, which was not changed throughout the year. Under this system an average of 21.4 tons per man per shift were handled regularly. Two trammers constituted a gang. The size of the car was 1-ton capacity, and the average length of tram was 100 ft., it varying from 25 ft. to 275 ft. The length of tram made little difference apparently, as the superintendent of the mine states that for short trams the speed was 80 ft. per min. and for the long trams 330 ft. per min. The ore was loose and freshly broken and the ventilation was fair.

During 10 months 30,318 tons of ore was trammed in 1419 8-hr. shifts. The lowest number of tons trammed per man per shift was 18.6, the highest 23.2 and the average 21.4 tons.

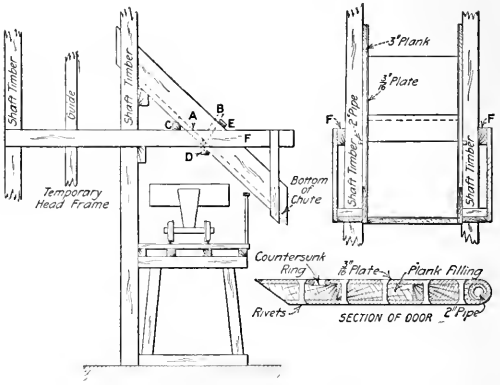
*Idaho Springs, Colo.

Rock- and Ore-Chute Door

By D. E. Charlton*

The accompanying sketch shows a combination rock- and ore-chute door that was made use of at one of the Mesabi Range mines. The shaft had been sunk the required depth and guides were placed in the hoisting compartments. Two drifts were started in rock, and one shortly afterward encountered ore of a merchantable quality. The ore demanded as early a shipment as possible. Because of this and the nonarrival of the headframe that had been ordered, the arrangement described was devised to be used with the temporary or sinking headframe, so that the ore might be hoisted and placed in the cars for shipment without interfering with the hoisting of the rock.

A Kimberley dump skip was substituted for the regular sinking bucket, and dump plates were placed on the temporary headframe. The position of the door when ore was being dumped is shown at *A*, the ore passing down the chute to the ore cars. When rock was hoisted



DETAILS OF DOOR AND CHUTE

the door was swung back to the position *B*, so that the rock passed about half-way down the chute and thence into the dump car and was trammed to the rock pile. The lower side of the door in this case acted as a buffer. A small trestle was built to bring the dump car to the required height, so that the rock in falling would do no damage to the car.

The bottom and sides of the chute were of 3-in. plank, lined with $\frac{3}{16}$-in. iron plate. In the construction of the

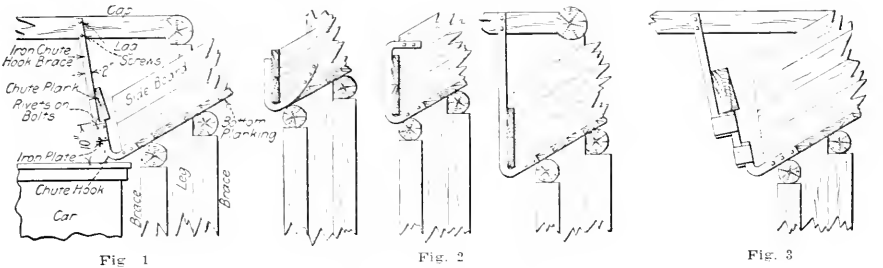
*Virginia, Minn.

door, as shown in the sketch, the plate was formed into an extended U-shape and filled with plank, the lower end of the U and a 2-in. pipe forming the hinge on which the door could swing. The plate was firmly fastened to the plank by means of countersunk rivets. At the upper end, a countersunk ring placed on the upper side of the door served as a means of lifting it. The door extended the entire width of the chute, and when open gave an aperture of 2 ft. 3 in. Crosspiece *D* served as a bearing piece for the chute and for the hinge of the door, the pipe extending through the main support, which was tied to the main shaft uprights. Crosspiece *C* served as a support for the door at the upper edge, which was beveled to meet the bottom of the chute at this point. The door, when thrown into position for dumping rock, had a backstop *E*.

An Improved Chute Hook

A serviceable and durable chute hook may be easily made as indicated in the accompanying drawing, Fig. 1. The chute hook is made of 2x1½-in. or 2x⅝-in. iron, as shown. Connected to this, by a pair of iron plates, riveted or bolted, is another 2x1½-in. iron strip which is fastened to the cap above by lagscrews. This brace strengthens the hook and allows a backing for the chute plank entirely to cover the chute mouth. The object in this break in the hook is to allow a resting place for the chute plank. There should at all times be a plank in the chute to prevent runs of rock. If no place for the plank is provided the trammer will take it out, set it beside the car and use the bar, causing frequent runs of rock, which necessitate shoveling up the track. To most miners the value of this rest is self-evident; but too many chutes have hooks as indicated in Fig. 2, which necessitate removing the plank entirely or require one chute man on each side to hold the plank up while running out the rock.

A second rest may be provided like the first by inserting a 10-in. piece of brace iron and a second pair of plates. A rest for two planks may be made as indicated in Fig. 3.



TYPES OF CHUTE HOOKS

Too Short Steel Piling

In a test pit at an iron mine near Riverton, Minn., sheet-steel piling arranged in circular form was used, and it was found that too short lengths of piling made it very unsatisfactory and difficult to handle. Although the Riverton country is sandy, the piling in this pit was not satisfactory after the water level was reached on account of considerable buckling of the piling sheets.

Relocation of Mining Claims

By A. L. H. Street*

The Arizona Supreme Court dealt with questions concerning the sufficiency of notices of relocation of mining claims in the recent case of Stratton vs. Copper Queen Consolidated Mining Co. (149 Pacific Reporter, 389). Referring to the Federal statute which authorizes a relocation where an original locator has failed to perform the required annual work, and has not resumed operations, the court said:

> The only restraint the statute places upon a relocation of the land after an original location has been made is such as prevents the relocator by his relocation from depriving the former locator of any of his rights. But when, as here, all of the rights of the original locator have been abandoned or forfeited, and no claim of such rights is asserted by the original locator, his heirs, assigns or legal representatives, and the contesting parties to the action concede that all rights that ever existed by reason of such prior location ceased to exist before any relocation of the ground was attempted, then it is clear that, under the statute and its unquestioned meaning, the land was open to relocation in the same manner as if no location of the same had ever been made. . . . In order to complete a valid location of the ground in question the locators were not required to state if the whole or any part of the location was located as abandoned property, because they were not in fact locating the ground as abandoned property, but were locating the ground in the same manner as other public mineral ground is located —that is, as an original location. . . . If the location is located as abandoned property, under the local statute (Paragraph 3241, Revised Statutes of Arizona, 1901) before its amendment, then in that case only the location was required to state the fact. But the statute never required the location notice of an original location so to state.

Proportion of Surface to Underground Men

At 58 different mines in Arizona there are employed 1917 surface men and 7505 men underground, according to the annual report of the State Mine Inspector for 1914. This is at the rate of 1 surface man for each 3.9 men underground. This includes all of the larger operations; also many small ones in which the proportion of surface men to underground men is much greater, and may vary from 1:1, to the average given. At the Morenci mines of the Arizona Copper Co. the ratio is 1 surface man to 4.2 men underground; at the Calumet & Arizona, Bisbee, the ratio is 1:6.5; at the Copper Queen, Bisbee, the ratio is 1 to 12.2; at the Inspiration, 1:4.8; at the Ray, 1:2.2; at the United Verde 1:[illegible]; at the Miami 1:7.4.

*Attorney, St. Paul, Minn.

Details of Milling and Smelting

Barth Slide Rule for Pulp Measurement

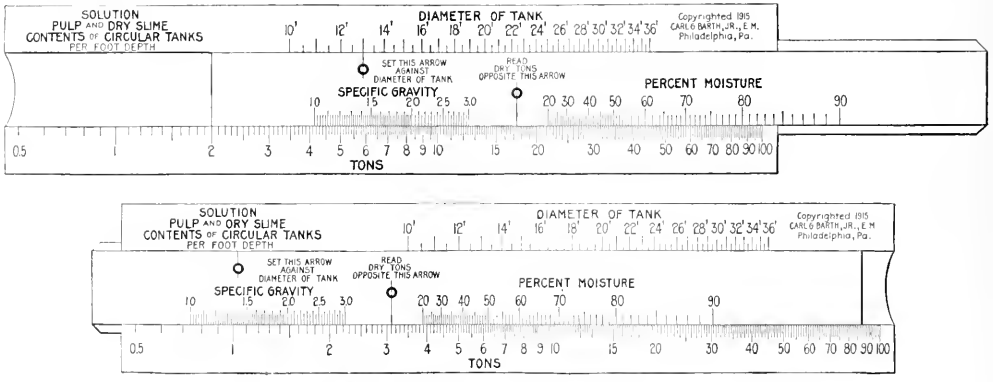
By Carl G. Barth, Jr.*

This slide rule gives the contents, in tons, of tanks ranging in diameter from 10 to 36 ft. and in specific gravity from 1 to 3. The rule consists of four scales—one giving the diameter of the tank by 6-in. intervals, a specific-gravity scale ranging from 1 to 3, a scale giving the percentage of moisture from 20 to 90 and a scale giving the tons of 2000 pounds.

To operate, the arrow is first set against the diameter of the tank, and opposite the specific gravity is read the contents in tons for one foot of depth—if for water, opposite specific gravity 1; if for pulp, of specific gravity 1.5, opposite 1.5. When the dry-slime content is desired, the percentage of moisture contained in this pulp must previously be known. This might be 50%. Remembering or marking the point, read opposite the pulp of specific gravity of 1.5; next move the slide until the number 50, representing the moisture on the scale so indicated, coincides with this, and then read opposite the arrow the tons of dry slime.

As an illustration the problem for which the slide rule is set herein is used. Given a tank of 13-ft. diameter, what is its content per foot-depth in tons of water, tons of pulp of a specific gravity of 1.5 having 50% moisture and in tons of dry slime?

Set the arrow against 13 on the scale showing the diameter of tank. Opposite specific gravity 1, read 4.15 tons water. Opposite specific gravity 1.5, read 6.22 tons pulp. Move the slide so that 50 on the scale, showing percentage moisture, coincides with 6.22. Read opposite the arrow 3.11 tons of dry slime.



METHOD OF USING THE SLIDE RULE

*Consulting engineer, 6151 Columbia Ave., Philadelphia, Penn.

Don'ts in the Designing of a Smelting Works

The bare description of the plant of the Ohio & Colorado Smelting & Refining Co. at Salida, Colo., with the dimensions of apparatus and appliances, cannot be very instructive to beginners, nor interesting for those who have been long in the work, writes F. D. Weeks.[1] However, it seems that some of the peculiarities of the Salida plant as originally built should serve to prevent the younger men from making similar mistakes; the older men can get their satisfaction by reflecting that they never did anything quite so far removed from good practice as some of the things done here.

Originally, a brick wall, with a narrow door in front of each blast furnace, was constructed. How the work was to be done behind this wall is not known, but it shows that the designer did not know how to do the work.

The water jackets were held in place by a 12-in. I-beam running the length of the furnace, thus effectually preventing anyone from examining a tuyere or jacket.

The shaft walls on the feed floor were so thick that the feeders were shoving ore into one end of a tunnel and, since the opening was not so wide as the shaft, the ends of the furnace could not be fed except by throwing the charge around a corner—which, of course, was not done.

The proposal to concentrate matte, carrying 20% lead and 5% copper, in a copper-matting furnace was intended to do away with the necessity of buying roasting equipment.

The largest corliss engine on the plant was the exhibition engine at one of the world's fairs held some

[1]Excerpt from a paper entitled, "The Salida Smelter," to be read before the San Francisco meeting of the American Institute of Mining Engineers, Sept., 1915.

years ago. When repairs were needed, it was discovered that this was the only engine of the kind ever built, and the drawings of it were lost; so each repair part called for an accurate drawing.

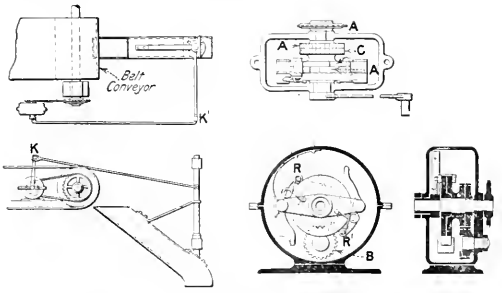
In the track plan of the works, all the ore, coke and limestone had to be unloaded from one track. This track also held the cars which were to be unloaded at the oxide crusher as well as at the sulphide mill. The problem of dispersing some of this congestion was not simple. It was solved by building two trestles in place of one; by having the limestone brought in dump cars so that unloading took little time; and by building an oxide crushing and screening plant on new tracks.

Mechanical Ore Sampler

By J. H. Taylor*

The apparatus here described is not intended to take the place of a sampling plant, but where a mill man wants to have confidence in his sample and the expenditure for a plant to handle 20% of the ore is not warranted, it is much better than hand-sampling.

The device here shown will cut about 0.5% of the ore passing over the end of the belt conveyor, without selection. The sample so taken will not be so accurate for a given day as if taken by cutting 20% each time, but at the end of a week the errors will be largely compensated.



USEFUL MECHANICAL ORE SAMPLER

I have had a mechanical sampler in use for the last 18 months, with excellent results.

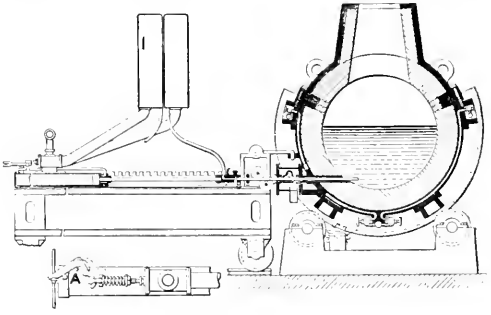
The operation of the device is as follows: The sprocket wheel *A*, gear *A* and disk *A* are keyed to the shaft and driven by a sprocket wheel on the shaft of the driving pulley of the belt conveyor. The gear *A* drives an idle gear *B*, which in turn drives gear *C*. Gear *C* and disk *C* are of one piece. As gear *A* has 31 teeth and gear *C* has 30 teeth, disk *A* will revolve 30 times while disk *C* revolves 31 times. At the beginning of one revolution of each 30, the recesses in disks *A* and *C* will coincide and roller *R* or R^1 will engage disk *A* for half a revolution, when it will be released. Hence a sample will be taken once in 30 revolutions. The lengths of the cranks are such that crank *K* passes through the middle 60° of the 180° while the sample is being taken, so that the increment of the swing of the sample chute is nearly constant, while the stream of flow is actually being cut.

With disks 4½ in. in diameter and a crank 12 in. long this device will successfully sample ore crushed to 4 in. from the end of a belt conveyor 2 ft. wide. The finer the ore the more accurate the daily sample will be, as is usual in mechanical sampling.

*Isabella, Tenn.

Mechanical Tuyere Puncher for Copper Converters

Ralph Baggaley, of Pittsburgh, Penn., has patented (U. S. Pat. 1,135,489) an apparatus for automatically punching the tuyeres of converters and furnaces, the general form of which is shown in the accompanying sketch. An air-cooled punching rod is used, and as many rods are provided as there are tuyeres on the converter, each punching bar being actuated by a separate motor or cylinder. The punching device is mounted upon a movable carriage that may be temporarily fixed in position. The punching rods are operated successively



BAGGALEY MECHANICAL TUYERE PUNCHER

by means of an endless rope, which engages one arm of a bell crank connected with the valve stem of each motor.

The motors or air cylinders that actuate the punching rods are reciprocated by means of air at 70-lb. pressure. This air escaping to a large receiver is cooled by expansion and is then utilized to cool the punching rod. However, water cooling may be used if desired. When repairs are to be made, any actuating cylinder may be stopped by engaging the arm of the bell crank with the special pin *A*.

Recovery of Elemental Sulphur

A new solution for the problem of recovering elemental sulphur from blast-furnace gases is given by W. F. Lamoreaux and C. W. Renwick, of Isabella, Tenn., in U. S. Pat. 1,140,310. Their process consists in passing these sulphur-bearing gases through a red-hot carbon column, which reduces the sulphur dioxide or sulphur trioxide to sulphur. They call attention to the fact that this reaction has its velocity enormously increased by increase in temperature. For instance, in some gases from pyritic smelting, 5% of the sulphur dioxide was reduced at a temperature of 800° C. in 5 sec.; 34% was reduced at 900° in 5 sec.; 63% at 1000°; 91% at 1100°; 96% at 1200°; 98% at 1300°.

It is not possible to keep up a temperature in the coke column high enough to perform this reduction in a sufficiently short space of time without the use of external heat. This is obtained by passing an electric current through the coke column, using this current to obtain the required temperature.

Company Reports

Alaska Treadwell in 1914

The report of the Alaska Treadwell Gold Mining Co., Douglas Island, Alaska, for 1914 shows a profit of $1,351,403 from the treatment of 910,285 tons of ore, before providing for $250,953 depreciation charge. Receipts aggregated $2,435,375, made up of $1,264,945 from bullion, $1,102,617 from sulphurets treated, $24,017 from interest receipts and $43,795 from commercial profits. The following table is a summary of operating costs per ton of ore treated:

Operating costs:	
Mining; development, 5934 ft.; stoping, 301,491 tons	$0.6896
Milling, 910,285 tons	.2572
Sulphuret expense, 13,324 tons treated	.0850
San Francisco office	.0191
London office expense	.0014
Paris office expense	.0003
Legal expense	.0018
Taxes	.0125
Bullion charges	.0113
Total operating costs	$1.0782
Construction costs and repair costs	.0344
Total operating and construction charges	$1.1126
Sundry charges:	
Boarding-house loss	.0057
Dwellings loss	.0115
Wharf loss	.0007
Sundry adjustments	.0603
	$1.1908
Depreciation charged off	.275
Total cost with depreciation	$1.4658

Ore reserves for tons in place are estimated to contain 6,601,086 tons, compared with 4,978,759 in 1913, but ore reserves of broken ore in stopes are estimated at 555,167 tons, compared with a reserve of 1,114,549 in 1913. The decrease in reserves of broken ore in stopes accounts for the difference between tons reported stoped and tons milled. The average value per ton estimated for all reserves was $2.48, compared with $2.67 in 1913.

The average number of men employed per day for the year was 733 and the average wage was $3.51. The assay office made 14,224 assays at a cost of 23.6c. per sample; of these 9748 samples were for the Alaska Treadwell mine and mills. Dividends amounting to $1,100,000 were paid during the year.

Broken Hill Proprietary Co.

The Broken Hill Proprietary Co., Broken Hill, N.S.W., Australia, for the half-year ended Nov. 30, 1914, reports a working income of $1,079,469 from which other charges amounting to $522,971 are deducted, leaving $556,498 balance from which $286,984 in dividends were paid. After adding $53,971 for miscellaneous income, there was a balance of $323,485 left after dividend payments. There were 121,316 tons of ore raised from the mine. The crushing sections of the mills handled 111,489 tons of sulphide ore, producing 18,586 tons of lead concentrates, assaying 64.18% lead and 27.41 oz. silver per ton. The re-treating section dealt with 56,600 tons of tailings and produced 1174 tons of lead concentrates assaying 52.02% lead and 26.33 oz. silver per ton. The zinc-flotation plant treated 78,124 tons and produced 15,851 tons of zinc concentrates assaying 46.86% zinc, 6.41% lead and 12.78 oz. silver per ton.

The lead smelteries produced 43,553 tons of bullion. The Ropp roasters treated 33,564 tons of concentrates and slimes and the Dwight-Lloyd plant 30,849 tons. The refinery dealt with 39,200 tons of bullion, including some concentrates from other companies, resulting in 1,546,238 oz. of silver, 699 oz. of gold, 33,507 tons of soft lead and 309 tons of antimonial lead. The spelter plant handled 7773 tons of concentrates and slimes, and produced 2341 tons of spelter and 342 tons of blue powder.

Alaska United

The annual report of the Alaska United Gold Mining Co., Douglas Island, Alaska, for 1914 shows a profit of $247,938 from 458,314 tons of ore treated, before deducting $81,153 for depreciation of property and plant. Receipts totaled $975,329, made up of $534,407 from bullion sales from the Ready Bullion claim, $431,384 from bullion sales from the 700-Foot claim, and $9538 from interest receipts. Expenditures aggregated $727,391 and consisted of: Operating and construction on Ready Bullion claim, $342,580; operating and construction on 700-Foot claim, $365,272; dwelling loss for year, $1228; coal loss, $1642; sundry adjustments, $16,669. Dividends amounting to $162,180 were paid. The following tables are summaries of costs per ton treated on the two claims:

READY BULLION CLAIM

Operating costs:	
Mining, development, 3569 ft.; stoping, 249,545 tons	$1.0550
Milling, 233,100 tons	.2641
Sulphuret expense, 5700 tons treated	.0933
San Francisco office expense	.0111
London office expense	.0017
Paris office expense	.0003
Legal expense	.0034
Bullion charges	.0100
Taxes	.0104
Total operating cost	$1.4493
Construction	.0204
	$1.4697
Sundry losses and adjustments, less interest receipts	.0218
Depreciation charged off	.1750
Total cost, including depreciation	$1.6665

700-FOOT CLAIM

Operating costs:	
Mining, development, 8528 ft.; stoping, 106,002 tons	$1.2302
Milling, 225,214 tons	.2638
Sulphuret expense, 4409 tons treated	.0797
San Francisco office expense	.0115
London office expense	.0017
Paris office expense	.0002
Legal expenses	.0035
Taxes	.0108
Bullion charges	.0082
Total operating costs	$1.6096
Construction	.0123
	$1.6219
Sundry losses and adjustments, less interest receipts	.0218
Depreciation charged off	.1750
Total cost with depreciation	$1.8187

The Ready Bullion mine is estimated to have 1,835,650 tons of ore in place compared with 1,433,334 tons in 1913; broken ore in stopes amounted to 308,412 tons, compared with 275,328 tons for the previous year. The total ore reserve of both classes amounted to 2,144,062 tons having an assay value of $2.68 per ton.

The 700-Foot claim ore reserves are estimated to contain 2,542,477 tons of ore having an assay value of $2.35 per ton, as compared with 1,281,475 tons at $2.46 per ton, in 1913. The reserve at the end of 1914 was made up of 2,359,495 tons of ore in place and 182,982 tons broken in stopes. Broken ore in stopes shows a decrease of 92,678 tons during the year.

An addition of 30 stamps was made to the Ready Bullion mill and the same number were added to the 700-Foot claim mill. The average number of men employed was 246 at an average wage of $3.49 per day. Employees were charged $25 per month for meals at the company's boarding house and $2 per month for a room in the lodging house.

Mount Morgan Gold

The Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, for the half-year ended Nov. 29, 1914, reports that revenue from all sources amounted to $2,441,574. Expenses charged off were $2,131,332, thereby leaving a balance of $310,242, of which $243,000 was paid in dividends. All ore treated amounted to 179,939 tons, yielding 4,593.58 tons of copper and 58,309 oz. of gold. Of this ore, 13,039 tons were purchased and miscellaneous ores. The mines produced 196,965 tons of rock of which 25,610 tons were waste and the remainder ore. Ore reserves are estimated to contain 1,123,000 tons of high-grade and 1,849,000 tons of medium-grade ore. Development work totaled 2484 ft. and consisted of 1394 ft. of drifts, 110 ft. of recessing, 865 ft. of sinking and 115 ft. of raising.

The new smelting furnaces were started in July. The present cost of coke per ton of Mount Morgan ore smelted is $2.19 but this cost it is expected will be reduced. The handling of flotation concentrates has been a source of trouble on account of their fineness. Laboratory experiments indicate that this trouble can be overcome. The following table gives details of concentration results:

	Weight, Tons	Assays Copper, %	Assays Gold, Dwts.	Recovery Copper, %	Recovery Gold, %
Ore treated	31,274	2.365	5.36	...	...
Table concentrates produced	5,993	3.29	11.44	26.68	40.89
Flotation concentrates produced	3,026	13.94	18.85	57.02	34 00
Total concentrates produced	9,019	6.86	13.93	83.70	74.89

The working cost of Mount Morgan ore treated, inclusive of development and estimated realization charges, amounted to $11.49 per ton.

Le Roi No. 2

The Le Roi No. 2, Rossland, B. C., for the year ended Sept. 30, 1914, reports that as a result of mining operations $39,386 was remitted to the London office of the company. The mine produced 43,908 tons of rock, consisting of 22,479 tons of mixed ore, 1689 tons of second-class ore, 5689 tons of mill ore and 14,051 tons of waste. After hand-sorting, this tonnage was disposed of as follows: 17,566 tons of shipping ore, 12,113 tons of milling ore, 11,178 tons of waste to dump and 3051 tons of waste to fill old workings. Stoping costs totaled $95,089, or $3.32 per ton of ore. Diamond drilling amounted to $19,957, or 70c. per ton of ore. Mining costs in all aggregated $4.02 per ton for the following charges: Ore production, labor, 83c.; explosives, 35c.; illuminants, 3c.; sundries, 6c.; ore sorting, 19c.; general expense, 47c.; power plant, labor, 10c.; supplies, 49c.; mine general, labor, 70c.; supplies, 10c; diamond drilling, labor, 35c.; carbon, 21c.; supplies, 14c. Depreciation amounting to $2.51 was charged off, but not included in the costs just stated.

The gross value of 17,014 tons shipped was $20.19 per ton, made up of $12.13 in gold, 93c. in silver and $7.13 for copper. The mill concentrated 12,170 tons of ore averaging 0.132 oz. gold and 10.44 lb. of copper per ton. From this ore 1322 tons of concentrates were produced containing 0.751 oz. of gold, 0.756 oz. of silver and 20.7 lb. of copper per ton. The smelting charges amounted to $4.98 per ton of concentrates. Development work aggregated about 3794 ft. at a cost of $21.45 per ft. There were 67 diamond-drill holes drilled totaling 12,249 ft. at an average cost of $1.63 per ft.

Broken Hill South Silver

The report of the Broken Hill South Silver Mining Co., Broken Hill, N. S. W., Australia, for the half-year ended Dec. 31, 1914, shows a balance from the working account of $297,199, and receipts of $901,376. After providing for all other charges and income the net balance for the year was $88,965. The mine produced 111,891 tons of ore averaging 15.3% Pb, 7.1 oz. Ag and 14.2% Zn. Of this ore 96.8% was mined on contract, 0.4% by miners on wages, and 2.8% from development work. The average earnings of contract miners was $4.41 per 8-hr. shift and of truckers $3.52 per shift. There were 417 surface employees of whom 404 were in daily attendance and 779 underground employees of whom 734 were in daily attendance. All employees totaled 1196 and averaged 1138 in daily attendance. There were 25,698 cu.yd. of loose material sent below to fill stopes at a cost of 92c. per ton of material used for filling, or 21.6c. per ton of ore extracted. The following gives a tabulation of the classification effected by the concentrating plant:

	Net Weight, Tons	Proportion	Assay Value % Pb	Assay Value Oz. Ag	Assay Value % Zn	Proportion of Metal Contents, per Cent. Pb	Ag	Zn
Concentrates	20,375	18.1	64.9	21.6	8.3	76.7	54.9	10.6
Tailings:								
Zinc	69,943	61.9	3.1	3.3	16.9	12.5	29.0	73.8
Quartz	5,942	5.3	1.7	1.6	4.1	0.6	1.1	1.5
Slimes	16,490	14.7	10.8	7.3	13.7	10.2	15.0	14.1
Total ore	112,750	100	15.3	7.1	14.2	100	100	100

Working costs amounted to $4.88 per ton and consisted of $3.15 for mining, 22c. for filling stopes, 49c. for development and $1.02 for concentrating. Total mine cost per ton of concentrates was $27.56. In treating this ore 26,675,000 gal. of water was consumed.

Van Roi Mine

The Van Roi Mining Co., Silverton, B. C., for the year ended Sept. 30, 1914, reports that the mill ran 3457 hr. and treated 16,025 tons of ore averaging 13.85 oz. Ag, 2.69% Pb and 6.64% Zn. Lead concentrates to the amount of 588 tons were produced, averaging 192.08 oz. Ag, 54.75% Pb and 11.15% Zn per ton. Zinc concentrates produced amounted to 1096 tons, averaging 51.91 oz. Ag, 3% Pb and 39.47% Zn. The cost of mining was reported at $2.57 per ton and $1.61 for concentrating. Development work consisted of 2087 ft. at an average cost

of $13.66 per ft. The average cost of drifts was $13.04 and raises, $15.42 per ft. The results of development during the year did not justify any further expenditure in this direction and no attempt will be made to extract ore from the mine during the continuance of the European war.

Alaska Mexican

The report of the Alaska Mexican Gold Mining Co., Douglas Island, Alaska, for 1914 shows a profit of $170,202 from the treatment of 233,457 tons of ore, before providing for $25,451 depreciation charge. The average yield was $2.18 per ton of ore. Total receipts were $513,318, of which $238,756 came from bullion sales, $270,267 from concentrates treated and $4295 from interest receipts. Dividends during the year aggregated $144,000. The following table gives details of costs per ton of ore treated:

Operating costs:	
Mining; development, 2952 ft.; stoping, 167,274 tons	$1.0188
Milling, 233,457 tons	.2457
Sulphuret expense, 4330 tons treated	.0798
San Francisco office expense	.0225
London office expense	.0030
Paris office expense	.0005
Legal expense	.0057
Taxes	.0087
Bullion charges	.0082
Total operating costs	$1.3929
Construction	.0211
Boarding-house loss for year	.0062
Dwellings loss for year	.0175
Sundry adjustments	.0328
	$1.4705
Depreciation charged off	.1090
Total cost with depreciation	$1.5795

Ore reserves are estimated to contain 688,738 tons of ore, having an assay value of $2.68 per ton, consisting of 327,426 tons of ore in place and 361,312 tons broken in stopes; compared with 816,882 tons having an average assay value of $2.53 per ton and consisting of 430,939 tons in place and 385,943 tons broken in stopes at the end of 1913. The average number of men employed was 159 at an average wage of $3.28 per day.

Arizona Copper

The report of the Arizona Copper Co., Clifton, Ariz., for year ended Sept. 30, 1914, shows a production of 38,756,000 lb. of bessemer copper. Ore mined from the company's properties amounted to 1,079,950 dry tons and the smelting returns indicated an average contents of 36.17 lb. of copper per ton. About 95% of the ore mined was concentrating ore. Of the copper produced 81.4% came from the sulphide ores and 18.6% from oxidized ores. The financial statements show that the profit from operations in Arizona was $1,100,919. After payment of $119,224 in dividends, satisfying bond interest and other charges and adding other income, the net surplus carried forward for the year was $743,837.

The Humbolt mine produced 525,530 tons of ore during the year. The second-class ore at this mine averaged 2.42% against 2.85% during 1913. The Clay mine produced 140,542 tons of ore of which 695 tons were smelting and 140,017 tons concentrating ore. The production at the Petaluma and Carrasco mines amounted to 17,074 tons of which 5001 tons were smelting and the remainder concentrating ore. The Yavapai mine produced 597 tons of smelting ore, 31,226 tons of concentrating ore and 5191 tons of pyrites. The Longfellow North Extension mine production amounted to 61,433 tons concentrating and 1360 tons of smelting ore. The Coronado mine produced 145,352 tons of concentrating and 7756 tons of first-class smelting ore. The Metcalf mines produced from surface and underground 87,297 tons of oxide and concentrating ore. The King mine produced 36,441 tons of which 27,823 tons were sulphide concentrating and 3740 tons oxide concentrating and 4918 tons oxide smelting ores.

The sulphide concentrators treated 932,954 dry tons of sulphide ore of which 76.8% were treated at No. 6 and 23.2% at the Clifton concentrator. The average ratio of concentration was 8.42 tons of ore into one ton of concentrates. The oxide concentrator and leacher treated 87,875 dry tons of ore, producing 5414 tons of concentrates sent to the smelter and 72,649 tons of tailings treated in the leaching plant. Of the total copper production 5.7% came from these ores.

The report states that after the first few months of breaking in the new smelting plant, it has operated smoothly and well. It also mentions the fact that in 1910 the total taxes for state and county purposes in Arizona amounted to $65,060, while in 1914 they were $180,157.

Canada Copper Corporation

The Canada Copper Corporation, Greenwood, B. C., was organized in March, 1914, with an authorized capital of $5,000,000, made up of 1,000,000 shares. There was also authorized at the time of organization an issue of $1,000,000 6% convertible debentures. On Dec. 31, 1914, 600,200 shares of the stock had been issued and 200,000 shares were held for the conversion of the bonds; $600,000 of the bonds had been negotiated, and the remaining $400,000 of bonds and 199,800 shares of stock may be used for future requirements. Under the plan of organization the stockholders of the British Columbia Copper Co. were invited to subscribe for the bonds and to exchange their shares for shares of the Canada Copper Corporation. There were exchanged 444,952 shares of the British Columbia company. The Corporation also holds a first mortgage on the British Columbia Copper Co. to secure a loan of $340,000.

Some details of operating costs at the mines are given in this report. At the Motherlode mine the cost of placing the ore on board the railroad cars at the mine was 85.43c. per ton. This cost includes ore sorting at 1.55c. per ton; development, at 8.7c. per ton, or $5.97 per ft. of work; and diamond drilling at 6.48c. per ton of ore or $2.38 per ft. drilled.

At the smeltery 299,928 tons were handled consisting of 193,542 tons of British Columbia Copper Co.'s ore and 106,116 tons of custom ore. There were 5129 tons of converter slag made and smelted which contained 1627 tons of custom ore and 466 tons of clay. There were 41,026 tons of coke used, which was equal to 13.52% of the entire charge fed to the furnaces. The average grade of the matte was 39.7% copper. The blast furnace slag contained 0.251% Cu, 0.0039 oz. Au, and 0.07 oz. Ag per ton. The average analysis was 41.9% silica, 18% iron and 22% lime. The production of fine copper was 4,146,490 lb.; gold, 14,442 oz., and silver, 63,501 oz. The company closed the year with $181,106 in cash on hand.

Correspondence and Discussion

Proposed Memorial to Doctor Holmes

I have just returned from Washington, where I was in attendance at the funeral of Dr. Joseph A. Holmes, on Saturday. The services at the church and at the grave in Rock Creek Cemetery were dignified, but perfect in simplicity, as befitted his character. The arrangements were made by his loyal friend and assistant, Van H. Manning. The flowers were beautiful, and included a wreath from President Wilson. Each of the bureau's chief stations, Pittsburgh, Denver, San Francisco and Washington, was represented by set pieces, including an exquisite reproduction of the bureau's emblem of the eagle, the crossed hammer and pick and the Doctor's own motto, "Safety and Efficiency." Secretaries Lane, Daniels and Wilson, Gifford Pinchot, and other prominent persons were honorary pallbearers; the bureau division chiefs were active pallbearers.

In talking with a number of Doctor Holmes' personal friends, both in and outside of the bureau, views were expressed that there should be some permanent memorials for so big and unique a man as Doctor Holmes, who covered so wide a range of scientific activities, but most of all who touched the humanitarian side of the thousands with whom he came in contact—from the most successful mine operators to the humblest among the miners. It was a matter of regret to all that he could not have seen in life some of the larger fruits of the work which he inspired among many.

Two plans were suggested which seemed to meet general approbation, including that of Mr. Manning, acting director; and I was informally asked by several to bring the matter before a number of my friends, also friends of Doctor Holmes, who would be in better position than any persons within the bureau to sound out by discussing each in his own special circle of friends in the mining and metallurgical industries the merits of the following or alternative proposals, and the possibility of carrying them out effectively:

The first, the erection of an appropriate monument at the grave in Rock Creek Cemetery, Washington, to be of a simple yet beautiful character, such as the statue of "Grief," by Saint-Gaudens, in the same cemetery, which in itself attracts thousands of visitors. It is thought that there will be tens of thousands of miners, operators, metallurgical workers in the great mining and metallurgical industry, who would gladly contribute the individual small amount needed for such a memorial.

The second, a memorial volume, to contain: (1) A sketch of Doctor Holmes' life; (2) views of his work by a number of selected persons, each representing some phase of the professions and industries with which Doctor Holmes has had to do, such as safety in mining, conservation and efficiency in mining and metallurgy, educational work, geology, as a friend of labor, and as a man; (3) resolutions of various societies and associations, which are now beginning to pour in to the bureau, and to his family; (4) selected writings and addresses by Doctor Holmes. The volume to be carefully edited by some friend of Doctor Holmes who has literary ability, and to be handsomely bound.

It is believed that there would be thousands of subscribers, who for a moderate subscription would at once do honor to Doctor Holmes' memory and at the same time furnish themselves with a book which each would be glad to possess.

It has seemed to a number of those with whom I talked that both the above proposals could be carried out, the first by a large committee under the leadership of some prominent person who would be in position to give some of his attention to it; the second project to be undertaken under the auspices of one of our national engineering or chemical societies, such as the American Institute of Mining Engineers, though of course without financial obligation, the subscriptions in cash to be first obtained. The assembling of the various engineering societies in San Francisco in September would be an admirable time to bring this matter to a climax; but it is well that both the projects, if they seem feasible, should be started as soon as possible.

The replies will probably throw some light on the best manner of proceeding. It will be appreciated that it would not be possible for anyone connected with the bureau to follow the matter up to a finality, but I know all the bureau men will do all they can in a personal, private way to assist those or any other projects to honor the memory of a man who was so much beloved by every one of them.

GEO. S. RICE, Chief Mining Engineer.
United States Bureau of Mines.
Pittsburgh, Penn., July 19, 1915.

Recent Progress in Flotation

I have noticed in the *Journal* of May 29, 1915, an article by O. C. Ralston and F. Cameron on ore extraction by the so-called oil-flotation process which seems to be quite to the point on the question. May I add a few suggestions on what is worth while. I commenced in the oil-refining business almost at the first of refining petroleum, extracting all of the many products, and became interested immediately in the oil part when oil flotation of minerals first came out.

I concluded then as I do now, that complete success must depend upon holding the temperature of the oil at all times the same as the temperature of the ore and mill water used, or as the atmosphere, by interlocking automatic temperature gages. The oil should be held in something like an oil still, so that the temperature of the whole contents of the still can be changed quickly to correspond with the atmosphere, ore and water. Nothing is more susceptible and sensitive to heat and cold than oil.

A practical oil refiner would surely build his stills and appliances to adapt his oil closely and quickly to

the temperature of the mill whether run at midnight, midday, or in wet, damp, cold or stormy weather. Without doing so, the tailings value is bound to go up and down and the extraction be unsatisfactory.

JAMES A. FLEMING.

Globe, Ariz., July 22, 1915.

The Case of Spelter

Producers and sellers of zinc, known in the trade as spelter, are taking advantage of the lull following spelter's advance to unprecedentedly high prices to make careful inventory of the situation. The important query current in zinc circles is: "Will the war demand for the metal be sufficient to absorb the very considerably increased production which is on the way, and will it be able to make up for the falling off in the peace demand for spelter?"

Action brings reaction. The shutting off of zinc supplies from Germany, Austria and Belgium, producers of 50% of the world's spelter, and the demand for the metal by makers of war munitions produced a temporary pinch in the supply which drove its price from about 5c. to nearly 30c. a lb. The importance of the three nations mentioned as producers is seen from the following table, which gives their 1913 spelter production in tons of 2000 lb.:

	Tons
World's production	1,100,000
Germany	312,000
Belgium	218,000
Austria	24,000
Total	554,000
Consumption of these three nations	387,000
Available for export	167,000

With 167,000 tons or 334,000,000 lb. of export metal cut off from the world's sources of supply at one fell swoop, higher prices were inevitable. Fear of a corner rather than an actual corner impelled manufacturers, especially those with war contracts, to rush into the market and bid for the metal almost without regard to price. Undoubtedly they bought more metal and paid much higher prices than the situation warranted.

Since the war began our exports have averaged and are still running at the rate of 10,000 tons per month, or only 120,000 tons per annum. Apparently the warring nations do not need now as much as they required in peace times. The requirement now is chiefly for brass. To make brass two tons of copper are used for every ton of spelter. We have no statistics of copper consumption, but we have statistics of copper exports. They have fallen off, which confirms the theory that less rather than more spelter is being used abroad.

Two important reactions followed the abnormal advance in price as inevitable corrollaries. The first was a sharp decline in what may be termed the peace demand for the metal and the second was a tremendous stimulation of production. Galvanizers who in normal times use 60% of the spelter consumed in the United States, doing business on comparatively narrow margins of profit and unprotected by the large profit margins of war orders, simply could not afford to pay the piper. It is conservatively estimated that the demand from galvanizers has decreased at least 50%, or, say, 100,000 tons per annum.

Producers, fired by the golden lure of prices such as no man has ever seen before, and probably never will see again, are straining every nerve to increase production. Smelteries are operating at capacity, thousands of additional workmen are busy in these plants and at the mines, and millions of dollars are being spent in enlargement of existing zinc smelteries and the building of new ones.

The Steel Corporation is building two large plants, one at Donora, Pa., and one at Gary, Ind., at an estimated cost of $5,000,000 and with a combined production of 50,000 tons per annum. Together with the corporation's present capacity to produce, this will practically remove from the market this large buyer, whose total consumption has heretofore taken about one-fourth of the country's output.

A canvass of the zinc smelteries of the country shows that the operative capacity at the end of 1914, which amounted to 114,000 retorts, as shown by Government survey, has been or will be by Jan. 1 increased to 154,000 retorts. A low estimate of the capacity of these retorts to produce zinc is 4 tons per annum, or, say, a net annual output of at least 600,000 tons. Theoretically the capacity is really about 10% in excess of this quantity, and if anything like current conditions continue to prevail, making it desirable to push operations, at least 650,000 tons per annum can easily be made. This would mean an increase of 300,000 tons over last year's production, thereby making up for the loss of shipments from Germany, Austria and Belgium, with 133,000 tons per annum to spare.

Under these circumstances it is only a matter of time, and a short time at that, when an equilibrium between supply and demand will be reëstablished. When the war is over and Europe is again producing and exporting spelter, this country will find itself with a smelting capacity two to three times greater than any possible demand. Then will come a struggle for existence, with the fittest surviving, and an era of low prices resulting from keen competition such as threatened bankruptcy to many concerns before the war.

Perhaps this readjustment, which is bound to come and which will eliminate the weaker producers, is one good reason why the zinc companies are going slowly in the matter of distributing the large surplus which they are piling up in these piping times, and why conservative investors feel that current prices for zinc shares have sufficiently discounted the situation in spite of present plethoric profits.

J. P. B.

New York, July 29, 1915.

Drilling Campaign of the Consolidated Copper-mines Co.

Recently returning from an absence of several weeks, in an out-of-the-way place, I find my issues of the *Engineering and Mining Journal* awaiting me. Heretofore I have considered the *Engineering and Mining Journal* to be an un-owned, unprejudiced standard of modern mining.

Were it not for the fact that I am sure that the *Journal* has committed a carelessness, not usually characteristic

of it, I would be tempted to suspect that I had been under misapprehension.

The error occurs in the issue of June 19, 1915 (Vol. 99, No. 25), on p. 1069 and is entitled "Drilling Campaign of the Consolidated Coppermines Co.". The *Journal*, having unfortunately omitted the author of this article, would be held responsible for it by anyone who was unfamiliar with the *Journal's* high standards.

As this before-mentioned article appears to be merely a deliberated and undeserved attack upon Colonel Wall, and in no way represents the facts about the Consolidated Coppermines Co., it would be pre-assumed that the *Journal* is not personally responsible for it. On p. 1070, the resources of the great Morris mine are either deliberately misrepresented, or so diluted with waste, that they give no resemblance to the original values. Concerning the Brooks mine, the location of the drill-holes, as shown in the appended plat, vastly discredits that mine; at no place are the drill-holes (put down by former General-Manager F. P. Mills, of the Giroux Co.), which lie to the south of the Bunker Hill, even indicated. This is a severe depreciation as these drill-holes promised that the orebody of the Brooks-Bunker Hill would swing to the south and meet the large bodies of concentrating (largely native copper) ore which underlie the rich zones of the Alpha mine. Neither are the drill-holes shown to the east of the Bunker Hill, indicating a connection with the orebody which follows along, or overlaps the Butte & Ely line, and connects with the Liberty Pit of the Nevada Consolidated Co.; nor is any mention made of these orebodies. Also, no mention is made of the so-called "Old Glory porphyry ore," which is in no way related to the "territory served by the Old Glory shaft"; a large part of the sampling of which was personally supervised by a United States geologist, and which acts as a connecting link between the Morris mine and the rich Veteran orebody of the Nevada Consolidated Co. Nor is mention made of the orebody penetrated in the neighborhood of the Dewey shaft (independent of "the territory served by the Taylor shaft"). Nor is any mention made of a fairly large tonnage developed in the Butte & Ely property, and allowed by as ultra-conservative an engineer as Henry Krumb, of Salt Lake City. To appreciate fully the seriousness of these discrepancies, I will call your attention to the Giroux ore reserves as estimated above the signature of Thomas F. Cole, in the annual report of the Giroux Consolidated Mines Co. for 1911, and reaffirmed by the annual report of 1912; or even as far back as the annual report of the Giroux Consolidated Mines Co. for 1910.

Since, in this article of unknown authorship, no definite value is claimed for the development of the Alpha-Giroux shafts, I will call your attention to the records of the office of the Surveyor-General of the United States, where sworn statements are given in connection with the patenting of the Mammoth and other groups south of the Alpha-Giroux shafts.

Also, in this same deceptive literature, it is interesting to note that the only apparent method of financing the Consolidated Coppermines Co., is by a proposed sale of bonds; and nothing is said of the one million dollars promised by those most interested in the consolidation, which was the most vital element guaranteed in the formation of the Consolidated Coppermines Company.

I think, when you look into the facts of this situation, you will make haste to correct the unfortunate mistake of bearing the responsibility of an apparent attempt, if not conspiracy, to depreciate a very valuable property.

A. J. Sale.

Battle Mountain, Nev., July 24, 1915.

[It is not unusual for persons who read in a newspaper something that they do not like, or something with which they disagree, to charge that it was put in by someone who "owns" the paper, or in pursuance of a conspiracy, etc. The article with which Mr. Sale finds fault was published as a matter of news, and consisted of the summary of a statement by E. F. Gray, the manager of the Consolidated Coppermines Co., to his directors, followed by a brief account of the annual meeting of the stockholders, and concluded with a summary of what President Boynton said in his annual report. All of this was made clear enough in the article.

Mr. Gray in his report of the ore reserves said: "No allowance has been made for any direct-smelting ores known to exist in the Old Glory, Taylor, Giroux and Alpha shafts, or the territory contiguous thereto, as these openings—except on the 770- and 1000-ft. levels of the Giroux shaft—are at present inaccessible."

There was no animadversion about Colonel Wall. The only reference to him was in the account of the stockholders' meeting, in connection with which it was remarked that "No opposition developed from the fiery attack made on the management recently in a circular by Col. Enos A. Wall." The nondevelopment of opposition was a mere statement of fact. Anybody who read Colonel Wall's circular will concede that the characterization of it as "fiery" was very temperate.

We print Mr. Sale's letter for it gives another side of a controversy that appears to have developed, as to the merits of which the *Journal* offers no opinion. Mr Sale's reference to the Giroux report of 1910 is not a happy one, however, the official figures published therein having been rather emphatically discredited.—Editor.]

Fineness of Crushing for Assaying

Will not the readers of the *Journal* give some data on the cause of the differences in assays produced by variation in the mesh to which the ore is crushed before assaying it? Apparently there is a point of maximum recovery; that is, up to a certain point the assays increase as the mesh diminishes, after which the assays decrease as the fineness of sample increases.

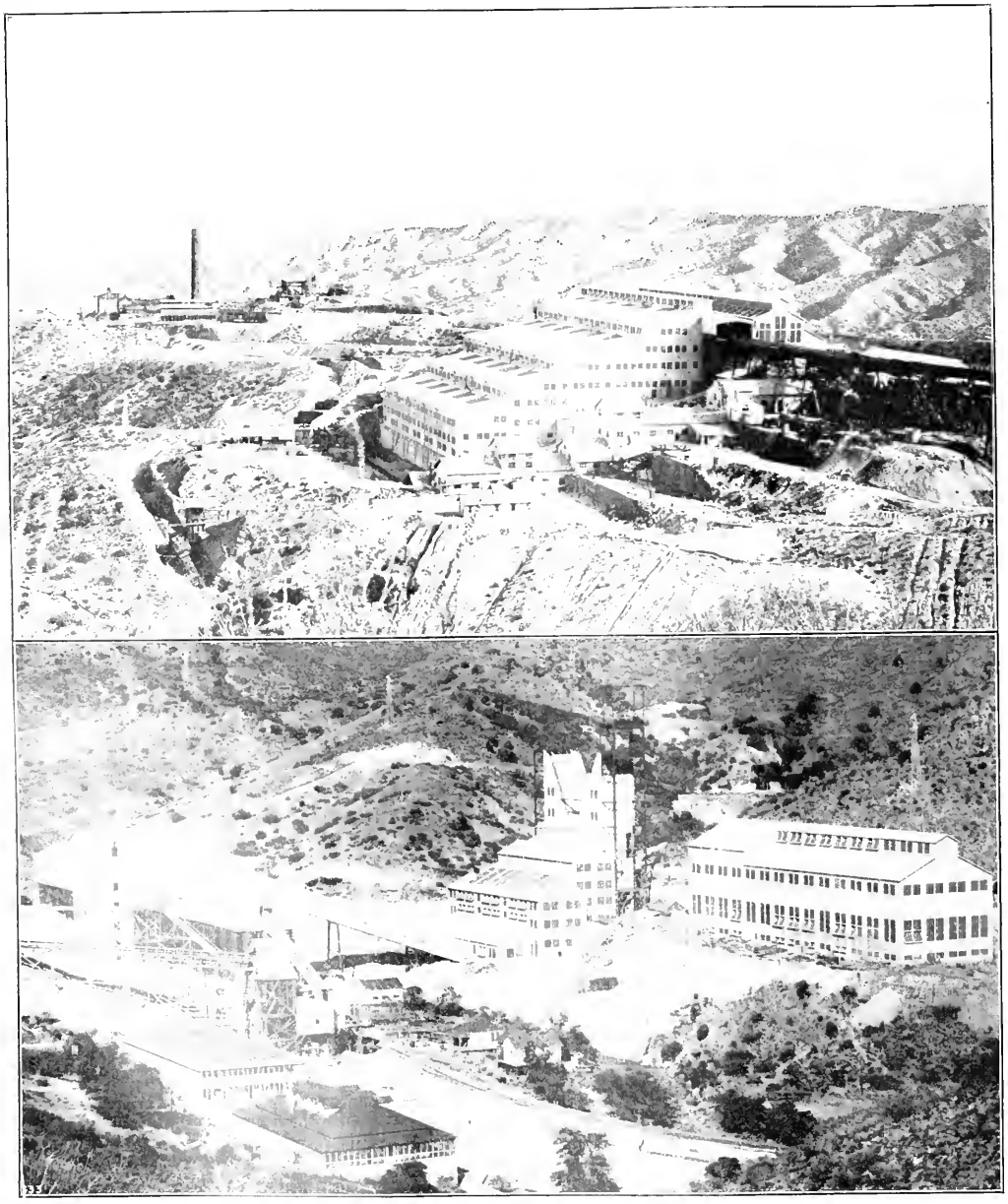
I have always supposed the low results with too coarse ore were due to the collector (reduced litharge) going down through the charge before complete fusion had taken place and that the low results with too fine ore were owing to the introduction of extraneous material from the crushing machinery.

Some weight is lent to this view by the fact that the point of maximum recovery is reached—according to my own experience—at a lower mesh on hard ores than it is on soft. But one man's experience and his time and opportunity for experiment are limited, so I should like to hear of other experimenters' work and conclusions.

A. A. Nason.

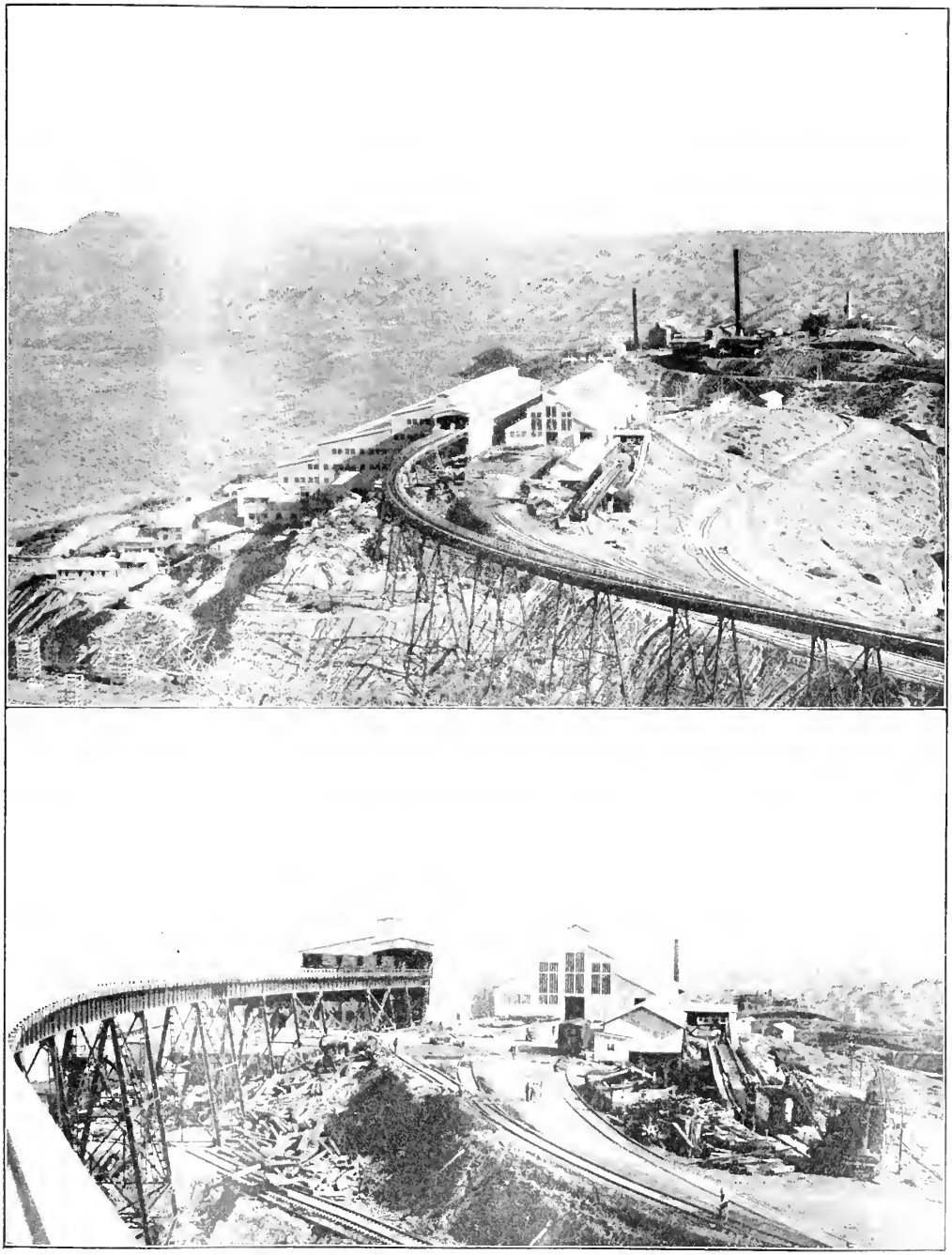
New York, July 18, 1915.

Photographs from the Field



[illegible]HON CONSOLIDATED COPPER CO., MIAMI, ARIZ.

Upper view shows con[illegible] mill and trestle, with smeltery in the background. Lower view shows the hoist house, h[illegible] of the twin shafts, crushing plant and loading station at the mines



INSPIRATION CONSOLIDATED COPPER CO., MIAMI, ARIZ.

Upper view shows the general arrangement of smeltery (right background), concentrator (foreground), and wells and pump station (left background). Lower picture shows a close view of trestle, concentrator, shops and yard

Imports and Exports of Metals

The United States returns of exports and imports for May and the five months ended May 31, as summarized below, show considerable change this year, mainly on account of the conditions arising from the war in Europe. The noteworthy changes in the more important metals are the large decrease in copper exports and the extraordinary increases in lead and zinc. In the minor metals the chief changes were a large increase in antimony and a heavy reduction in aluminum, due to the foreign embargoes placed on that metal.

United States foreign trade in the chief metals, other than iron and steel, is reported as follows for the five months ended May 31:

	Exports		Imports	
	1914	1915	1914	1915
Copper, long tons	187,993	134,607	67,761	43,628
Tin, long tons	344	308	19,879	18,308
Lead, short tons	7,858	67,906	10,346	28,607
Zinc, short tons	588	59,263	471	326

Copper includes contents of ore and matte. The imports of zinc ore in 1915 were 40,183 tons, containing 32,362,875 lb. zinc. No exports of ore have been reported in 1915. Exports include reëxports of foreign material.

The exports and imports of the minor metals in the United States for five months ended May 31, as reported by the Department of Commerce, were as follows:

	Exports		Imports	
	1914	1915	1914	1915
Nickel, lb	11,603,325	12,623,241	17,093,496	19,403,608
Antimony, lb	3,122	302,625	6,233,503	7,367,600
Aluminum, lb	5,114	28,772	6,511,104	3,323,275
Quicksilver, lb	6,778	120,112		
Platinum, oz	143		34,548	7,749

Nickel and antimony include metallic contents of ore, matte, regulus, etc. Exports include reëxports of foreign material. Exports of aluminum in manufactured forms, not included in the foregoing figures, were valued at $423,855 in 1914 and $1,933,055 this year.

The imports and exports of secondary metallic products in the United States for the five months ended May 31 were as follows, in pounds:

	Exports		Imports	
	1914	1915	1914	1915
Copper sulphate	6,348,208	9,347,066		
White lead	7,384,563	11,118,184		
Zinc oxide	12,224,857	18,159,460		
Zinc dust	34,212	139,178	2,197,965	770,176
Zinc dross	572,477	4,738,324		

The exports of zinc dust given above are reëxports of foreign material.

California Petroleum Production, First Half of 1915

SPECIAL CORRESPONDENCE

The production of petroleum in California in the first half of 1915 is estimated at 44,600,000 bbl. On this basis the total production for the year would amount to 89,200,000 bbl., which would mean a decrease of 14,800,000 bbl. from the total of 104,000,000 bbl. produced in 1914. This decrease in oil production is directly traceable to the European War. There was in June some prospect, however, that the market would improve, as there was a noticeable increase of shipments of crude oil from the fields to the marketing and refining centers. But there is not at present anything in the situation of marked encouragement to independent producers. The production in June was 7,458,600 bbl., showing a small increase over the May figures. Total shipments from fields in June amounted to 7,662,629 bbl., which was approximately an increase over May shipments of 200,000 bbl. The shipments in June were the heaviest recorded since the war began, but not large enough to diminish stock appreciably. Total crude oil stocks at June 30 amounted to 60,616,289 bbl. The average daily production in June, 1915, was 248,620 bbl. and in June, 1914, was 302,400 bbl. In June, 1914, the prices in San Joaquin fields ranged from 40c. to 75c. per bbl. In June, 1915, the prices ranged from 32½c. to 50c. per bbl. in the same fields. One encouraging feature during the past six months is that the increase in stocks on hand totaled only 2,090,000 bbl., which would not have been possible if the Independent Agency had not insisted upon curtailing production.

World's Petroleum Production

The quantity of petroleum entering the markets of the world in 1914 amounted to 400,483,489 bbl., according to statistics compiled by J. D. Northrop of the Geological Survey. Of this record-breaking output the United States is credited with 66.36%, representing in quantity a trifle less than double the output of all the other oil-producing countries combined. Changes in rank during the year affected only Japan and Peru, the former superseding the latter by a narrow margin.

The accompanying table shows the marketed production of petroleum in the world in 1914, and for purposes of

WORLD'S PRODUCTION OF PETROLEUM—1913 AND 1914

Country	1914 Bbl. (42 gal.)	1914 Per-centage	1913 Bbl. (42 gal.)	1913 Per-centage
United States	265,762,535	66.36	248,446,230	64.59
Russia	67,020,522	16.74	62,834,356	16.34
Mexico	21,188,427	5.29	25,902,439	6.73
Roumania	12,826,579	3.20	13,554,768	3.52
Dutch East Indies	12,705,208*	3.17	11,966,857	3.11
India	8,000,000†	2.00	7,930,149	2.06
Galicia	5,033,350†	1.26	7,818,130	2.03
Japan	2,738,378‡	.68	1,942,009	.51
Peru	1,917,802	.48	2,133,261	.55
Germany	995,764†	.25	993,764†	.26
Egypt	777,038	.19	94,635	.03
Trinidad	643,533	.16	503,616	.13
Canada	214,805	.05	228,080	.06
Italy	39,548	.01	47,256	.01
Other countries	620,000§	.16	270,000†	.07
Total	400,483,489	100.00	384,667,550	100.00

* Includes British Borneo. † Estimated. ‡ Includes Formosa. §Includes 600,000 bbl. produced in Argentina.

comparison the corresponding output in 1913. The total world's production from 1857 to 1914 is estimated at 593,262,936 bbl., of which the United States has produced practically 60%.

Mineral Oil in Queensland

The Prime Minister of Queensland, Australia, recently made the following statement as to the deposits of oil in Queensland, about which so much has been said:

It is possible that we have large deposits of mineral oil in Queensland, but, while recognizing the necessity for urgent prospecting for it, the Government considered that before committing itself to the large expenditure which would be necessary to carry out operations, it would be well to obtain the opinion of persons who had special knowledge of the oil fields worked in other parts of the world. On my last visit to Europe I was able to bring the matter before several experts, who, before expressing an opinion, desired information as to the geographical formation of the country proposed to be tested. On my return to Queensland an officer of the Geological Survey was instructed to make a thorough inspection of the Roma district, which from present knowledge is the most promising locality, and his report was sub-

mitted to the experts, and their recommendations are about to be carried out. The acting hydraulic engineer is now on his way to America for the purpose of obtaining personal and practical knowledge of the methods adopted in the oil fields there, and, if he thinks advisable, to secure the services of a thoroughly qualified oilborer as his assistant, and also to negotiate for the purchase of an uptodate oil-boring plant.

Revision of Mining Laws Urged

Revision of Federal mining laws that they may encourage the prospector and not discourage him, as is the case at present, will be one of the paramount issues to come before a special meeting of the Mining and Metallurgical Society of America, which will open in Washington, D. C., Dec. 18, according to Horace V. Winchell, says the Salt Lake *Tribune*. Mr. Winchell arrived in Salt Lake, Wednesday, July 28, in connection with apex litigation. He is chairman of the committees on mining law of the American Institute of Mining Engineers and the Mining and Metallurgical Society of America, and, in consequence, is greatly interested in the present agitation for revision of federal mining laws. He said:

Salt Lake City's Commercial Club and Chamber of Commerce and all other Utah organizations interested in the development of the mining industry in this state and the West, will be asked to adopt resolutions for presentation to the American Mining Congress, asking that organization to make an organized effort to accomplish the revision of Federal mining laws. We are determined to bring this matter before the national congress at its next session in such a direct and forceful manner that it will find it imperative to heed our demands for new and better laws

PRESENT LAWS FORTY-FIVE YEARS OLD

The present laws under which claims are located were enacted in 1872, and since that time they have been in force practically unchanged. These laws were well adapted, probably, to conditions as they existed then, but they come far short in meeting conditions as they exist today. Mining men, generally, have condemned the operation of these laws, and there has been much agitation, but no organized effort to obtain action by Congress which would change the laws so as to encourage the prospector and not discourage him.

At the last session of Congress a bill was introduced in the Senate which received the general approbation of mining men. This bill provided for the appointment of a commission of three to investigate conditions in mining sections and to suggest amendments to the present laws. The proposed act passed the Senate with the hearty approval of the Committee on Mines and Mining, Secretary of the Interior Franklin K. Lane, the director of the Bureau of Mines and of the Geological Survey, and was recommended for passage in the House of Representatives by the House Committee on Mines and Mining. Western representatives, however, did not take the interest in the measure which Western senators did, and the bill died without action.

REVISION ENDORSED BY ALL THE LARGE MINING SOCIETIES

This movement for the amendment of mining legislation has the approval of the various different organizations of mining men throughout the United States. The American Institute of Mining Engineers, the Mining and Metallurgical Society of America and the American Mining Congress all have important committees at work on the subject. It is a matter of really great importance. The last report of the Bureau of Mines calls attention to the relative importance of mining and agricultural industries of the country and shows that although each laborer in a mine or smelter contributes an average of $2000 per annum to the wealth of the nation, each agricultural laborer contributes only $800 in the same length of time. Although the agricultural industry is everlasting and the mining industry is only temporary, so to speak, Congress appropriates thirty-five times as much money for the encouragement and development of the agricultural industry as it does for the mining industry.

In the report it is also shown that 65 per cent. of the freight business of all our railroads is in handling raw and manufactured products of mines, and that the standing of the United States among other nations as a manufacturing nation depends more largely upon mineral products than upon any other. But in spite of this fact it is singularly difficult to legislate wisely in the interest of the mining communties.

ACTION TO BE TAKEN IN DECEMBER

The pertinence of these remarks at this time lies in the fact that there is to be held in Washington, D. C., beginning Dec. 18, a meeting of the Mining and Metallurgical Society of America, to which will be invited representatives and delegates from all Western mining and commercial organizations interested in the development of the resources of the respective communities of the West. It is hoped that the meeting will be largely attended and that matters will be brought through this organized effort so directly and forcefully to the atention of Congress that it will result in the much-needed revision.

It is unnecessary to specify in what particulars revision is required, because every mining man and others conversant with the situation know that the law requiring a discovery of metal in places before a valid location can be made is not only absurd, but operates to discourage the prospector. Mining men universally condemn the apex law, which is the direct cause of so much litigation in all our camps and furnishes such fat fees to attorneys and experts at the expense of the mining companies.

Accident Rate at Various Hours of the Day

The accompanying table of accident frequencies is taken from the Raritan Copper Works *Ingot*, and appears to show the effect of tiredness toward the end of the shifts on the accident rate.

NUMBER OF ACCIDENTS OCCURRING EACH HOUR OF THE DAY

1915	Jan.	Feb.	Mar.	Apr.	May	June	No. of Accidents	Per Cent. of Total
3 (a.m.) to 3:59		1					1	4.
4 (a.m) to 4:59..					1		1	4.
5 (a.m) to 5:59..			1				1	4
6 (a.m) to 6:59 ..	1					2	3	12
7 (a.m.) to 7:59 ..			1				1	4
8 (a.m) to 8:59..			1				1	4
9 (a.m) to 9:59..	1						1	4
10 (a.m.) to 10:59.	2			1			3	12
11 (a.m.) to 11:59..		3		1			4	16
12(noon) to 12:59..	1						1	4
1 (p.m) to 1:59..					2		2	8
2 (p.m) to 2:59.				1		1	2	8
4 (p.m) to 4:59..			1		1		2	8
7 (p.m) to 7:59.	1						1	4
8 (p.m.) to 8:59..				1			1	4
Total.. ..	6	4	4	4	4	3	25	100

Exports and Imports of Lead

In the *Journal* for July 24, p. 156, was given the statement of lead imports for May and the five months ended May 31, as furnished by the Department of Commerce. The statement is now completed by the report of the exports for the same period. The shipments for May included 15,312 short tons of domestic lead exported and 3021 tons of foreign lead reëxported; a total of 18,333 tons. This makes the full report for the five months ended May 31 as follows, in short tons:

	1914	1915	Changes
Imports	10,346	28,607	I. 18,261
Exports	7,858	67,906	I. 60,048

In 1914 the imports exceeded the exports by 2488 tons; but in 1915 the exports have exceeded the imports by 39,299 tons, an average of nearly 8000 tons per month.

U. S. Bureau of Mines Car Touring Idaho

The itinerary of the Bureau of Mines Car No. 5, in charge of John Boardman, will be as follows for the next two months: Burke, Idaho, Aug. 8 to 14; Mace, Idaho, Aug. 15 to Aug. 21; Success, Idaho, Aug. 22 to 28; Kellogg, Idaho, Aug. 29 to Sept. 11; Wallace, Idaho, Sept. 12 to 15; Spokane, Wash. (shops for repairs), Sept. 16 to Oct. 9.

Editorials

The Independent Powder Companies and Their Chance

The manufacture of high-explosives in the United States has heretofore focused in a small group of big companies. There have been a good many small companies, far more than the consuming public has known. The United States Bureau of Mines not long ago listed 29 manufacturers of high explosives in the United States. Most of the small producers, however, have hid their light under a bushel. Their product has gone chiefly into local consumption. Talk with mining men generally—the great consumers of explosives—and few can tell the names of any dynamite-manufacturing companies other than those which arose through the dismemberment of the so-called powder trust.

The big companies are now absorbed in filling their great war contracts, in supplying high explosives to the armies of Europe. They are making fabulous profits, selling for about $1 per lb. what costs them about 30c. to make, so it is said; and the quotations for their shares have soared. While they are thus engaged there is a remarkable chance for their competitors, large and small, to make themselves known and capture a large share of the domestic business. For this there is every inducement. The peaceful business is not immediately so profitable as the military business, but it is more permanent. With mining going on at the high rate at present—copper mines, lead mines, zinc mines and gold mines being worked at their utmost capacity, while iron mining is rapidly rising to normal—there is no sense in anybody shutting his eyes to the possibilities of expansion with the excuse that times are dull.

It is not healthful for any industry to have its supply of an essential commodity centered in one place, or in only a few. More active competition in the supplying of dynamite would be welcomed. Every purchasing agent likes to shop and the existence of shopping tends to improve not only the feelings of the shopper but also the product that is offered to him. If, however, manufacturers want to give the shopper a chance to shop, they have got to let him know about themselves—they have got to kick the bushel off their light. In other words, they've got to advertise.

Those engineers who have broken away from the traditional routine and have tried the dynamites manufactured by the smaller independents find that, though less well known, they do work equal to the old standard brands, that their technical divisions are equally keen to supply the right powder to suit their customers' varying conditions, and that almost invariably the independent powder can be bought for less money. The mining engineers would welcome the widening of their field by the independents for the further reason that the restrictions of some of the dismembered companies have too often been irksome and the subject of complaint.

New Metallurgical Construction

With the practical completion of the New United Verde and Miami copper smelteries, the Inspiration and the Alaska Gastineau mills, the Anaconda and Chuquicamata leaching plants, the Rose Lake and Langeloth zinc smelteries, an extensive program of new construction begun two or three years ago is drawing toward a close. Several of these plants, however, are still lacking their final units, and work on these will be going on during the remainder of 1915, and even in 1916. Among such plants are the Inspiration, Chuquicamata, Alaska Gastineau and Langeloth, which will engage the attention of their builders for a long while yet.

The building of new metallurgical plants is, however, a never-ending process. About as fast as one group is completed another is started. The doubts and uncertainties of the first nine months following the beginning of the war caused a halt, but things are now active again, and probably metallurgical building is going on at as high a rate as previous to the war.

First and foremost is the reconstruction of several of the Anaconda plants, carrying out plans that involve the expenditure of millions of money. In gold milling, the Alaska Juneau mill is the big thing; in zinc smelting, the Donora and Gary plants of the Steel Corporation; in copper metallurgy, the leaching plant of the New Cornelia company. The Tacoma Smelting Co. is adding largely to its electrolytic refining capacity.

There are a great many small plants being put up in all directions, especially to supply the minor metals and various commodities whereof the prices have risen to high levels. In such operations speed of construction is a highly important consideration, and it is to be expected that many old records will be broken.

American Zinc Smelting Capacity

The recent editorial in the *Journal* on the subject of increased zinc-smelting capacity in the United States elicited some corrections from well-informed quarters, the general tenor of which was to show that the *Journal's* estimate was too low. This was not surprising. There appears to be an aversion on the part of the smelters who have been making increases to letting it be known, wherefore tentative lists are likely to be characterized by important omissions.

The following is a revised estimate: At 12 works listed Jan. 1, 1915, new retorts to the aggregate of 16,762 are being added. Five old works, not then listed, have been put in operation, with a total of old and new retorts amounting to 6601. Three new plants are being built with a total of 14,160 retorts. Therefore the total addition to American zinc-smelting capacity will be about 37,600 retorts, corresponding to capacity for about 160,000 tons of spelter per annum, which will give a total

smelting capacity for the production of about 660,000 tons of spelter per annum.

The new capacity will probably become available to its full extent a good deal sooner than was previously estimated. It turns out that the United States Steel Corporation is building not only at Donora, Penn., but also at Gary, Ind. It is said that the production of spelter at Donora is to begin about Nov. 1, and at Gary about Jan. 1. If those dates are lived up to, all records in building smelteries fired with coal will be surpassed. The managers of the Steel Corporation appear to have confidence in this inasmuch as its purchasing agent is reported to be buying no spelter for delivery after November. It is clear that these new plans are going to put the zinc-smelting industry into a new phase. When the largest consumer—a concern that uses about 110,000 tons of spelter per annum—puts itself into a position to supply about 70,000 tons of its requirement there will be a void in the general market that it will not be easy to fill.

*

Nevada Consolidated

About eight years after beginning production, the Nevada Consolidated company is taking steps to obtain ore from its Ruth mine. Heretofore its production has been made by the Eureka, Hecla and Liberty pits, with a little coming from the Veteran mine, which, however, has lately been idle. The Veteran orebody is relatively small and mining it is relatively costly, but the extraction of ore from it will be resumed later. The Ruth mine has a large body of high-grade ore, comparatively speaking. It will be mined by underground methods, which in this case figure out a little cheaper than stripping and steam-shoveling.

The Nevada Consolidated is an excellent example of the principle that great, flat-lying orebodies are usually underestimated. In the Eureka, Liberty and Hecla pits the fringes of the huge ore mass have been found to extend outward farther than ever was reckoned. A result is that after eight years of ore extraction this company is still able to figure its ore reserves at a larger quantity than ever. However, the average grade of the present ore is lower than was originally reckoned and the cost of producing copper from it has increased, though not in direct proportion to the diminution of grade of the ore which has been partially offset by improvements in the arts of mining, milling and smelting.

*

Mining Shares of No Par Value

The Kennecott Copper Corporation, the shares of which were recently introduced to the public, is unique in having a capitalization of shares which have no par value. This is a good idea to follow in the organization of mining companies. In former times it used to be the custom to capitalize a mining company at $100 per share, let us say, and offer the stock at $10 per share, the promoters and the public both hoping that development in the mine might cause the stock to grow up to its par value. Sometimes it did, but more often it did not, causing the stock to look rather ridiculous ever afterward.

In the more modern cases of the porphyry coppers the idea was to capitalize at the real value in the young days of the mine. Thus, Miami was brought out when it had about 2,500,000 tons of ore developed and the shares were made of $5 par value. As the known ore resources of the mine gradually increased to about 20,000,000 tons, the value of the stock increased more or less in proportion thereto, and in fact that company is now paying dividends at the rate of $3 per share per annum, which is 60 per cent. on the par value. This experience (that of Utah, Chino, Ray, and the rest of the porphyry coppers are similar) causes persons inexperienced in mining to wonder. In fact, the par values of these securities ceased long ago to have any significance (except for Federal- and state-taxation purposes). It would have been just as well if they had not been marked with any par value in the first place.

*

Metal Loss in Copper Slags

The important subject of metal losses in copper slags is taken up this week by Frank E. Lathe in the first of three articles dealing with the principal source of loss in copper smelting. Mr. Lathe reports the result of a long series of investigations of the Granby slags, and the conditions under which they are formed. While primarily concerned with the conditions at Grand Forks, he also made examinations of slags from other works, and his article is one of the important contributions on this subject and will, we feel sure, receive careful attention from copper metallurgists. The first installment deals almost entirely with a review of the literature of the subject.

After an exhaustive examination of the losses in copper slags, Mr. Lathe has come to the conclusion that in most instances improvement can be effected by a careful study of conditions. It may be mentioned that he dismisses as unimportant the loss from dissolved cuprous sulphide, and considers that the two great factors are suspended matte particles and oxidized copper. After examining many Granby slags and others from various works, he concludes that the loss from oxidized copper amounts to one-half or three-quarters of the total loss in the slag.

At many plants the metallurgists get into a sort of auto-hypnotic state with respect to the metal content of the slag, once its tenor has been established at what is regarded as the practical minimum with the equipment at hand. The metallurgist in charge may have a theory that a little more settling or some other slight change in practice would reduce the metal losses in the slag, but as this may be only a theory, in support of which he can submit no incontrovertible evidence, he hesitates to ask his directors for an appropriation for experimental purposes. And even while he hesitates, he perhaps receives instructions to proceed with some less promising experiment that has appealed to the vision of one of the lay directors of his company. The metallurgist, after having studied his slag losses and having become convinced that they are about as low as possible with the equipment available, eventually directs his efforts toward keeping the metal tenor of the slag at the conceived minimum.

The Granby Co. attacked the slag-loss problem in an aggressive way and made a decided betterment in this practice by deepening its furnaces and improving the settling conditions. The problem was studied persistently over a series of years, and the results at the Granby works, where over a million tons of slag is produced annually, are noteworthy. Every 0.01% of copper saved from the slag represents an amount equivalent to 200,000 lb. of metal per year; in other words, the 1914 practice at Grand Forks was better than that of 1907 by 2,640,000 lb.

At many other works the study of the slag losses on an exhaustive scale would probably repay the expense. The metallurgists in most instances are handicapped by the prevailing equipment, but were it shown that a marked saving could be made annually the funds would probably be forthcoming for such changes as were desired. At all events, we think that the subsequent installments of Mr. Lathe's article will stimulate metallurgists to an examination of their slag losses to see if only the irreducible minimum is going over the dump.

The index for Vol. 99 of the *Engineering and Mining Journal* will be mailed with this issue. Any subscriber not receiving a copy of it should notify the subscription department at once.

BY THE WAY

The Allis-Chalmers Co. is not so well known in Wall Street as it is in the mining industry. The following story is from the New York *Sun*:

Allis-Chalmers used to be described for the sake of convenience as the company which made everything in the world except money. But now that it is a war stock nobody alludes to it flippantly any longer. A broker just back from a holiday met one of his old customers. "Say, what is this 'war bride' they call Allis-Chalmers?" he called out. "Why?" asked the broker. "Oh, just curiosity. Last week I called up your office and they told me Allis-Chalmers was a hot one. So I bought a hundred. Now I have six points profit in it and I haven't the faintest idea whether it's a motor company, a street railway or a combination of barber shops."

A concession which ought to interest some people is now being offered in New York by Belgian parties, who obtained it from the Russian Government some time ago. It is for an electric power and light plant and a trolley line in the ancient and mysterious city of Samarkand. The introduction of the trolley car and electric light in that city of Oriental tradition seems to be an anachronism, but we suppose such things have to come, even if Kublai Khan turns in his grave. Samarkand is now the terminus of one branch of the Russian Transcaucasian R.R., and is capital of the Russian Central Asiatic provinces.

A few years ago the press throughout the country announced the salvation of the lay mining investor through the operation of the so-called "Blue Sky" laws, by which all mining securities offered for sale were first to be approved by a state commissioner—who was sometimes the bank commissioner, often merely a political appointee, but in no case a mining engineer, so far as is known. Shortly after the Kansas "Blue Sky" law was passed the *Journal* commented on the flotation of a certain company which had its prospectus, gold bonds and "guaranteed stock" approved by the "Blue Sky" commissioner in Kansas. Its name does not yet appear in this paper's dividend list, and it is doubtful whether buyers of the guaranteed stock have received their interest guarantees. Recently a correspondent sent in an item about Field's Process Smelter Fumes Co., which proposed to save the "vaporized metallics" and other elements of value in the fumes much better than the regular operators had been able to do it. This company was said to be selling stock to farmers and other residents in Shasta County, California, where there has been much "smoke talk." The "Blue Sky" commissioner of California is reported to have approved the sale of this company's securities. A decision in such matters involves technical judgment and experience. "And he spoke a parable unto them, can the blind lead the blind? shall they not both fall into the ditch?"

July Mining Dividends

Exclusive of the dazzling $25,000,000 stock dividend of the New Jersey Zinc Co., disbursements to stockholders by 38 United States mining companies making public reports reach $11,052,732, as compared with $7,654,337 in July, 1914. Industrial and holding companies allied to mining paid $2,469,821 in July, 1915,

United States Mining Companies	Situation	Per Share	Total
Abmeek, c	Mich.	10 00	500,000
Allouez, c	Mich.	1 00	100,000
Anaconda, c	Mont.	0 50	2,331,250
Anchor, s	Nev.	0 03	15,000
Arizona, c	Ariz.	0 24	368,849
Bunker Hill & Sullivan, l.s	Ida.	0 25	81,750
Bunker Hill Con., g	Calif.	0 02½	5,000
Caledonia, l s	Ida.	0 03	78,150
Camp Bird, pfd., g	Colo.	0 17	110,565
Center Creek, z	Mo.	0 15	15,000
Champion, c	Mich.	5 00	500,000
Continental, z	Mo.	0 50	11,000
Daly-Judge, l s	Utah	0 25	75,000
Ernestine, g s	N. M.	0 10	30,000
Goldfield, g s	Nev.	0 10	355,915
Golden Cycle, g	Colo.	0 02	30,000
Hecla, l s	Ida.	0 02	20,000
Homestake, g	So. Dak.	0 65	163,254
Interstate-Callahan, z	Ida.	1 25	575,000
Iron Blossom, s.l.g.	Utah	0 05	50,000
New Jersey Zinc, z	U. S.	30 00	3,000,000
New Jersey Zinc, z	U. S.	250 00*	25,000,000*
North Butte, c	Mont.	0 40	164,000
Osceola, c	Mich.	3 00	288,450
Parrot Silver & Copper, s.c.	Mont.	1 63	374,650
Plymouth, g	Calif.	0 24	58,520
Portland, g	Colo.	0 03	90,000
Prince Con., z, l s	Utah	0 02½	25,000
Silver King Coalition, l	Utah	0 15	187,500
Silver King Con., l s	Utah	0 10	63,758
South Eureka, g	Calif.	0 03	9,900
Stewart, s l	Ida.	0 35	433,392
Success, z	Ida.	0 04	60,000
Tennessee, c	Tenn.	0 75	150,000
Tonopah Belmont	Nev.	0 12½	187,500
Tonopah Extension	Nev.	0 10	94,343
Tonopah Mining	Nev.	0 25	250,000
Utah Con., c	Utah	0 50	150,000
Vindicator, g	Colo.	0 03	45,000
Wasp No. 2, g	So. Dak.	0 01	6,000
*Stock dividend			
Iron, Industrial and Holding Companies			
Am. Smelters Securities, pfd A	U. S.	1 50	252,450
Am. Smelters Securities, pfd B	U. S.	1 25	375,000
Bethlehem Steel	Penna.	1 75	239,625
Brier Hill Steel, pfd	Penna.	1 75	83,452
Guggenheim Exp.	U. S., Mex.	1 00	833,732
Pennsylvania Salt	Penn.	2 00	100,000
St. Mary's Mineral Land	Mich.	1 00	160,000
U. S. Sm. Ref. & Min., pfd	U. S., Mex.	0 87½	425,562
Canadian, Mexican and Central American Companies			
Con. Min. & Sm., l, c, g s	B. C.	2 00	116,098
Crown-Reserve, s	Ont.	0 02	35,376
Esperanza, s.g	Mex.	0 24	165,848
Hollinger, g	Ont	0 20	120,000
La Rose, s	Ont.	0 05	37,466
Lucky Tiger, g s.	Mex.	0 06	64,380
McKinley-Darragh-Savage, s	Ont.	0 03	67,341
New York & Honduras Rosario, g.s	U. S. A.	0 30	60,000
Nipissing, s	Ont.	0 25	300,000
Porcupine-Crown, s	Ont.	0 03	60,000

as compared with $3,320,245 in 1914, while Canadian and Mexican companies paid $962,129 as compared with $1,605,950 a year ago.

The totals for the first seven months of the year are as follows: Mining companies, $37,053,776, as against $40,580,220 in 1914; metallurgical and holding companies, $36,633,973, as against $45,034,348 in 1914; Canadian and Mexican mines, $4,497,751, as against $11,500,862 in 1914. The accompanying table shows details of the month's payments.

PERSONALS

Edwin Northey, of Calumet, Mich., has been appointed clerk at the White Pine Mine.

Frank M. Woods has returned to Colorado Springs, Colo., after making examinations at Oatman, Arizona.

Arthur J. Hoskin has been in the Taos district, New Mexico, inspecting placer property along the Rio Grande.

Sir Richard McBride, premier and Minister of Mines of British Columbia, has returned to Victoria after a European trip.

Edwin E. Chase, of Denver, has been making a trip into the northern part of Ontario and will return to Denver this week.

J. A. Durfee has been appointed by the Jones & Laughlin Steel Co., Pittsburgh, to the position of metallurgical engineer.

M. C. H. Little, representing the Lewisohn interests, is sampling the St. Anthony gold mine in the Sturgeon Lake area in Ontario.

Robert H. Stewart, general manager of the Consolidated Mining & Smelting Co., of Canada, is in Eastern Canada on a business trip.

Ivan P. Tashof is at Morenci, Ariz., working on flotation in the mill of the Miami Copper Co. He expects to remain there most of August.

Frank H. Sistermans has returned from his trip to the Piz-Piz district of Nicaragua, and will be at his headquarters in El Paso, within a short time.

Robert S. Lewis, of the University of Utah, has just returned to Salt Lake City from a visit to the mines at Juneau, Alaska and Dawson, Yukon Territory.

D. C. Stapleton, general manager of the Anglo-Colombian Development Co., Ltd., has been in New York for a few weeks and has gone to Omaha, Nebraska.

J. G. Sipprell, formerly manager of the York Ontario, Cobalt, is now in charge of a molybdenite prospect, near Renfrew, Ont., from which high-grade ore is being taken.

Morton Webber, who obtained a commission in the British Royal Field Artillery and was wounded in France, has now recovered and has joined the British forces at the Dardanelles.

Frank J. Hambly, president of the Cerro Gordo Mining Co., has returned to San Jose, Calif., from a two months trip to New York and Boston, returning by way of Toronto, Seattle and Portland.

Walter E. Burlingame announces that from Aug. 1 the business of E. E. Burlingame & Co., asayers and chemists, will be conducted under his name at the old office 1736 Lawrence St., Denver, Colorado.

Dr. A. C. Lane, formerly state geologist of Michigan, but now one of the faculty of Tufts College, Massachusetts, is making a geological examination of the Indiana Mine in the Michigan copper region.

Dr. F. W. McNair, president of the Michigan College of Mines, has returned to Houghton after a visit to Cobalt, Porcupine and Sudbury. At each camp he was entertained by graduates of the college.

Robert T. Hill, who has been engaged in making a geological survey of Southern California during the last three years, spent a few days in New York this week. Mr. Hill has lately been in Washington, working on his report.

P. K. Horner, manager of the Union Minière du Haut Katanga, who has been visiting in the United States for several months, sailed for London on July 31 on the S.S. "Philadelphia" and will return soon to the Belgian Congo.

L. A. Friedman of the Rochester Mines Co., was in San Francisco recently closing his deal for the purchase of the Four-J lease at Rochester, Nev., and to arrange for listing stocks of the mines in that camp on the San Francisco Exchange.

F. A. Thompson, for three years past superintendent of the Triumph Gold Mining & Milling Co., Lumpkin, Calif., resigned Aug. 1, and will spend some time looking into mining propositions in Nevada and Arizona. His temporary address is at Goldfield, Nevada.

David A. Thomas, the British coal operator, has arrived in Canada on a special mission representing the British Minister of Munitions, and is making a tour of inspection of the factories in Eastern Canada, to ascertain their capacity for producing shells and other war supplies.

A. J. Beaudette, of Vancouver, B. C., is now retained by the Pacific Great Eastern Ry. Co. to advise and assist prospectors relative to the development of mining property along the company's line from Vancouver through Lillooet and Cariboo districts to Prince George.

E. J. W. Donahue, of the Locker-Donahue Co., formerly controlling Cuyuna-Mille Lacs, Cuyuna-Duluth, Duluth-Brainerd and other Cuyuna range stock companies has resigned as an official in the above corporations. He intends to devote his time to private interests on the Cuyuna range.

Roy Reynolds has been appointed captain at the Trimountain mine of the Copper Range Consolidated in Michigan, succeeding Captain Richard Bowden. Reynolds was assistant under Bowden. He is a Michigan College of Mines man. Richard Martin, mining captain, who resigned with Bowden is succeeded by Captains Letcher and Lambert, both capable and experienced men.

OBITUARY

Frank W. Heimick, mining man and capitalist, died at his residence, Duluth, Minn., July 19, from pneumonia. He held many interests on the Mesabi Range and undeveloped property on other Minnesota ranges. He was best known locally for his philanthropical activities.

Henry Anthony de Meli died at Catania, Italy, July 20, aged 73 years. He was born in New York and studied at Columbia University, being a member of the first class graduated by the School of Mines. After leaving college, Mr. de Meli became interested in mining properties at Georgetown, Colo., but he retired in 1870 and went to Europe. He had a home in Dresden, Saxony, as well as in Catania.

James W. Weaver, secretary and treasurer Thomas Iron Co., Easton, Penn., who died July 8, had been in the service of the company 45 years. He began as an apprentice in the machine shop at Hokendauqua, Penn., in 1867, at the age of 15. Later he had positions as clerk and telegraph operator at various plants and became secretary and treasurer in 1892. He was also secretary and treasurer of the various railroad subsidiaries of the Thomas Iron Co. His father was a pioneer iron manufacturer in the Lehigh Valley.

Theodore Bryant Comstock died at Los Angeles, Calif., July 25, aged 66 years. He had a high reputation as a geologist and was well known in the scientific world. He was born at Cuyahoga Falls, Ohio, 1849, educated in the public schools of that state and Pennsylvania and obtained a degree of bachelor of agriculture at the Pennsylvania State College in 1868, bachelor of science from Cornell University in 1870, and doctor of science in 1886. He married in 1880. When but 21 years old he participated as assistant and photographer in the Morgan expedition to Brazil, and in 1873 served as geologist and assistant to the Capt. W. D. Jones, expedition into Northwestern Wyoming and Yellowstone Park. He led a scientific expedition into the Northwest Territory of Canada in 1877. Dr. Comstock was also prominently identified with educational work. He was the founder and director of the Kirtland Summer School of Natural History, Cleveland, 1875; founded the department of economic geology, Cornell University, and was professor of geology and paleontology there from 1875 to 1879; founder and director of the Arizona School of Mines from 1891 to 1895, and president of the University of Arizona, 1892 to 1895. He acted as manager and consulting engineer of several mining companies also. He also occupied many prominent official and public positions. He was assistant state geologist of Texas from 1889 to 1891, and contributed many notable additions to knowledge of the geology of that state; was vice-president of the National Irrigation Congress in 1893; secretary and chief engineer of the Los Angeles Board of Public Utilities, 1910 to 1912; director of the Arizona Agricultural Experiment Station, 1894; assistant state geologist of Arkansas, 1887-88. Dr. Comstock was an original Fellow of the Geological Society of America; original member of Sigma Xi; founder of the Cornell Chapter, Delta Upsilon; and charter member of the Mining & Metallurgical Society of America. He was a frequent contributor to many technical and scientific magazines and journals; also to the transactions of the Mining & Metallurgical Society and the American Institute of Mining Engineers. He served as chairman of the Southern California section of the last-mentioned and was one of its founders. "An Outline of Geology," published in 1879, was his work and he was editor of the "Bulletin" of the Southern California Academy of Sciences. He held membership in several local clubs and lodges. No immediate family, except the widow, is left. He was a man of high attainments and untiring industry.

Editorial Correspondence

SAN FRANCISCO—July 28

Gold Production in California for the first half of 1915 is equal to about $700,000 more than the production in 1914 in the same period, or a total for the first half of 1915 of approximately $11,400,000. It is believed the increase will continue in the second half of the year so that the total production for 1915 will probably reach $23,000,000. Surface placer mining increased in production owing to the abundance of water, and the season for hydraulic mining has been extended for the same reason. There was also plenty of water for mill purposes. The dredge-mining industry was prosperous and productive and some new dredges were put in commission, and others that went into commission late in 1914 added to the production for the first half of the present year. There has been a large amount of new mining and metallurgical machinery installed, chiefly in Nevada, Shasta, and Amador Counties. Copper mining has largely improved, chiefly in the mines of the Mammoth Copper Co. and the Mountain Copper Co. in Shasta County. The production of copper was very appreciably reduced in the last half of 1914 owing to war conditions but in the second quarter of 1915, there has been a notable advance in the demand for, and the production of copper. The report of the Selby Smelter Commission in the latter part of 1914 had a good effect upon the farmers who have largely withdrawn from the fight against the smelteries, and there is not great probability that the fight will be effectively renewed. New investments in California mines have not been as encouraging as was hoped for at the beginning of the second quarter of the year. There were some old mines reopened which will probably add to the gold output for the last half of the year. The outlook for production of potash in Searles Lake region is encouraging and there has been some encouraging prospecting done for antimony ores. Quicksilver has advanced steadily in price in the first half of the year but the total production has not increased. Some of the quicksilver mines have increased production but the promised reopening of old mines has not been equal to the expectation in the last of 1914.

Protests of Farmers in Campo Seco District against the Penn Mining Co. have been renewed by application to Governor Johnson. The farmers urge that some action be taken upon the report of the commission appointed by the Governor in 1913. This commission found something wrong with the crops in the various sections it investigated and under the law providing for the appointment, the attorney general is authorized to bring suit against all persons whom the commission reports in violation of the smelter-waste law. This commission made its report about the time that the Selby commission reported, but the findings were never made public. Some persons believe that the findings were not important enough to make public. At any rate there seems to be no good reason why the copper-mining industry should not be made fully acquainted with the results of an investigation which the taxpayers of California paid for; the copper mine operators being among the taxpayers. This subject of smeltery fumes affecting the farms and the farmers in Calaveras and Amador Counties in the region of the Campo Seco smeltery has been presented in the "Journal" a number of times. The most recent mention of affairs in this region referred to a number of suits brought by a law firm in San Francisco in behalf of farmers who really had no complaint to make but were willing that suits should be brought in their names, accepting the proposition of the attorneys that the farmers would be out no expense for filing or trying the suits but would share in whatever profit might be gained through verdicts in their favor. These suits are about ready for trial. In the meantime the Penn Mining Co. has employed experts who are making examinations of soil. In studying the pest subject in the belief that it will be shown that much, in fact most, of the damage done to crops has been done by unfavorable soil conditions and certain pests probably the aphis. It is quite probable that more fact will be brought out in the trial that may be useful in teaching some of the farmers the value of a course in an agricultural college. Much of this land is worn out. It has been tilled to death, and the process has been going on for the last 50 years. The few farmers who practise rotation in crops and the use of fertilizers are still prosperous in spite of the small amount of fumes from the smeltery. It is hardly believed probable that Attorney-General Webb will order suits brought upon the complaints made to the Governor. One thing is certain, the Penn Mining Co. has done everything possible to prevent damage to the crops and will continue experiments until a satisfactory method shall have been adopted. The thiogen process had its first practical demonstration at the Campo Seco smeltery. That process has since been taken over by the American Smelting & Refining Co. and may yet be adopted by the Penn Mining Co.

BUTTE—July 29

In The State First-Aid Contest held at Billings, Mont., July 23 and 24, the team from the Leonard mine in Butte won first prize after having been disqualified from entry in the elimination contests held in Butte. The teams sent from the Anaconda mines were those from West Colusa and Anaconda, and two more from the Washoe and Boston & Montana reduction works. The Leonard mine team went to Billings at its own expense. It had done good work in the elimination contests, but a comparatively slight error spoiled its chances of winning, but because of its interest in first-aid work it decided to go to Billings at its own expense, and there they won the first prize, a silver medal, given by the American Mine Safety Association. The Leonard team was composed of G. Ethier, captain; H. Hagens, J. E. McCloud, W. E. Barraugh, Ryan Gaul and F. C. Deakin.

Members of the United Mine Workers of America, who are employed in the Butte copper mines, must deposit their working cards with the local union of the Western Federation of Miners or they will be rated as labor outlaws. That was decided on at a conference between a committee representing both national miners' organizations in Butte, July 28. There are about 700 men with United cards working in Butte and if they obey the orders of the joint committee they will join the remnant of the local Federation union, which already has about 200 members out of the 12,000 miners working in Butte. Miners, with former experiences fresh in mind, are reluctant to join any union of miners in Butte and the action of the 700 United Mine Workers will be watched with some interest. There is expectation that many of them will ignore the orders of the committee. The conference held in Butte was called to act on the proposition to amalgamate the Western Federation of Miners and the United Mine Workers of America, but the committee decided that the project was premature and impractical at this time, probably because of the discredited state of the Western Federation and its officers. The two organizations will continue to exchange working cards, but that is all.

SALT LAKE CITY—July 30

The New Wage Scale in Bingham which went into effect Aug. 1 is as follows: Machine men, $3.50 per shift; machine helpers, $3.25 per shift; steel miners, $3 to $3.25 per shift; maximum wages to apply only to skilled miners. Timber men and timber men helpers increased 25c. per shift, with maximum for timber men of $3.50 per shift. Hand trammers, $3 per shift. Horse and mule trammers, $3.25 per shift. Horse and mule trammers' helpers, $3 per shift. Nippers, $3 per shift. All other day labor now being paid $2.50 or more per day will receive an advance of 25c. per day; and all day labor, now being paid less than $2.50 per day, will receive an advance of 20c. per day, while the above scale is in effect. The employees of the Salt Lake smelteries and the Bingham & Garfield railway will likewise receive an increase. The new scale is based on a sustained price of 17c. per lb. for copper—New York quotation—and 5.25c. per lb. for lead. About 7000 men are affected. The raise will add about $750,000 a year to the payroll.

Zinc-Producing Properties in Utah in the last three weeks have been able to market ore running as low as 28 or 29% zinc, as compared with a minimum of 30% or over previously. There appears to be a somewhat better inquiry for this ore, as evidenced by the number of buyers, though the prices paid are not high. Twenty-nine per cent. zinc ore is worth about $1 a unit f.o.b. Salt Lake, the buyer paying the freight. The following companies have men in the field: The Granby Mining & Smelting Co., the Empire Zinc Co., of Colorado, Consolidated Ores Co., representing the Edgar Zinc Co., and Beer Sondheimer & Co. The production of zinc ore at present from

Tintic is about 500 to 600 tons a month of carbonate ore; from Park City, 600 tons, all concentrates, and this should be increased in the near future through the operation of two new mills to work tailings. Stockton produces about 200 tons of zinc ore a month—the Hidden Treasure and Queen of the Mills in Dry Cañon being the principal shippers. Ophir is not producing any zinc at present. Bingham is producing little straight zinc ore, though mixed zinc ores are mined and treated by the United States Co. The Horn Silver in Beaver county ships a mixed zinc ore to Midvale. The Cedar-Talisman in Beaver county produces one or two cars of carbonate zinc ore a month. Most of the ores are shipped to Missouri river points and farther east.

JUNEAU—July 17

Fire at Valdez destroyed approximately $800,000 worth of property on July 15 at 4 a.m. Stiff breeze blowing off the glacier toward open water fanned the fire but saved the town on account of the direction in which it was blowing. U. S. Road Commission office burned with maps and records of 10 years' accumulation. Residents of Valdez started to rebuild at once. Only a small part of loss covered by insurance.

KELLOGG, IDA.—July 21

The Stewart Mining Co. has obtained control of the Cœur d'Alene Development Co. by the purchase of 229,000 shares of stock from Frederick Burbidge, of Spokane, and C. W. Beale, of Wallace. The Cœur d'Alene Development Co. was organized in 1899 by Burbidge; it was capitalized for 1,000,000 shares, par value $1. F. Augustus Heinze bought 330,000 shares, which were turned over to the Stewart company in 1908. Since that time the Stewart has been trying to get control, and they now have all the issued stock except that held by Fred W. Bradley, president of the Bunker Hill & Sullivan, Albert Burch, of San Francisco, and Joseph McDonald, former superintendent of the Treadwell mines. The holdings of the Cœur d'Alene Development Co. include 10 patented claims near Kellogg and adjoining the Stewart mine. The company also owns the concentrator now being used by the Stewart, which was built at a cost of $70,000. Considerable development work has been done on the claims and a gross production of more than a million dollars is reported. There is a block of unexplored ground that will probably be prospected at once by the Stewart. The Ontario Mining Co., composed of Stanley A. Easton, general manager of the Bunker Hill & Sullivan mine, M. A. Folsom, and associates, lessees of the Ontario mine, have a working privilege on the lower tunnel of the Cœur d'Alene Co., and are taking out ore under an agreement whereby they must do a certain amount of development work each month.

ASHLAND, WIS.—July 31

On the Gogebic Range the C. & N. W. Ry. officials report extraordinarily heavy tonnage. Thus far, 1,317,000 tons have gone over Ashland docks, as against 1,062,790 for same period 1914.

HIBBING, MINN.—July 31

Militia Has Been Requested by the village council of Hibbing which has asked Governor Hammond to establish martial law in the village. The request has been denied. Iron-mining companies holding valuable property within the village limits have refused to pay $750,000 taxes and the village is without funds to pay police or firemen.

ISHPEMING, MICH.—July 31

Serious Consideration to Leaching Processes to recover copper from the tailings is being given at the present time by the managements of many of the copper companies in Michigan. The Calumet & Hecla company has erected a leaching plant to treat the tails from the new regrinding plant at Lake Linden and is recovering copper by means of the ammonia process. At Winona a 20-ton experimental plant is now being erected to treat the tails, which carry from five to seven pounds of copper per ton. The solvent will be ferrous chloride, hypochlorous acid and chlorine. The copper will be precipitated by iron. The solution is subject to regeneration by the use of salt, 20 lb. of which will be required per ton of tails treated. Laboratory experiments have shown a recovery of 95% of copper in the tails, and it is believed that almost as good results can be obtained in a plant working on a large scale. The Copper Range company is considering a number of different processes for leaching its tails, of which it has a large stock on hand. All of the tails from the White Pine mill are being saved, with a view of leaching at some future time. The oil-flotation process is also being looked into by Michigan companies, and it is thought that it may work at such properties as the Nonesuch, White Pine and White Pine Extension.

HOUGHTON—July 31

The Workingmen Employed at the Isle Royale and the shareholders residing in this district are gratified to learn that the Isle Royale is to remain under Calumet & Hecla management. They realize that the Isle Royale at best is a low-grade proposition at present running under 13 pounds refined copper—and can operate successfully on a low copper market only by extensive tonnages. It is generally believed that the Isle Royale's new stamp mill will be put in running order at a cost of under $10,000 and it will be the most modern and most economical mill in the district. Of course the long haul on the rock tonnage, made necessary by the fact that Isle Royale rock has been milled at Point Mills and at the Tamarack mill since last December, adds materially to the cost of putting the copper on the market. At the same time the affiliation with the Calumet & Hecla interests was the only thing that made it possible for Isle Royale to maintain operations at all during this present prosperous copper-producing period. Two heads now are working at the new Isle Royale mill and the third will be within a month. This new mill was erected in speedy time and is a credit to the methods and ability of the Calumet & Hecla construction crews. The operation of two heads here released the one head at the Tamarack mill. It is supposed that two heads at Point Mills plant will continue on Isle Royale rock and two at the Isle Royale mill. When the third is ready to go into commission it is hoped that Isle Royale will then be in shape to keep five heads going. This will require about twice the tonnage of rock that Isle Royale formerly produced but will be the solution of the Isle Royale problem, no matter what the price of the metal.

JOPLIN—July 28

Rapid Mill Building is being done by three 9-hour working shifts in the construction of the 500-ton concentrating plant of the Haywood Scott Mining Co., at Duenweg, six miles east of Joplin, Mo., this being the first mill in the history of the Missouri-Kansas-Oklahoma district to be constructed in this manner. Powerful electric lights illuminate the grounds while within the mill-building proper there are scores of brilliant incandescent bulbs, making the work after nightfall just as expeditious as in the day time. Night workmen receive 50 per cent. additional wages. The shifts are so arranged that they overlap, each succeeding shift thereby being enabled to pick up the work quickly. Work on the big plant begun about middle of June will be finished by July 31. The Scott mill will have the largest crusher capacity of any plant in the district, two sets of 14-in. crushers and five sets of 36-in. rolls having been installed. In addition there are two sets of 24-in. rolls for grinding chats. The mill building proper is 100 ft. wide by 140 ft. long and so arranged that either half of the equipment can be run independent of the other half, with the exception of the cleaner jig, of which there is only one installation. Electric power is to be used in the operation of the plant. Four sludge tables will be installed at first and others placed in later if necessary. At the ends of all jigs, dewatering screens will be placed, the water being conveyed to four settling tanks, two of which are on one side of the mill and two on the other. High concrete piers hold the mill building well above the ground and underneath the entire structure a concrete floor will be constructed to catch any fine ore that may sift through. This is a decided innovation as the custom that has prevailed throughout the district is to permit the fine ore to settle through onto the ground and when this becomes sufficiently enriched to warrant it, it is cleaned up and milled. The "dog house" is divided into two apartments, both floored with concrete. One is to be used as a dining room, the other as a bath and dressing room. The latter is equipped with ventilated steel lockers, two shower baths and a swimming pool, 15x26 ft. and 5 ft. deep at one end by 6 ft. at the other. This is the first natatorium to be installed in a Joplin district "dog house."

TORONTO—July 31

Information Regarding the Big Duck Lake Gold Area, lying some 13 miles north of Schreiber on Lake Superior, embodied in memorandum has been issued by Dr. Willet G. Miller, of the Ontario Bureau of Mines. Not much development has been done, but superficial sampling shows encouraging results. The J. Johnson claim south of Little Duck Lake gave $7.60 from a sample across 5 ft. The Coco-Estelle claim gave $8.60 from a sample across 4 ft. of quartz and pyrites. The McCuaig claim is said to contain rich gold ore, some of which was hand-picked and shipped during the winter. The Sjolander-McKirdy claims are said to have a large vein which has a pay-streak near the hanging wall. The Eustace claim is reported to have a large vein, samples from which gave 2% copper and 20c. gold.

The Mining News

ALASKA

THE REPORT THAT PLATINUM HAS BEEN DISCOVERED on the hill back of the town has caused considerable excitement in Dawson. A stampede took place from Dawson and the entire hill was located and the assay plants have been running night and day to determine the value of the ores.

CHARLES HERRON (Six Mile, via Seward)—New mill being installed at Herron's quartz property in the Sunrise-Hope district. Mine shows promise.

KENSINGTON (Juneau)—Hayden-Jackling interests said to be planning reopening of these mines near Juneau and construction of 1000-ton milling plant.

ANACONDA COPPER (Whitehorse)—Ore from this property is now being shipped over railroad to Skagway en route to Tacoma smeltery and is first ore to be shipped from Whitehorse district since Pueblo closed down six weeks after beginning of war in Europe.

TREADWELL (Juneau)—Portion of big plant is shut down owing to breaking of shaft at central hoist. Shaft is 20 in. in diameter and 40 ft. long; new one will have to be brought from Atlantic coast before operations can be resumed. This is most expensive delay ever experienced by this company since its operation during which time it is said to have produced over $200,000,000.

ALASKA GOLD (Juneau)—Original hydro-electro power project on Salmon Creek to deliver 6000 hp. is being supplemented by development of another hydro-electric proposition at Annex Creek, which will give 4000 hp. additional. This will give 10,000 hp. for the 10,000-ton mill or at rate of 1 hp. per ton, but operations indicate that this estimate will be reduced to $^3/_4$ hp. per ton actually required.

ALASKA JUNEAU (Juneau)—Consulting Engineer J. H. McKenzie announces plans for the development of Alaska Juneau mine and estimates that by Oct. 1, 1916, all development work to bring tonnage up to 8000 tons daily will be finished. When that work has been finished all hands will be put to widening drifts and crosscuts to 9x14 ft. It is planned to install a 7500-kw. power plant, consisting of oil-fired boilers and steam turbine. Location of plant not yet decided upon.

NORTH STAR GOLD (Fort Wells)—Sixteen tons of machinery and construction materials have been shipped from Seattle for new stamp mill to be installed on this property. Carl Staps, officer of company, will leave for Atlantic coast shortly to place contracts for equipment. Ore on this property averages about $20 per ton in gold and some has run as high as $120 per ton. Property consists of two claims and enough ore, it is stated, has been blocked out to keep proposed stamp mill running for years. Gus Ohm is president of company.

ARIZONA

Cochise County

PRIMOS CHEMICAL CO. is reported to be actively engaged in mining tungsten ores in Dragoon mountains. About 60 men are at work. Ore is sacked and shipped to company's plant at Primos.

RINE PLATE (Bisbee)—Development work in new shaft has opened up $50 ore. Compressor and hoist are to be installed. Property located in Ash Cañon.

Gila County

SLEEPING BEAUTY (Globe)—Arizona Eastern has constructed good approach to Burch spur, which has been repaired, and ore can be carried to point on railroad by 3-mile haul. From there it is not much over three miles to International smeltery to which plant McClure and Miner will ship. They have been delayed considerably in securing teams, but finally have two six-horse outfits working and will soon be shipping. Fifteen men are now being worked at property and force will be increased as fast as faces are opened.

OLD DOMINION (Globe)—At Old Dominion smeltery during July, copper production has been averaging about 50 tons per day; four furnaces have been in operation entire month. Old converter shell, which has been in operation over two years, is still treating entire output of the furnaces. At central power plant new stack is being erected over one of boilers and plans are being made to install new economizers in some boilers. At concentrator daily tonnage has exceeded 600 tons per day for entire month. Some experimental work is being done with new air-flotation machine. Third compartment has been installed in Woodbury jigs at top of mill, with view to improved efficiency and old shaking screens have been replaced with two low Code shaking screens. Big pocket below 16th level, on north side of station, has been completed and is already being used. Its use relieves congestion of cars on 16th level and also of skilful hoisting operations. Small churn drill hole has been put down for ventilation from 16th to the 18th level and others will be drilled in various parts of mine where occasion demands. On surface a 3x3-ft. flume is being constructed to carry water from concrete dam, above Maurel hotel, past old Dominion's property and down to Hamm Ponds, with view to having as little water as possible get into sands of creek for concentrator's workings.

Mohave County

GOLDEN GEM (Cerbat)—Mill being overhauled. Pipe line is to be laid from mine to mill for water supply.

GOLD REED (Oatman)—Main shaft now down below 330 ft. Station is to be cut at 100 ft. L. L. Moore, of Bisbee, is in charge.

Santa Cruz County

AUSTERLITZ (Oro Blanco)—Recent developments in upper levels have opened up some important orebodies. Mill is to be put in operation soon.

SAN JORGE (Alto.)—C. V. Hudson, owner, has opened up wide ledge of copper ore on this property, but is bothered with water. He has commenced a shaft, and will proceed as long as water does not drive him out.

TRENCH (Patagonia)—Now being reopened by sinking a 500-ft. shaft. Property owned by Clark interests, who have organized Trench Consolidated Mining Co., of which Charles Clark, of Jerome, is president. John Hoy, formerly of Butte, Mont., is manager.

FLUX (Patagonia)—This mine lately equipped with mill now in full operation, sending out ore and concentrates at rate of 25 tons per day. Mill is a dry-crushing plant, using Stebbins table, and is reported as running smoothly. An Ambursen tram connects mine and mill and loading bins.

CALIFORNIA

San Bernardino County

TWIN PEAKS MINING CO. (Hart)—Thomas A. Hine, of 100 William St., New York City, has exercised his option on Sunnyside Group of claims, and has organized Twin Peaks company, a New York corporation, to operate same. Pay ore is exposed at four different points on property, and work of sinking 200-ft. shaft will be undertaken immediately. F. E. Browne is manager.

Shasta County

DREDGING GROUND SOUTH OF REDDING acquired recently by Lawrence Gardella, dredge operator, of Oroville. Ground purchased was McCormick-Saeltzer ranch of 2250 acres, four miles south of Redding.

BULLY HILL (Kennett)—Stated experimental zinc plant is entire success and commercial-size plant may be installed.

SPREAD EAGLE (Kennett)—Development work on this group owned by Mammoth Copper Mining Co., is progressing with satisfactory results. Highly mineralized fissure cut recently in main tunnel; drifting for oreshoot now under way.

MAMMOTH COPPER (Kennett)—Stated contract made to sell all baghouse residue to eastern zinc smelter for $8 per ton. Baghouse installed in 1910, at cost of $250,000, on account of state law and farmers' "smoke suit." Since then no market found for residue until recent high price of zinc made product of commercial value. Eighteen to twenty thousand tons have accumulated.

Sierra County

SECRET CAÑON (Downieville)—From shaft being sunk on manganese ledge by George Henk, assays run from $38 to $81 per ton.

SACRED MOUNT (Sierra City)—Cyanide plant installed and in operation by J. C. Folsom upon tailings of many years accumulation, which assays well.

SOVEREIGN (Sierra City)—Morse Bros. and Meany operating under lease are recovering $2.50 per ton, free gold, from roller mill, and $4 per ton additional through cyanidation.

BIGELOW (Sierra City)—Quartz mine owned by W. H. Martin, Nevada City, Calif., bonded to Croesus Mining Co., of New York. Development work under Manager W. B. Pearson, of Croesus Company.

YOUNG AMERICA (Sierra City)—Dump containing 50,000 tons tailings assaying from $1.50 to $2.50 per ton, gold, purchased by Bonlay & Zachert, of San Francisco, who will construct reduction plant.

OXFORD (Downieville)—Vein cut by crosscut shows well, and extensive drifting being done by Cliff Mining Co. who are operating this and Gold Bluff quartz property together under bond. Grant Snyder is in charge.

Sonoma County

SEBASTOPOL MINING CO. (Sebastopol)—Incorporation of company contemplated. Stated that London men are negotiating for purchase of, or an interest in, the property.

Trinity County

DREDGING-GROUND OPTION extended from July 1 to Nov. 1. This option is on 1500 acres ground on Trinity River from above Carryille to four miles below Trinity Center, and some ground up both sides Coffee Creek. Consideration involved stated to be in neighborhood of $1,000,000. Churn-drill prospecting will be resumed under direction of E. A. Wiltsee. Stated $75,000 already expended in work. Placer ground near Igo, Shasta county, will also be prospected by same company.

Tuolumne County

KNOWLES (Sonora)—John Parsons, who recently leased this property, will install mill immediately.

NORWEGIAN (Tuttletown)—W. E. Booker has installed a hoist and small compressor and will put in power drills. Work will be continued on 100-ft. level, where large amount high-grade ore has been mined.

BUCKEYE (Sonora)—Machinery and supplies have been purchased, and grading for mill site and straightening main gangway and rebuilding track in inclined shaft are nearly completed. Compressed-air drills will be used, and steel cars will displace wooden ones.

COLORADO

Boulder County

LIVINGSTON (Sugar Loaf)—Rich gold ore has been struck in vein that years ago yielded famous Nyanza oreshoot on surface. New disclosure is in workings of United Gold Corporation whose officers claim to have 5-in. streak averaging 10 oz. gold, accompanied by 1 ft. running 2 oz. gold per ton.

BRAINERD TUNNEL (Ward)—Years ago, Col. Wesley Brainerd drove adit about one-half mile for drainage and transportation for mines of Ward district. Death terminated his enterprise, relatives declining to push it. With revival of interest in district and success met in various other mining tunnels of state, movement is on foot to revive this project. This adit would cut principal veins of district at depths varying between 1000 and 1500 ft. below outcrops and would shorten railway hauls on ores about six miles.

Chaffee County

TABOR (Monarch)—F. C. Watson and Harry E. Mathews have taken a 10-year lease on this mine which has been closed 30 years through litigation with owners of adjoining Columbus mine. Vein is 10 to 15 ft. thick and carries gold, silver and lead.

Clear Creek County

PRIMOS CHEMICAL (Empire)—Is working 45 men in molybdenite mine in Dyke district about 11 miles above Empire. Crude ore is sacked, packed down hill on burros, hauled to Empire Station in wagons, and shipped to Pittsburgh for treatment.

Gilpin County

OLD TOWN (Russell Gulch)—Iron City Concentrator has run 26-cord lot of ore from Hutchens lease in deepest workings where 20-ft. shoot is shipped without sorting. Lot produced gold retorts weighing 85 oz. and 58 tons of concentrate assaying 1.45 oz. gold and 2 oz. silver.

Gunnison County

CARTER (Ohio City)—Sellers and Watzling, leasing 400 level, shipped 150 tons of $11 gold ore, while Little & Co., leasing 100 level, produce ore running about 4 oz. per ton.

DOCTOR (Crested Butte)—This mine was closed down 15 years ago because of obnoxious zinc content of ore. It is now under lease by group of railroad conductors who are putting it in shape to produce 65 tons of ore per day under selling contract that calls for delivery of 5000 tons of 30% zinc ore before Nov. 1. A 12-mile wagon-road is being built from mine to station of Almont on Gunnison branch of the D. & R. G. Ry. George Runtz is superintendent.

Lake County

PENN (Leadville)—Lamphier Brothers maintain heavy shipments of iron ore—suitable for smeltery flux—and zinc ore.

VALLEY (Leadville)—Warren F. Page continues to push this adit into Prospect Mt. and has reached distance of 1200 ft. According to original estimates, breast is near expected ore-bearing contact in virgin portion of this district.

LILLIAN (Leadville)—This once-famous mine in Iowa Gulch has been idle for years, but J. Clarence Hersey, manager of property, has recently granted several leases and shipments have been resumed. Ore carries carbonate of zinc and free gold.

GORDON-TIGER (Twin Lakes)—Old mill is being remodeled and will be ready to run within few weeks with capacity of 30 tons daily. Manager George W. Boyce has mine workings reopened and in shape to keep mill supplied to capacity. He also has a force of men developing the Bwlchcogh mine and is running its 10-stamp mill.

San Miguel County

SUFFOLK (Ophir)—Mine has been taken over by new company known as Ophir Range Gold Mining Co. and will be operated under management of W. H. Staver with Thomas Ivey as superintendent. Mill will be remodeled and enlarged.

Summit County

FRENCH GULCH DREDGING CO. (Breckenridge)—Dredge is digging in good ground, recovering about $1000 per day. Production during last week in June was over 400 oz. of gold. Hermann J. Reiling, manager, has placed wager that last 15 days of July will show recovery of over $15,000. Accepting rated capacity of his dredge as 2000 cu.yd. per day, this gravel is yielding approximately 50c. per yd.

IDAHO

Shoshone County

NONPAREIL COPPER CO. (Mullan)—Directors of Nonpareil have decide to sell 207,750 shares of treasury stock to raise money for further development. Call has also been issued for bids to continue driving No. 4 tunnel westward along vein. When driven 880 ft. further this tunnel will have depth of 770 ft. and will be directly under promising surface showing.

LOGAN & PIKE (Gem)—Logan & Pike are installing two jigs, a rougher and a cleaner, about three miles above Wallace for purpose of reworking old tailing deposits of Cañon Creek. Tailings carried by creek at present will be avoided as far as possible, as they are too low-grade to yield profit. Operators expect to recover 40 tons of lead concentrates a month.

SILVER MOON MINING CO. (Wallace)—Company owns nine claims on Cañon Creek, adjoining Frisco on north, and containing two known veins, one of which is near creek and other 2000 ft. up ridge. Shaft sinking on the right limit of the creek is down about 140 ft., which makes it considerably below the creek level. Water is handled by bailing without difficulty. The equipment includes a small air compressor driven by a 35-hp. motor, air hoist, and drills.

HYPOTHEEK (Wallace)—It was announced by management on July 22 that shipments of high-grade ore from 900-ft. level would commence within two weeks, a contract having been let for hauling ore to the railway station at Enaville. Survey will also be made at once for tramway from mine to Enaville, distance of 2½ miles. Company has millsite at Enaville and plans erection of mill. Meanwhile high-grade ore only will be shipped, and ore of lower grade stored. Crosscut on 1100-ft. level being driven to vein, which is supposed to be 160 ft. from shaft. As soon as 1100 is opened sufficiently for production, large electric hoist will be substituted for air hoist now in use. Mine will then have ore available for stoping on four levels—500, 700, 900 and 1100.

KENTUCKY

Hopkins County

WESTERN KENTUCKY SMELTING CO. (Dawsonsprings)—Has been incorporated with capital stock $20,000 to develop zinc and lead deposits at Dawsonsprings.

MICHIGAN

Copper

KEWEENAW (Mandan)—Has levied assessment of $1 payable Sept. 1.

NEW ARCADIAN (Houghton)—Is now making a second mill shipment.

PHOENIX (Calumet)—Has levied assessment of $2 a share, half payable Sept. 1 and balance Jan. 1.

LA SALLE (Calumet)—Continues to ship 450 tons of rock per day, most of it coming from No. 1. It is better than La Salle's previous average

QUINCY (Hancock)—Is using steel tubes in conical mills at stamping plant as substitute for pebbles and finds them successful, covering a test of seven weeks.

FRANKLIN (Hancock)—It will be two weeks before Franklin has electric haulage on 37th level in shape for handling rock. A 10-ton skip will be used and shipments then will run to 1200 daily.

CALUMET & HECLA (Calumet)—Regrinding of tailings will commence as soon as power is furnished from Ahmeek mill turbine. It will be at least six weeks before regrinding plant on dredge output can be in running order.

ISLE ROYALE (Houghton)—Third stamp head at Isle Royale mill will be operated Aug. 15 as will also sixth head at Ahmeek mill. Other two heads at Ahmeek will not be put into commission until some later date.

SOUTH LAKE (Houghton)—Shipped two carloads of rock from stockpile to Franklin mill; is beginning of further regular shipments from this property. More drills are going to work and good rock is being taken out.

CHEROKEE (Houghton)—Has uncovered five lodes, by trenching. Two contained a little copper, showing width of 30 ft. They will be opened farther by blasting. Years ago when former organization had charge of work they opened what was supposed to be Winona lode. Captain Dunn had charge but three shafts that were opened were not deep. As matter of fact it is now believed that Winona formation is carried in these newer openings.

MICHIGAN (Michigan)—Recent $1 assessment called by Michigan will not pay outstanding indebtedness. Understood that creditors will permit use of portion—about half—for exploratory work along lines suggested by management. There are two possible opportunities for Michigan, which owns large acreage. One is development and operation of same formation as Mass is working so successfully, dependent largely upon substantial tonnage. The other is development of some of lodes which South Lake has found so rich.

MINNESOTA

Cuyuna Range

CUYUNA-SULTANA (Ironton)—Test shaft now down 100 ft. Soo Line about to construct ½-mile spur to property. Portion of orebody will be stripped.

CUYUNA-MILLE LACS (Ironton)—Work resumed; 175 men will be employed. Company has sold large tonnage of manganiferous ore to Pittsburgh Steel Co.

Mesabi Range

CORSICA (McKinley)—Resumed July 26, employing 200 men.

LEONIDAS (Eveleth)—Last week 1002 cars were loaded out, being largest shipment ever made from a state-owned iron mine.

MONTANA

Madison County

BEAR GULCH DISTRICT—Bielenberg & Higgins mill in Bear Gulch near Twin Bridges, has been started up and will continue operations through season. From 20 to 25 men will be employed at present; number may be increased as conditions warrant. Tunnel is being extended under contract.

Park County

MONTANA SCOTCH BONNET (Cooke City)—In "Journal" of July 3 stated to be 60 miles from Cooke City; should have read 6 miles.

Silver Bow County

DAVIS-DALY (Butte)—Satisfactory progress made in opening orebodies recently discovered on 2500 level of Colorado mine. Last assays showed 5.6% copper and 6½ oz. of silver per ton. About a carload per day is being shipped from 2500 and 1700 levels. Southwest crosscut on which strike was made on 2500 level is being continued to intersect Hesperus orebody.

TIMBER BUTTE MILLING CO. (Butte)—The zinc concentrator of this company is again running at capacity and handling between 400 and 500 tons of ore per day. It confines its operations to output of the Elm Orlu mine. Concentrates are being shipped to the Oklahoma smelters which are under contract to take 6000 tons per month. Attempts to secure additional smelting facilities have so far not been successful, as a result of which company has been compelled to pile up considerable amounts of concentrates awaiting shipment. About 125 men are employed at company's mill.

TUOLUMNE COPPER MINING CO. (Butte)—President Hickey, being of the opinion that operations at the Tuolumne can be profitably carried on at present, sent a letter to stock-

holders a few weeks ago asking for contributions to the amount of $35,000 for resuming operations. Stockholders have volunteered to lend company $20,000, while Mr. Hickey has advanced $5000. The necessary balance of $10,000 will be forthcoming by the time of starting operations by the end of the month. This will mean that from 75 to 150 men will be put to work causing an addition to the Butte payroll of from $7500 to $15,000 per month.

ANACONDA (Butte)—Company has taken lease on Emma mine of Butte Copper & Zinc Co., and holds option to purchase stock of latter company. Emma is promising zinc mine, located in heart of city of Butte, at Colorado and Silver streets. Some time ago Butte Copper & Zinc Co. gave option to American Zinc Co., which was unable to finance deal and it fell through. Lease and option entered into with Anaconda company is for period of five years, with additional five years to be granted upon complying with certain conditions. Combined with lease is option for 88,300 shares of treasury stock and 100,00 shares of owners' stock, at $1 per share. According to agreement Anaconda company is to unwater mine to 800-ft. level and keep it pumped out at that level for 45 days. Anaconda company is at present making thorough investigation of the mining properties at Neihart in Cascade County with view to reopening Neihart camp. Mines in that camp are low-grade properties; ore carries lead, silver and zinc. One of difficulties of camp in past has been presence of large quantities of zinc which, with processes then in vogue, could not be handled profitably. It is believed that by flotation this ore may be made to yield profitable results and it is with this expectation that Anaconda has taken option on mines where large amount of such ore is blocked out.

NEVADA

Clark County

WHALE (Goodsprings)—At distance of 300 ft. development tunnel has intersected main vein, carrying high-grade zinc-carbonate ore, and it is expected that property will begin shipments in near future.

BULLION (Goodsprings)—Construction work on new 50-ton concentrator being rushed; expected plant will be in operation within 30 days. Force at mine has been increased. Only high-grade lead ore is being shipped, pending completion of mill.

GREEN MONSTER (Goodsprings)—After being idle several years on account of difficulties of transportation, large force of men is now at work getting mine in shape for active production. Considerable tonnage of zinc-carbonate ore is blocked in mine and it is planned to maintain monthly production of 500 tons. In conjunction with Azalia Mining Co., motor truck road is to be built through Wilson Pass to connect with Yellow Pine R.R. above Goodsprings.

ORO AMIGO (Goodsprings)—Ore containing 150 oz. gold and 15 oz. platinum per ton has been discovered on upper tunnel level and is now being sacked for shipment. Occurrence is similar to that at Boss mine, where rich gold-platinum ore was discovered last summer and which produced only platinum in United States recovered in 1914 from a lode deposit. Ore occurs along fracture-zone in limestone; gangue being oxidized quartzose material, carrying some copper and considerable iron; mineral carrying platinum has been identified by U. S. Geological Survey as cupro-jarosite. Discovery at Oro Amigo is especially important, since property is situated two miles from Boss mine, and it introduces possibility of further discoveries along zone of considerable area. Discovery has resulted in increased activity in vicinity.

Nye County

TONOPAH ORE PRODUCTION for week ended July 24 totaled 11,137 tons valued at $226,426, compared with 10,307 tons week previous. Producers were: Tonopah Belmont, 3541; Tonopah Mining, 3150; Tonopah Extension, 1820; West End, 1514; Jim Butler, 1100; North Star, 56; and miscellaneous leasers 146 tons.

TONOPAH MINING (Tonopah)—For quarter ending May 31 net earnings of Tonopah Placers Co., $34,67; of which is owned by Tonopah Mining, amounted to $63,005.

OREGON

Baker County

BEN HARRISON (Baker)—Will make extensive improvements to cost $100,000.

UTAH

Juab County

TINTIC ORE SHIPMENTS for the week ended July 23 have exceeded those of any week in two years, having amounted to 193 cars or about 9650 tons of an estimated value of $240,000.

GODIVA (Eureka)—Lead-silver ore is reported to have been opened recently on 200- and 400-ft. levels.

MAY DAY (Eureka)—The 500-ft. level is being worked by leasers, and 800 is to follow. Good profits are being made, and dividend is expected in August.

NORTH CLIFF (Silver City)—Dump of low-grade ore has been sampled, and it is hoped that it can be treated by new mill, which is in process of construction by Tintic Milling Co.

SELMA (North Tintic)—Crosscut from 200 level has been advanced over 100 ft., and face is in limestone showing some mineralization. Six men are working.

SIOUX MILL DUMP (Mammoth)—About 30,000 tons of low-grade ore have been shipped from this dump, purchased by A. S. & R. some time ago, and another month it is thought dump will be exhausted.

EAGLE & BLUE BELL (Eureka)—Bingham Mines Co., controlling this property as well as Commercial and Dalton & Lark mines in Eureka, has acquired Victoria ground adjoining Eagle & Blue Bell through which property work will be carried on.

MAMMOTH (Mammoth)—Will soon begin shipments from dump left on old mill site southwest of Tintic. There are several thousand tons of the material, which is low-grade copper ore, which will be hauled two miles by wagon to tracks of San Pedro railroad for shipment.

TINTIC MILLING (Silver City)—Preliminary work being done for new mill which is to be built here by Knight-Dern interests; and good progress is being made. Machinery from plant of Mines Operating Co., at Park City, is being shipped to Silver City, to be used in construction of new mill.

CHIEF CONSOLIDATED (Eureka)—This company has recently issued a map of Tintic drawn to scale, 800 ft. to the inch, showing holdings of various companies, and table of production of camp from 1877 to 1914. Map shows company's own property in eastern and northern ends of district, which has recently been increased by 250 to 300 newly acquired claims. Latter will be prospected by diamond drilling with view to study of formations and mineralization and locating shafts and tunnels.

Salt Lake County

EMMA COPPER (Alta)—New lens of ore up to 2 ft. thick has been opened in raise above crosscut. In second or south raise silver-lead ore 6 in. thick has been opened.

ALBION (Alta)—Small seams of ore and copper staining show in face of drift being driven from Quincy tunnel of South Hecla to reach Kate Hays fissure. Leasers are mining ore from old workings.

SOUTH HECLA (Alta)—Stock has been listed on Salt Lake Exchange. Capitalization is $500,000, of which 237,839 shares, par value $1, are unissued. Company owns 41 claims comprising 550 acres in Little Cottonwood and Alta district; eight miles from railroad. Twenty-six claims are patented. Development consists of about 14,000 ft. of workings. Ores carry silver, lead, gold and copper. George H. Watson is president. Property is making regular shipments of one carload a day.

Summit County

BIG FOUR EXPLORATION (Park City)—New mill, seven miles north of city began work July 16. Company has added to its holdings by securing lease on lower half of deposits on Homer ranch.

WASHINGTON

King County

UNIVERSITY OF WASHINGTON (Seattle)—College of Mines, Milnor Roberts, dean, will erect coal-washing plant on campus. Plans have been prepared, work expected to start soon.

Pierce County

TACOMA SMELTERY (Tacoma)—Owing to rapidly increasing copper production of Alaska it is reliably reported that Tacoma smeltery will make extensive additions to increase capacity.

WISCONSIN

Zinc-Lead District

CLIMAX (Platteville)—Is unwatering Homestead mine and will operate Acme property adjoining.

HODGE (Platteville)—Ben Webster & Co. is unwatering this mine and will commence milling within next few days.

KLAR PIQUETTE (Platteville)—Mine closed down for two years and said to have been exhausted, has again been placed on dividend basis.

GRANT COUNTY (Platteville)—H. E. Stephens and Chas. Kistler have taken option on this property and are overhauling milling equipment.

POLLARD & SANE (Linden)—Has acquired Hinkle and Kickapoo properties at Linden and O. P. David mine and milling equipment at Montfort.

CANADA

Ontario

CASEY-SENECA (Cobalt)—Plant has been installed and shaft is down 30 ft.

McINTYRE EXTENSION (Porcupine)—This company capitalized at $2,500,000, has been incorporated to take over Pearl Lake property recently acquired by McIntyre.

PRESTON EAST DOME (Porcupine)—Diamond-drilling will shortly be started on north claim of company immediately adjoining Dome, in hope of striking some of orebodies coming in from latter.

GOULD (Cobalt)—Lease of this property owned by Peterson Lake has been turned over to Mercer Silver Mines and operations have been resumed with W. E. Segsworth as managing director and A. C. Bailey, manager.

TOUGH OAKES (Kirkland Lake)—Application has been made to English courts for winding up of Tough Oakes Gold Mines, Ltd., which was formed in England to acquire these claims, but could not meet payments.

TEMISKAMING (Cobalt)—Half yearly report of company says: In order to carry out our policy of deep mining, it was found necessary to install a new hoist. This we expect to have installed and running within 60 days. This hoist will enable us to reach the lower contact between the diabase and the Keewatin formations (a depth of between 1600 and 1700 ft.) and it is believed that as rich values will be encountered at the lower contact as have been developed at the contact above. This work will be pushed forward as rapidly as conditions will permit.

Yukon

CANADIAN-KLONDYKE (Dawson)—No. 2 dredge, which overturned last autumn, was righted and drydocked on July 20, but an accident on July 23 will prevent its going into commission as early as expected. One man was killed and two were seriously and one slightly injured. The yields from the other three dredges have lately been the highest ever recorded. For the week ended July 20, 3407 oz.; July 27, 3436 oz.

SOUTH AMERICA

Colombia

ANGLO-COLOMBIAN DEVELOPMENT (Istmina)—The new dredge completed its preliminary run successfully on July 20 and is now operating regularly near the mouth of the Condoto. The camp name has been changed to Andagoya, Boca de Condoto.

The Market Report

Metal Markets

NEW YORK—Aug. 4

Copper and tin declined during the early part of the week and then rallied. Lead experienced a sharp decline and the course of spelter was steadily downward.

Copper, Tin, Lead and Zinc

Copper—During the early part of the week the copper market was only nominal, there being no buyers but plenty of sellers who made offerings at concessions from day to day. In the latter part of the week some sales were effected, but business was not general. However, there were some inquiries in the market toward the close both from domestic and foreign quarters, and there was a feeling of hopefulness that these would shortly result in business. The pressure of Australian and Japanese copper in the European markets appears to have relaxed and sales of American copper for export were made at about 17.60c., New York. For domestic shipments copper was offered at the close at 17¾@18c., regular terms.

Copper production at Katanga during the first six months of 1915 was slightly in excess of 15,000,000 pounds.

Copper Exports for the week ended July 24 are reported by the Department of Commerce at 11,352,552 lb.; the chief items being, 7,492,788 lb. to France, 1,906,316 lb. to Russia and 1,308,704 lb. to England. Imports were 1,880,454 lb. metal and 981,316 lb. in ore and matte, 2,861,770 lb. in all, chiefly from Canada.

Copper Sheets bring 24@25c. per lb.; no base quotations are made by the principal maker. Wire is quoted at 20@20½c. per lb., carload lots at mill.

Tin—After an early decline this market rallied a little. There were no features of special interest.

Visible Stocks of Tin on Aug. 1 are reported as follows, including tin afloat: London, 7352; Holland 41; United States, excluding Pacific ports, 8691; total, 16,084 long tons, an increase of 157 tons during July.

Lead—Opinion which was optimistic at the date of our last report suddenly turned pessimistic. The price of the A. S. & R. Co. had previously been cut by dealers, but at the beginning of our week of review lead was offered at sharp concessions by outside producers, and on July 30, the A. S. & R. Co. reduced its price to 5.50c. This was immediately shaded by other sellers and on Aug. 2 the A. S. & R. Co. reduced to 5.25c., its competitors following with further cuts, and at the close of the week lead was available in large lots at 5c. per pound. Small sales were reported at that figure and a great deal offered for which buyers could not be found. This lead was offered by dealers, by consumers who wanted to resell, and by producers. The opinion is expressed in the trade that consumers overbought themselves in their recent operations in the market.

Spelter—The course of the zinc market was steadily downward throughout the week. Large supplies are being offered from numerous quarters. Transactions were light. The differential between prices for early and late deliveries contracted futther. At the close contracts for delivery during the remainder of the year, including both near-by and later deliveries, could be made at 14½@15c. There appears to be some speculative spelter hanging over the market and it appears also that certain manufacturers who overbought their requirements and offered their surplus for resale have not yet disposed of all they want to.

Zinc Sheets are in good demand and sales are steady. The base price is $24 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras are charged.

We understand that the U. S. Steel Corporation expects to be able to begin the production of spelter at Donora before the end of this year. However, the production in 1916 will be very small, even if there be no miscarriage of plans.

According to the London "Financial Times," the Vieille Montagne company is running its smelteries in Belgium almost as usual. With a view to keeping the staff together and the works in good order the direction has been treating accumulated concentrates and stocking the zinc produced in default of any facilities for shipping it.

Other Metals

Aluminum is steady and in fair demand, but with no material change in prices. Current quotations are 31@33c. per lb. for No. 1 ingots, New York.

Antimony has been dull with very little business forward. Prices are hardly more than nominal. Ordinary brands being 35@37½c. per lb. For Cookson's 48@50c. is asked.

Quicksilver shows a moderate business chiefly of a small order. New York price is $92@94 per flask of 75 lb. for large lots, $95@98 for smaller orders. San Francisco reports by telegraph $92.50@95 per flask, with a quiet market. London price is rather higher, £18 12s. 6d. per flask being named.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
July Aug.	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			17 50		5 45	5 35	15 25
29	4 7638	46⅞	@17 75	35¼	@5.55	@5.40	@16.50
			17 35		5.35	5 25	15 00
30	4 7613	47⅛	@17 55	35⅛	@5.50	@5.35	@16.00
			17 35		5.25	5 25	15 00
31	4 7000	47⅛	@17 55	35	@5.50	@5.35	@15.50
			17.50		5.00	*5.00	15.00
2	4.7006	47⅛	@17 60	35	@5.25	@5.10	@15 50
			17 50		5.00	*4 90	14 50
3	4 7006	47⅜	@17 60	35½	@5.12½	@5 10	@15.00
			17.60			*4 90	14 50
4	4 7006	47½	@17.80	35½	5.00	@5 00	@15.00

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
July-Aug.	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
29	22⅞	71¼	72⅜	87½	18 64	158¾	158¾	23½	5 09	92½	19 70
30	22⅞	71¼	72⅜	87½	18 64	155	155¼	23½	5 01	92½	19 70
31	22⅞										
2											
3	22⅞	72½	73½	87	18.53	157	157¾	23½	5.04	91½	19 48
4	22⅞	73	74½	87	18 53	156½	157¾	23½	5.04	91½	19 48

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter is subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound, the following approximate ratios are given, reckoning exchange at 4 80: £10 = 2.14c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations of £1 = 0.21½c.

Gold, Silver and Platinum

NEW YORK—Aug. 4

Gold and Silver Movement in the United States, six months ended June 30, as reported by the Department of Commerce:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$83,974,535	$7,582,527	$25,510,170	$24,819,297
Imports	30,743,422	144,924,436	12,590,464	14,741,600
Excess	E.$53,231,113	I. $137,341,909	E. $12,919,706	E. $10,107,697

Exports of merchandise for the half-year in 1915 were valued at $1,701,862,297; imports, $860,821,865; excess of exports, $841,040,432. Adding the gold and silver leaves $718,806,220 as the net export balance.

Silver—Under date of July 22 London writes that the silver market shows no animation. The dominant factor is still the very restricted amount of selling from America, which offset the sluggish disposition of buyers. Cables of later date confirm substance of mail better.

Platinum—The market continues quiet and business is moderate, as it has been for some time past. Quotations are about $37@39 per oz. for refined platinum and $41@44 per oz. for hard metal.

Our Russian correspondent reports under date of July 9 that there is no change. In Petrograd there was demand for some quantities for export, but no actual sales. At Ekaterinburg buying from the mines and sales by speculators have gone on as usual. Quotations for crude metal, 83% platinum, are 33,000 rubles per pood at Petrograd; 8.20 rubles per zolotnik at Ekaterinburg—equal to $32.34 and $30.73 per oz., respectively.

Zinc and Lead Ore Markets

JOPLIN, MO.—July 31

Blende, high price, $112; base price per ton of 60% zinc, premium ore $110, medium $107@100; $98@80 lower grades; Calamine, base per ton of 40% zinc, $50@56; average, all grades of zinc, $103.30. Lead, high price, $60.50; base, $60 per ton of 80% metal content; average, all grades of lead, $58.08 per ton.

SHIPMENTS, WEEK ENDED JULY 31

	Blende	Calamine	Lead	Values
Totals this week..	10,649,660	511,400	1,719,700	$627,350
Total 7 months..	332,826,660	28,312,770	50,482,880	$14,418,020

Blende value, the week, $562,890; 7 months, $12,464,080.
Calamine value, the week, $14,530; 7 months, $164,820.
Lead value, the week, $49,930; 7 months, $1,339,120.

PLATTEVILLE, WIS.—July 31

The base price paid this week for 60% zinc ore was lowered to $100 per ton. The base price paid for 80% lead was $60 per ton.

SHIPMENTS WEEK ENDED JULY 31

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	2,138,360	.....	714,800
Year	107,900,580	4,083,160	15,916,450

Shipped to separating plants during week, 5,120,500 lb. zinc ore. Shipments light because of rains.

Iron Trade Review

NEW YORK—Aug. 4

The market is in an unprecented condition for July, usually a dull month. Export orders show a large increase and there is a steady gain in domestic business. Recent price advances are well held and further ones in bars and plates will be made, it is said.

Pig iron is stronger and more business is reported, while in some cases there are larger takings under contract. There is talk, as there has been for some time, of speculaive buying of pig. These rumors are not usually easy to confirm, but there is probably some truth in them.

Imports at Baltimore for the week included 3928 tons of ferromanganese from Middlesboro, England, and 1050 tons manganese ore from Rio Janeiro, Brazil.

PITTSBURGH—Aug. 3

The steel mills are now filled with business, except for a limited tonnage of bessemer which could still be produced, and buyers of some finished products will be urged to take bessemer instead of openhearth, when it can be shown that the former is equally serviceable for the purpose. The delivery promise on new specifications for steel bars has been lengthening rapidly, and is now at a minimum of six weeks. On large steel rounds, for shrapnel, the mills are almost entirely filled for more than six months, but are still in receipt of large orders. A curious result is that they are quite the reverse of eager to accept orders for rails, though they accept them as a matter of trade courtesy. A large part of the rail capacity of the country is now rolling steel rounds for shells.

New orders for steel products have become relatively light, but specifications on contracts are as heavy as ever, and even the increased steel production does not prevent the mills from accumulating shipping orders on books.

Steel prices continue to harden. There are prospects of an early advance in steel bars from 1.30c. to 1.35c. In shapes the 1.25c. quotation has disappeared, the market now being 1.30c., while in plates the tonnage offered at 1.25c. has become limited. Black sheets have stiffened to 1.80c., but this is no higher than the market at the beginning of the year.

Pig Iron—W. P. Snyder & Co. announce their computations of average realized prices, on all sales of Valley iron 1000 tons and over, for July at $13.991 for bessemer, an increase of 24.1c. over June, and 12.959 for basic, an increase of 23.5c. over June. The market has become rather excited and while no large sales have been made in the past week some Valley furnaces have advanced their quotations 50c. on basic and 25c. on bessemer. It is reported that the Tennessee company has advanced its price on foundry iron to $12.50. Birmingham, which means that it has withdrawn entirely from the market, which has lately advanced from $9.50 to $10. Some large purchases in the local market are expected this month, particularly of steel making grades. We quote: Bessemer, $14.25@14.50; basic, $13@13.50; No. 2 foundry, $12.75@13; malleable, $13; gray forge, $12.50@12.75, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The ferromanganese situation is made particularly uncertain by the recent order of the British government, requiring the English producers to carry three months' stock of ore and three months' stock of ferromanganese, and the British consumers to carry three months' stock of ferromanganese. This may seriously affect our imports. On the other hand, however, our imports of ore have been much larger in the past three months than in the first four months of the year, when they were almost negligible. Small prompt lots are held at $100@105, while there is no regular contract market.

COKE

Coke production for the week in the Connellsville region was 367,095 short tons; shipments, 360,852 tons. Production of Greensburg and Upper Connellsville districts was 43,565 tons.

Chemicals

NEW YORK—Aug. 4

The general markets are quiet, and more or less affected by the seasonal conditions.

Arsenic—Only about the usual trade is being done. Supplies seem to be sufficient for all demands. Quotations are about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady but not particularly active. Quotations show little change, $7.25 per 100 lb. being named for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is fair for the season, and is steady, with prices unchanged. Quotations are 2.35c. per lb. for spot and for all positions this year.

Pyrites—Imports at Baltimore for the week included 3222 tons of pyrites from Huelva, Spain.

Potash Salts—Imports of potash salts in the United States for June and the six months ended June 30 are reported by the Department of Commerce as follows, in pounds:

	June		Six Months	
	1914	1915	1914	1915
Carbonate of potash	1,385,750	588	11,252,825	8,396,622
Hydrate of potash	740,930	7,000	4,203,568	2,023,942
Nitrate of potash	479,881	.....	1,558,926	6,855
Cyanide of potash	22,400	.....	298,377	828,577
Other potash salts	540,295	11,275	3,244,686	2,075,535

Imports of the crude or manure salts were as follows, in long tons:

	June		Six Months	
	1914	1915	1914	1915
Kainit	17,891	2,860	257,253	6,646
Manure salts	33,151	.....	114,820	12,456
Sulphate of potash	16,473	1,095	37,786	9,901
Muriate of potash	3,000	320	108,759	56,455

The changes were due to the interruption by the war to shipments from Germany.

PETROLEUM

Oil production in California, six months ended June 30, was 44,677,443 bbl. The stocks reported on June 30, 1915, were 60,616,286 bbl., an increase of 2,090,012 bbl. over those at the opening of the year.

Shipments of oil from Mexico in May were 2,378,848 bbl., of which 1,504,629 bbl. went to the United States. For the six months ended June 30, the total shipments were 10,438,528 bbl., a decrease of 212,094 bbl. from last year.

Assessments

Company	Delinqt	Sale	Amt.
American, Ida	Aug. 7	Sept. 2	$0.001
Belmont, Ida	Aug. 10	Sept. 10	0.003
Blue Bell, Ida	July 5	Aug. 4	0.003
Carbonate, Ida., (post.)		Aug. 23	0.001
Challenge Con., Nev.	July 12	Aug. 1	0.05
Con. Virginia, Nev	July 19	Aug. 10	0.05
Contact Copper, Mich	May 15		1.00
East Coeur d'Alene, Ida	Aug. 9	Sept. 9	0.001
East Hercules Ext., Wash.	Aug. 10	Sept. 10	0.0015
Eastern Star, Ida		Aug. 24	0.002
Four Timbers, Ida	July 28	Aug. 28	0.001
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1.00
Houghton, Mich	May 25		1.00
Idaho-Nevada, Ida	July 14	Aug. 6	0.001
Iron Mask, Ida	July 1	Aug. 10	0.002
Ivanhoe, Ida	July 12	Aug. 12	0.002
Klog of Pine Ck., Ida. (post.)		Aug. 6	0.002
MacNamara, Nev	Aug. 23	Sept. 13	0.02
Majestic-Idol, Nev.	Dec. 15	July 20	0.005
Michigan Copper, Mich	July 19		1.00
Mineral Range, Utah	May 24		0.003
Moonlight, Ida	June 5	July 8	0.005
Nabob, Ida	July 5	Aug. 2	0.005
New Arcadiao, Mich.	June 1		0.50
New Arcadian, Mich.	Dec. 1		0.50
New Baltic, Mich	July 15		0.50
New Baltic, Mich	Jan. 15		0.50
Nevada Douglas, Nev.	July 21	Aug. 18	0.10
Oreano, Ida	Aug. 2	Sept. 2	0.0015
Rainbow, Ida	July 7	Aug. 7	0.002
Rescue-Eula, Nev.	July 14	Aug. 10	0.01
Revelator, Utah	Aug. 17	Sept. 3	0.001
Revelator, Utah	Oct. 4	Oct. 25	0.001
Sierra Nevada, Nev.	July 27	Aug. 16	0.05
Smuggler, Utah	Aug. 17	Sept. 10	0.005
Sonora, Ida	July 23	Aug. 31	0.004
Springfield, Ida	July 30	Aug. 30	0.002
Sunrise, Ida	July 17	Aug. 17	0.002
Tarbox, Ida	July 17	Aug. 7	0.0025
Tonopah Gypsy Queen, Nev.	July 12	Aug. 17	0.001
Tonopah Midway, Nev.	Aug. 18	Sept. 18	0.01
Umatilla Tonopah, Nev.	July 12	Aug. 16	0.01
Union Cons., Nev	Aug. 24	Sept. 14	0.05
West Tonopah Con., Nev.	July 10	Aug. 10	0.01
Wyandot, Mich	July 28		1.00

Stock Quotations

The New York Stock Exchange listing in the first half of 1915 shows the following mining securities: Alaska G. M. 6% debentures; Chile Copper conv. 7's; Butte & Superior stock, Dome Mines stock.

COLO. SPRINGS	Aug. 3	SALT LAKE	Aug. 3
Name of Comp.	Bid.	Name of Comp	Bid.
Acacia	.02½	Beck Tunnel	.05½
Cripple Cr'k Con.	.006	Black Jack	.08½
C. K. & N.	.03	Colorado Mining	.09½
Doctor Jack Pot.	.10½	Crown Point	.01½
Elkton Con.	.34	Daly-Judge	7.50
El Paso	.69	Gold Chain	.20
Findlay	.03	Grand Central	.58
Gold Dollar	.01	Iron Blossom	.72
Gold Sovereign	.03½	Little Bell	.10
Golden Cycle	1.77½	Lower Mammoth	.03
Isabella	.29	Mason Valley	2.00
Jack Pot	.06½	May Day	.21
Jennie Sample	‡ .02	Opohonga	.00½
Jerry Johnson	.05	Prince Con	.78
Lexington	‡ .004	Seven Troughs	.01½
Mary McKinney	.37	Silver King Coal'n	3.42½
Pharmacist	.008	Silver King Con.	2.07½
Portland	1.45	Sioux Con.	.02½
Raven B. H.	.02	Uncle Sam	.04½
Vindicator	1.71	Yankee	.12

TORONTO	Aug. 3		
Bailey	.02½	Dome Extn	.22
Coniagas	3.50	Foley O'Brien	.30
Peterson Lake	.19	Hollinger	24.50
Right of Way	‡ .03	Imperial	.06
Seneca Superior	2.00	Jupiter	.13
Silver Queen	.01	McIntyre	.47
T. & Hudson Bay	18.00	Pearl Lake	.00½
Timiskaming	.32	Porcu Crown	.70
Wettlaufer-Lor.	.02	Preston E. D.	.03½
Dome Mines	21.87½	Ren	‡ .10

SAN FRANCISCO	Aug. 3		
Comstock Stocks		Misc. Nev. & Cal	
Alta	‡ .07	Belmont	3.62½
Andes	.07	Jim Butler	.82
Belcher	.25	Lone Star	.04
Best & Belcher	.06	MacNamara	.01
Caledonia	.25	Midway	.10
Challenge Con	.10	Mont.-Tonopah	.30
Confidence	.10	North Star	.12
Con. Virginia	.10	Rescue Eula	.06
Gould & Curry	.03	West End Con	.59
Hale & Norcross	.03	Atlanta	.31
Julia	‡ .01	Booth	.47
Mexican	.46	C.O.D. Con	.03
Occidental	.79	Comb. Frac	.07
Ophir	.19	Jumbo Extension	1.52½
Overman	.06	Pitts.-Silver Peak	.06
Potosi	.01	Round Mountain	.44
Belcher	.03	Sandstorm Kendall	.06
Sierra Nevada	.10	Silver Pick	.09
Union Con	.16	Central Eureka	.16
Yellow Jacket	.30	So. Eureka	‡1.50

N. Y. EXCH.	Aug. 3		
Name of Comp.	Clg.		
Am. Sm. & Ref. com.	80½		
Am. Sm. & Ref., pf.	106½		
Am. Sm. Sec., pf. B	79		
Anaconda	70½		
Batopilas Min	1½		
Bethlehem Steel	268		
Bethlehem Steel, pf.	132		
Chino	45½		
Colo. Fuel & Iron	39½		
Crucible Steel	71½		
Federal M. & S., pf.	45		
Great Nor., ore., etf.	41½		
Guggen. Exp.	63		
Homestake	117		
Inspiration Con.	33½		
Mex. Petroleum	80		
Miami Copper	26½		
Nat'l Lead, com.	64½		
National Lead, pf.	110		
Nev. Consol.	14½		
Ontario Min	2½		
Quicksilver, pf.	3½		
Ray Con.	23½		
Republic I.&S., com.	43½		
Republic I.&S., pf.	97		
Sloss-Sheff'd, com.	43½		
Tennessee Copper	38½		
Utah Copper	66½		
U. S. Steel, com	68		
U. S. Steel, pf.	111½		

N. Y. CURB	Aug. 3		
Alask'a Juneau	12½		
Alta Con	82		
Beaver Con	30		
Big Four	.05		
Blue Bell	.02		
Braden Copper	6½		
Buffalo Mines	43½		
Can. Cop. Corpn.	½		
Can. G. & S.	‡ .05		
Cashboy	.04		
Chambers Ferland	.13		
Chile Cop	18½		
Con. Ariz. Sm.	½		
Coo. Coppermines	1½		
Con. Nev.-Utah	1/16		
Davis-Daly	1/16		
Dlam'field-Daisy	.03		
Dla Black B.	.02		
Florence	.47		
Goldfield Con	1/16		
Goldfield Merger	.22		
Greene Cananea	41½		
Kennecott Cop.	34½		
Kerr Lake	3½		
La Rose	7/16		
McKinley-Dar-Sa	.20		
Mines of Am.	‡2½		
Nevada Hills	.18		
New Utah Bingham	.3		
Nipissing Mines	.5½		
Oro	.07		
St. Joseph Lead	12½		
South Utah	‡ .25		
Stand'd Oil of N.J.	417		
Standard S. L.	1½		
Stewart	1½		
Tonopah	.5½		
Tonopah Ex.	.2½		
Tonopah Merger	.38		
Tribullion	3/16		
Tularosa	1/16		
Yukon Gold	2½		

LONDON	July 22		
Alaska Tre'dwell	£7	7s	6d
Burma Corp.	1	15	3
Cam & Motor.	0	13	6
Camp Bird	0	4	3
El Oro	0	7	0
Esperanza	0	8	0
Mexico Mines	3	7	6
Nechi, pfd.	0	10	6
Oroville	0	14	3
Santa Gert'dis	0	7	6
Tombay	1	0	3
Tough Oakes	0	5	9

BOSTON EXCH	Aug. 3		
Name of Comp.	Clg.		
Adventure	2		
Ahmeek	397		
Alaska Gold M	33½		
Algomah	2½		
Allouez	54½		
Am. Zinc	56		
Ariz. Com., ctfs.	⅞		
Bonanza	37		
Butte-Balaklava	4		
Butte & Superior	68½		
Calumet & Ariz	64		
Calumet & Hecla	571		
Centennial	18½		
Cliff	1		
Copper Range	56½		
Daly West	2½		
East Butte	13		
Franklin	8½		
Granby	84		
Hancock	17½		
Hedley	28		
Helvetia	35		
Indiana	4½		
Island Crk. com.	46½		
Island Crk. pfd.	89		
Isle Royale	28		
Keweenaw	2		
Lake	15		
La Salle	6½		
Mass	11½		
Maydower	4		
Michigan	2½		
Mohawk	74½		
New Arcadian	10½		
North Butte	30½		
North Lake	2½		
Ojibway	1½		
Old Colony	3½		
Old Dominion	53½		
Osceola	82½		
Quincy	87		
Santa Fe	3		
Shannon	8½		
Shattuck-Ariz.	26½		
Superior	28		
Superior & Bost.	2½		
Tamarack	46½		
Trinity	3½		
Tuolumne	51		
U. S. Smelting	42		
U. S. Smelt'g, pf.	46½		
Utah Apex	4		
Utah Con	13		
Victoria	2½		
Winona	4		
Wolverine	611		
Wyandot	1½		

BOSTON CURB	Aug. 3		
Alvarado	70		
Bingham Mines	8½		
Boston Ely	20		
Butte & Lon'n Dev	29		
Calaveras	1½		
Calumet-Corbin	04		
Chief Con	99		
Corbin	‡.50		
Cortez	.30		
Crown Reserve	40		
Eagle & Blue Bell	1½		
First Nat. Cop.	2½		
Houghton Copper	3½		
Iron Cap Cop., pf	64		
Majestic Dev.	63		
Mexican Metals	22		
Nevada-Douglas	70		
New Baltic	3½		
Ohio Copper	20		
Oneco	1		
Raven Copper	08		
Stanley Dev.	20		
So. Lake	‡64		
Tonopah Victor	28		
Trethewey	‡ 11		
United Verde Ext.	64		

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.355	28 983	26 553	22.731
February	61 642	57 506	48.477	28 357	26 573	22.753
March	57 870	58 067	50.241	26.669	26 788	23.708
April	59 490	58 519	50.250	27.416	26 955	23.709
May	60 361	58 .75	49.915	27 825	26 704	23.570
June	58 990	56 471	49.034	27 199	25 948	23.267
July	58 721	54 .678	47.519	27 074	25.219	22 597
August	59 293	54 344		27 335	25 979	
September	60 640	53.290		27.956	24 260	
October	60 793	50.654		28 083	23.199	
November	58 995	49 082		27 263	22 703	
December	57.760	49.375		26.720	22 900	
Year	59 791	54 811		27 576	25 314	

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

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.644	64.304	60.756	65 488	65 749
February	14 491	14.394	65.259	63.494	70 188	*
March	14.331	14.787	64.276	66.152	69 126	*
April	14.211	16.811	64.747	75.069	69 313	*
May	13.99	18.506	63.182	77 600	67 786	*
June	13.603	19.477	61.336	82 574	66 274	95 333
July	13.223	18.796	60.540	76.011	64 955	91 509
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	14.749	53.227				
December	12 801	56.841				
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 779	34.260	171.905	156 550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173 619	180.141
April	36.154	47 884	163.963	181.225
May	33 360	38 790	150.702	162.675
June	30 577	40.288	138.321	167.636
July	31 707	37.423	142 517	167.080
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		149.391	
December	33.601		147.102	
Av. year	34 301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4 011	3.548	19 665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3 970	4 053	3.850	3.997	19.651	21.883
April	3.810	4.221	3 688	4.142	18 925	21.094
May	3 900	4.774	3.808	4.182	18.503	20.347
June	3.900	5 932	3.810	5.836	19.411	25.170
July	3 891	5 659	3 738	5.531	19 051	24 611
August	3.857		3 715		‡	
September	3 828		3 658		‡	
October	3.528		3 384		‡	
November	3.683		3.585		18.500	
December	3 800		3 662		19.097	
Year	3 862		3 737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5 113	10.012	4.96	9.837	21 568	49.888
May	5 074	14.781	4 924	14.602	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	19.026	4 770	18 856	21 568	97.250
August	5 568		5 418		‡	
September	5 380		5 230		‡	
October	4 909		4 750		‡	
November	5 112		4.962		25.316	
December	5.592		5.430		27.369	
Year	5.213		5 063			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.50	$13 23	$13.43	$13 99	$13.90
February	15 06	14.55	14 12	13 43	14 08	13 90
March	15 07	14.55	13.94	13.45	14 10	13.95
April	14.90	14.55	13.90	13.45	14 13	13.95
May	14.90	14.61	13 90	13.60	14 27	13 83
June	14.70	14.70	13.90	13.67	13 90	13 77
July	14 90	14.94	13 90	13.91	13 90	13 90
August	14.90		13 90		14 08	
September	14 90		13 90		14 03	
October	14.84		13.75		13 97	
November	14.59		13 43		13 84	
December	14.70		13 45		13 90	
Year	$14 88		$13 78		$14 04	

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown, inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

1504—ARIZONA—Progress at the Old Dominion Mine, Mill and Smelter. C. A. Tupper. (Min. and Eng. Wld., June 19, 1915; 5¾ pp., illus.). 20c.

1505—ASSAYING—A Method of Assaying Copper. Arthur Fraser. (Journ. Soc. Chem. Ind., May 15, 1915; 1½ pp.)

1506—CENTRAL STATES—Silver, Copper, Lead and Zinc in the Central States in 1914. B. S. Butler and J. P. Dunlop. (Mineral Resources of the U. S., 1914, Part II; 98 pp.)

1507—CONCENTRATION—Bolivian Copper Concentration by Cia. Corocoro de Bolivia. F. A. Sundt. (Eng. and Min. Journ., July 17, 1915; ¾ p.) 20c.

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The Engineering and Mining Journal

VOLUME 100 AUGUST 14, 1915 NUMBER 7

Amador Consolidated Milling Plant, Amador City, Calif.

By T. S. O'Brien*

SYNOPSIS—A plant operating on Mother Lode ores and following a practice unusual in that district. No amalgamation is done in mortars, and it is planned to eliminate the practice of stamp crushing. An unusual zinc-precipitation system is used similar to that of the Ajax, Victor, Colo.

Milling was resumed at the Amador Consolidated plant on May 1, 1915, after a shutdown of 60 days, during which time the plant was entirely overhauled, and to the original twenty 1000-lb. stamps were added two 8-ft. by 36-in. Hardinge mills, 10 new double- and 1 single-deck Deister Concentrator Co. tables and a 32-ft. diameter by 16-ft. deep thickening tank. The new mill will have a capacity of 300 tons daily, compared with 90 tons daily in the old mill.

The design of this mill is a departure from the usual Mother Lode practice, inasmuch as no amalgamating is done in the mortar, and the ore—consisting mostly of hard quartz with a little slate, carrying about 1½% pyrite as it comes from the bins—is fed into revolving screens having ⅜-in. openings. Only the oversize of these screens goes to the stamps, while the undersize, amounting to about 25%, is passed around and joins the discharge from the stamps going to the drag classifiers, the sands discharge of which is fed to the Hardinge mills. The excess water and slimes overflow goes to the thickening tank. The ton-cap screens on the battery vary from ⅜- to ¾-in. opening, depending on the hardness of the ore going through, the object being to regulate the feed, percentage of water and pebble load in the Hardinge mills so the discharge from them will show a maximum of minus 30-mesh sands and a minimum of slimes. Even now it is indicated that there will be less slimes than with the stamps crushing to 20 mesh.

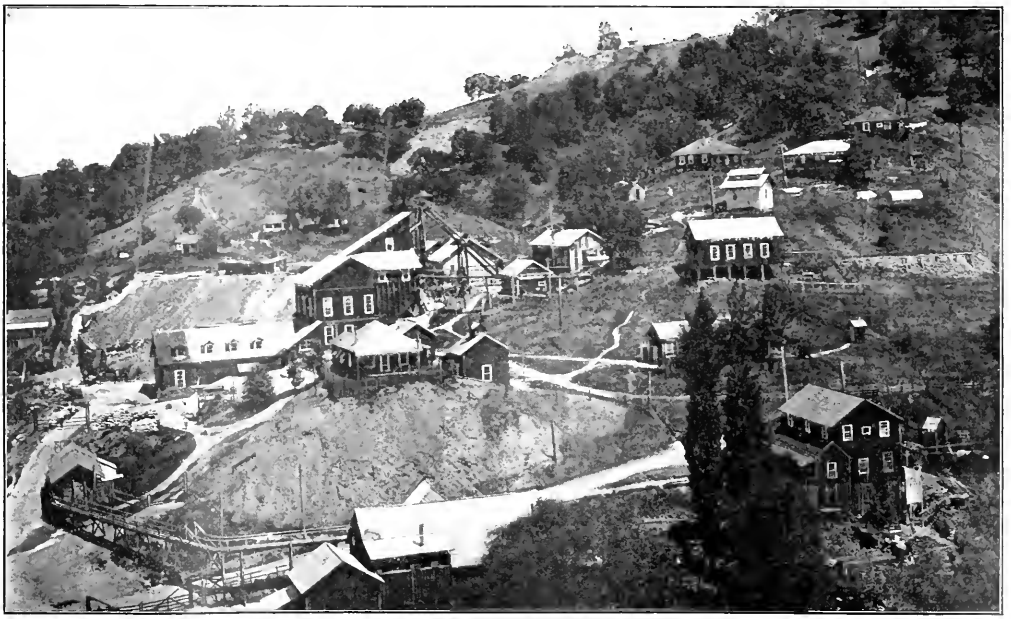


FIG. 1. GENERAL VIEW OF THE AMADOR CONSOLIDATED PLANT

*Superintendent, Amador Consolidated Mines Co., Amador City, Calif.

The discharge from the Hardinge mills goes into the Hardinge amalgamators, which are attached to and revolve with the mill. Mercury is fed into this amalgamator as required by the condition of the outside plates, in the same manner as feeding it into the stamp mortar. About a dozen small copper balls, made from ¼- or ⅜-in. wire, are kept in the amalgamator. As these balls roll around they build up, forming good-sized amalgam balls which are removed daily while the mill is in operation; after removing the accumulated amalgam, the balls are returned to repeat the operation.

The discharge from the amalgamator passes over the usual copper plates and goes to a hydraulic classifying launder having a trap and three spigots, one each for coarse, medium and fine sands, which go to separate tables. The slimes-overflow from the hydraulic classifiers joins the slimes-overflow from the drag classifier, going to a sump from which it is pumped to the thickening tank. From this tank the thickened slime is fed to the slimes tables and the clear overflow from the thickening tank is returned and again used for general mill purposes.

Treatment of Concentrates

The concentrates—having a specific gravity of about 4.4—from all the tables are piped to a central sump from which they are elevated to the second set of amalgamating plates where any gold or amalgam that escapes the first set of plates, or was carried over in the slimes-overflow, is recovered. From the second set of amalgamating plates the concentrates are piped and run by gravity to the dewatering bins from which they are trammed to the cyanide plant, which has a capacity of about 300 tons per month, where they are ground to pass a —200-mesh screen in a 4½-ft. by 12-in. Hardinge mill operated in closed circuit with a drag classifier. To this mill is also attached a Hardinge amalgamator which discharges on to a small copper plate. About 5% of the gold released during grinding is recovered previous to cyanide treatment.

The overflow from the classifier is pumped to one 18-ft. diameter by 12-ft. deep treatment tank equipped with the Trent cyaniding apparatus. This tank, with a dilution of 70%, has a capacity of 30 tons of concentrates. When starting to grind a charge, the treatment tank is filled with barren solution and the circulating pump started while the valves are set to operate as a thickener and replacer. Then the pulp from the classifier, having about 80% dilution and having had about 50% of the values dissolved during grinding, is pumped into a 12x12-in. box hung in the center and submerged 3 ft. While the charge is being ground and thickened in the bottom of the treatment tank, the clear overflow, with a large percentage of the dissolved values, goes to the sump tank, which has a filter bottom. After the charge is ground and previous to agitation, about 50% of the solution in the treatment tank is replaced with barren solution and the valves on the treatment tank changed to operate as an agitator. This process is continued for 6 or 8 hr. after which all the recoverable values are in solution. The valves are again changed on the treatment tank so as to operate it as a thickener and replacer and about 10% in excess of the solution in the treatment tank is replaced with barren solution. Then 20 tons of wash water carrying about 2 lb. alkalinity per ton, is added and the charge allowed to settle into the wash water. The solution above the pulp is then decanted off into the sump tank, and the pulp sluiced to waste.

Cyanide-Treatment Machinery

The treatment tank is equipped with test cocks placed vertically about 1 ft. apart, from which samples can be taken for assay or titration during treatment or while

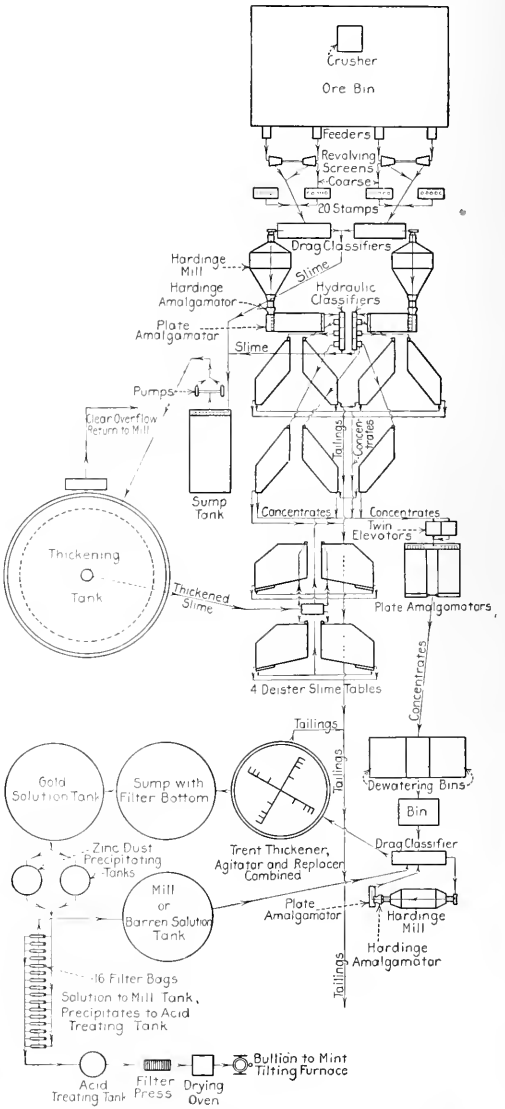


FIG. 2. FLOW SHEET, AMADOR CONSOLIDATED MILL

replacing. To illustrate the agitating ability of this machinery, it is on record that one charge, on account of some trouble with precipitation, was allowed to settle and held in the tank 80 hr. and in 15 min. after the

circulating pump was started the arms were making a complete revolution. Two hours after starting the samples taken from all the test cocks showed about the same specific gravity, showing that the entire charge was in suspension.

Precipitation was begun with zinc shavings, but owing to erratic precipitation and to the amount of labor required for dressing the boxes, the use of shavings was discarded and zinc dust installed. The method now used is the same as at the Ajax property, of Victor, Colo. The method makes use of two 5-ton tanks equipped with mechanical agitators, into which the solution from the gold tank is run. When the tank is about two-thirds full, the required amount of lead acetate and zinc dust is added, and by the time the tank is full, it has had sufficient agitation and is then pumped to the filters. While one tank is being pumped out, the other is being filled and agitated. Both the solution inlet pipe and pipe to the pump are equipped with three-way valves, making the flow to the filters almost continuous. This system is more satisfactory and economical from every standpoint than zinc shavings.

Filtering the precipitates is done with canvas bags each inclosing an inner bag of fine muslin. These are hung on a manifold, each bag having separate connection and valve to the main header, and the solution from the bags drains into a launder leading to the mill-solution tank.

The idea of these filter bags was furnished by H. R. Conklin of the Lluva de Oro Co., Chihuahua, Mexico.[1] They are practically the same as he used except that his bags tapered, and as the precipitates collected in the bottom or large end, it was necessary to destroy the bags to remove the precipitates. To overcome this, a cast head 4 in. in diameter was made to screw on to the 1-in. nipples of the manifold and the bags made straight, being thus 4½ in. in diameter by 36 in. long. These bags are fastened to the cast head with heavy twine and they can be readily removed from the manifold and used over a great many times. The inner bag, which contains the precipitates, can be easily removed from the outer bag and washed out into the clean-up tank, where the precipitates are acid-treated previous to smelting.

Neither the mill nor the cyanide plant has been in operation long enough to get any detailed data on costs, but the estimate on the mill, treating 9000 tons a month, is put at a total cost of 30c. per ton and—judging from the work done in the old mill, which made a 90% extraction—it is expected that a further saving will be made. During the next year the stamps will be discarded and ball mills or some other crushing machinery installed to give a ⅜-in. product to the Hardinge pebble mills. With about a million and a half tons of available ore blocked out in the mine above the 700-ft. level, the policy of the company will be to increase the mill capacity up to 1000 tons or more daily as soon as possible. On the 200 tons of concentrates treated at the cyanide plant, an extraction of 90.1% was made and by further modifications it is expected to increase this to 95%, a figure which was reached in the small experimental plant. On a basis of 300 tons per month the total treatment cost will be about $5 per ton.

[1]First described in "Eng. and Min. Journ.," May 17, 1913.

Bagley Scraper for Gravel Mining in Alaska

By Lewis H. Eddy*

The Bagley scraper was successfully used by Riley & Marsten on Otter Creek, Iditarod district, Alaska, in handling the gravel of two 20-acre claims during the season of 1914. About 10 acres remain to be scraped this season. That portion of the Riley & Marsten claims occupying the stream is worked with a 3½-cu.ft., Union Construction Co.'s bucket-elevator, flume-type dredge driven by a distillate engine.

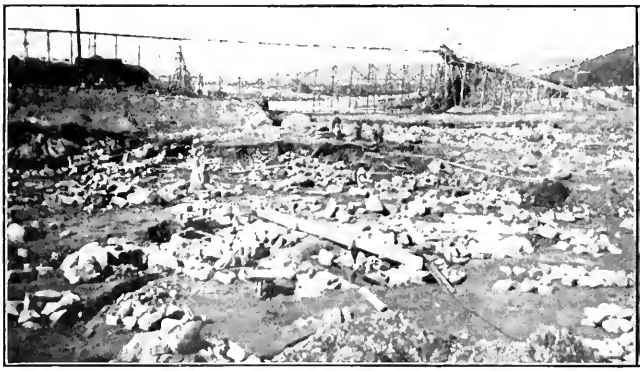


FIG. 1. CLEANED BEDROCK WITH THE SET-UP IN THE BACKGROUND

FIG. 2. SCRAPING UP A LOAD

The dredge operates in the stream while the scraper is used only on unwatered ground. The stream and bed naturally cover a considerable area, so that preparatory to scraping operations, the water is forced back and off the ground by a system of ditches. In other words, the ground is unwatered.

With from 2 to 6 ft. overburden and 4 to 5 ft. of waste gravel there is a total depth from surface to bedrock of from 8 to 12 ft. Thus a large amount of material must be removed before the gold is reached. The method employed is to ground-sluice the overburden, scrape the waste to one side, cut to bedrock with the

*Associate editor, "Engineering and Mining Journal, San Francisco, Calif.

scraper and load the material into cars which are hauled up an inclined track and their contents dumped into a dump-box at the head of the sluices.

The cost of handling the gravel by this method is approximately 20c. per sq.ft. of soft ground and 40c. per sq.ft. of hard ground. The yield Mr. Riley places at 75c. to $1 per sq.ft.

The scraper used at Otter Creek handles about 3 cu.yd. per load. It is manufactured by the Bagley Grader Co., of Tacoma, Wash., in various sizes from 1 to 5 cu.yd. capacity. It is so constructed with back curvature that no bottom is provided. It works with either side down. The knives which cut or peel up the dirt are fitted at the edges of the back. The edge of the scraper may be provided

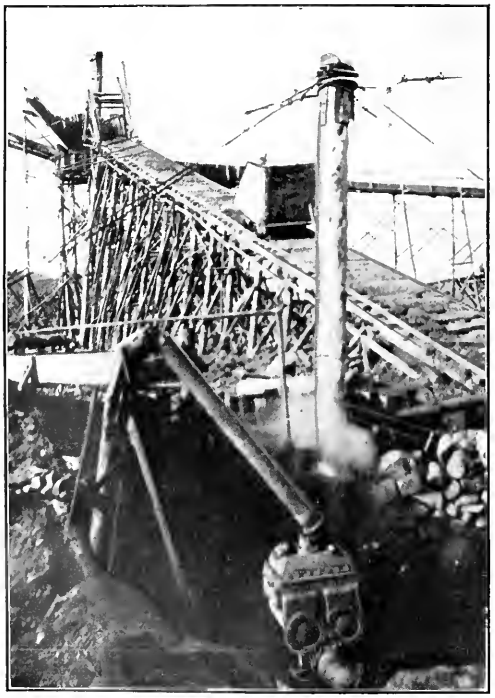


FIG. 3. INCLINED TRACK, LOADED CAR, LEAD MAST AND SEEPAGE PUMP

with teeth about 3 in. in section and set about 1 ft. apart. The scraper is automatically filled, lifting the back slightly so that the loaded scraper slides off on top of the ground. Unloading is accomplished by hauling the scraper back, leaving the load where it stopped, or by dumping it into a car. When the scraper goes ahead, the weight is on the scraping edge and when it goes back, the weight drags on the side.

The method of operation is practically the same in all classes of scraping. The practice on Otter Creek is to lay out the ground in an area about 500 ft. long and 400 ft. wide, so as to work about 200,000 sq.ft. of bedrock in one cut. After scraping to bedrock, the cleaning of the floor and services is done by hand.

The accompanying photographs give a fair idea of the situation and operation of the plant. Fig. 3 shows the inclined track, and a loaded car traveling up to the dump-box. The mast illustrated is the main lead mast. The seepage pump, which keeps the cut dry, appears in the middle foreground of the picture. In the background is the flume, carrying gravity water to the dump-box. A general view of the plant in the back-ground is given in Fig. 1 with the cleaned bedrock in the foreground. The rocks and gravel scattered about have been left in order to save the unnecessary expense of moving them, except from one part of the ground to the other when necessary to clean any particular part of the bedrock. This illustration shows the condition of the bedrock after having been finished by hand.

The set-up is placed at the outer edge of the cut or area to be scraped, opposite the river. The inclined track extends upward toward the cut and the dump- and sluice-boxes are placed at the head of the track. Two masts are situated on either side of the track about 60 ft. apart. One stands just within the cut and the other just outside. A cable extends from one mast to the other. The lead-line of the scraper is attached to this cable by a block which runs from mast to mast, so the lead may be changed to operate the scraper from any point of the area being scraped. Each mast is guyed with three lines.

The engine is set so that the engineer can see the work, usually on the opposite side from the set-up. Steam power and wood fuel are used.

The car is built high at the back, the sides running to a point at the forward end of the bottom. It is 10 ft. long, 5 ft. wide and 5 ft. high at the rear end, and is so pivoted as to avoid spilling the soft mud or water. The dump-box is 40 ft. long, 5 ft. wide and 3 ft. deep. This box narrows in the last 10 ft. to a width of 18 in. where it is connected to an 18-in. flume that is 125 ft. long and 3 ft. deep. The dump-box is lined on both sides with 2-in. plank. The bottom of it is provided with poles about 5 in. in diameter and a little short of 10 ft. long. These poles are made into three sets held together at the ends by 2x4-in. cross-pieces nailed or bolted. These three sets occupy the first 30 ft. of the box, having spaces between the ends of the sets. The last 10-ft. section of the box narrows gradually to the lower end and is fitted with poles like the other sections, the smaller ends of the poles being placed at the lower end of the section.

The flume is provided with riffles set lengthwise and spaces between the riffle sections. The flume riffles are built in 6-ft. sections, each section composed of five 2x3-in. pieces and provided on two sides with ¼x1½-in. steel or iron strips. The 4-in. spaces between sections provide for the necessary breaking up of clay and gravel. The poles in the dump-box will wear about 60 days. In some cases it has been found more economical to use 20-lb. steel rails instead of poles, but where timber is abundant and the distance is great from steamer landings or railroad stations, the use of poles is more economical. The clean-up usually requires about 3 hr. to a string.

The ground and creek begin freezing about the first of October and the spring thaw permits preliminary work by the first of May. Active scraping can be started in the middle of June. At these claims on Otter Creek the ground to be scraped is not so badly frozen as to require thawing with steam points. When the scraper gets down to frozen ground the work is shifted to another part of the cut and the frozen ground is thawed by the sun in the meantime.

Geological Anatomy of a Tennessee Zinc Mine

By Frank L. Nason*

SYNOPSIS—Origin of ore deposits considered to be in up-flowing magmatic waters rather than down-flowing meteoric waters. In this mine are two vertical fissures 90 ft. apart between which are four distinct rock horizons mineralized to various degrees. Sphalerite, galena and pyrite occur in veins, in irregular sheets on the bedding planes or as metasomatic replacements in dolomite. Probability is that ore will extend to depth.

In a former paper on the "The Zinc Deposits of Eastern Tennessee" (*Engineering and Mining Journal*, Vol. 99, No. 17, p. 734) I attempted to answer the questions: "What is the system of it;" and, "What determined them?"

In the above-cited paper the "system" of the zinc deposits was shown to be a series of strike faults in the Mascot and White Pine belts, resulting in zones of brecciation; in the Powell and Clinch River belts, a series of

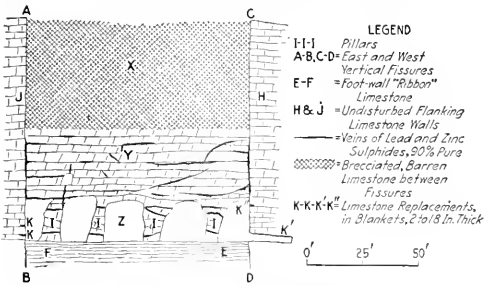


FIG. 1. VERTICAL NORTH AND SOUTH SECTION THROUGH NEW PROSPECT MINE, LEAD MINE BEND, TENN.

profound east and west faults, fractures or fissures, any one or all. The "system," then, is purely one of fissure veins. As to the origin of these ores, the theory of down-flowing or meteoric waters has its ardent advocates; others, myself included, regard these ores as having their origin in profound fissures with upward-flowing waters. The loci of deposition were determined by the flowing of these waters through prepared ground and along lines of least resistance. It is probable that no final and conclusive evidence can be advanced at this time, but the anatomy of the well-known New Prospect mine at Lead Mine Bend, Union County, Tenn., may contribute evidence on a subject that may have economic importance.

Local Topography

The New Prospect mine is located about one mile east of the Powell River. The Powell flows along or near what is evidently the crest of an eroded anticline which strikes ENE. The west leg of the anticline dips NW at an angle, in the main, of 45 deg.; the east, at a much lower angle.

*Geologist and mining engineer, West Haven, Conn.

At Lead Mine Bend there is another anticline which strikes nearly due east, to Straight Creek a distance of about 14 miles. The evidence of this anticline is the outcrop of the underlying Conasauga shales and the "ribbon" limestones lying at the base of the Knox. The resultant of these two folds is a series of dome-shaped hills which rise from 200 to 700 ft. above the waters of the Powell River.

The angle of the strike faults and folds varies between N45 to 65 deg. E. The angle of the cross-folds varies between N90 deg. E to 150 deg. S. The resulting blocks are thus parallelograms, with the acute angle varying from 50 to 60 deg. As is usual in limestone countries,

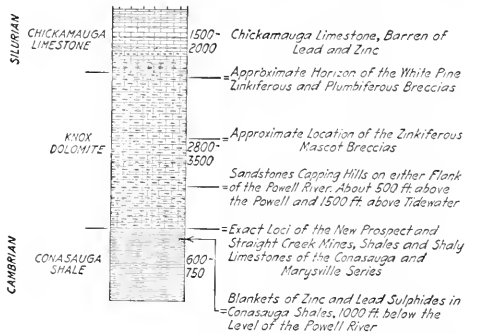


FIG. 2. THE ZINKIFEROUS HORIZONS OF UNION AND CLAIBORNE COUNTIES, TENN.*

the drainage here is almost exclusively underground, with the exception, of course, of base-level streams. The result of these block-fault domes is by this means brought into strong and oftentimes exaggerated relief. There is in other localities equally positive evidence of such cross-folds or faults. It is on one of these domes that the New Prospect mine is located.

Structural Features of the Mine

The structural features of the mine are obvious and are as follows (see Figs. 1 and 2): First, two vertical, parallel mineralized fissures, *A-B, C-D,* about 90 ft. apart; second, between these fissures are four distinct rock horizons—*X*, a horizon about 50 ft. thick, broken between the fissures into small lozenge-shaped fragments barren of mineral except in traces; *Y*, a horizon about 30 ft. thick, strata only slightly fractured and not displaced, mineralized to about 10%; *Z*, the main mine horizon about 20 ft. thick, strata broken and more or less warped with numerous heavily scored slips with east and west striæ, mineralization about 20%; *E-F*, a horizon of ribbon limestone, impure, floor of mine polished but no discernible striæ, strata warped, but not certainly broken, wholly barren of mineral except in the faults as later noted in this article.

*Geological column from Maynardsville Folio, U. S. G. S. Marginal notes by F. L. Nason.

From points *K-K*, for 100 ft. or more due east, is a face of solid limestone which is highly polished with deeply molded scores, rather than striæ pointing east. This is on the north wall of the mine; no similar phenomena are observable on the south wall.

Along the fissures *A-B* and *C-D* there are no apparent vertical displacements of the rock strata save to a very slight extent. These slight displacements are easily explained by one or both of two causes—first, inequality in thickness of the strata, or, second, owing to the fact that the motion was horizontal and the rock strata having a pitch of about 10 deg. to the east.

The whole formation pitches to the east at an angle of about 10 deg. The term pitch is here used advisedly, since it is the relation of the axis of the anticline to the horizon. That there is a northeast fault, somewhere east of the hill on which the mine is located, is evidenced by the fact that the "ribbon" limestones (*E-F*) outcrop at the east base of the hill, instead of the overlying formations *Z*, *Y* and *X*. That there is another fault to the west is again evidenced by the outcrop of the ribbon limestones, which here abut against the edges of the Knox. The hill, then, on which the mine is located is bounded on the south about three-fourths of a mile distant by the eroded crest of an anticline, and on the east and west by two faults which have brought to the surface the ribbon limestones. The vertical throw of the west fault can have been no less than 150 ft. and may have been more. The fourth side, on the north, does not seem to have been disturbed.

Underground, east of the portal, the pillars show the same slips and warped planes, but here, even, save for the two main fissures, no fractures seem to go from zone *Z* into the underlying floor of ribbon limestone, *E-F*. The east breast, about 300 ft. from the portal of the mine, is so covered with broken rock that nearly all structural features are hidden.

The tentative conclusion—not to put it too strongly—to be drawn from the foregoing facts is that these transverse fissures, with their east and west scores and striæ, are the resultants of the orographic movement which formed the general northeast strike of the Appalachian mountain system. In all likelihood these forces were operative before, or at least contemporaneously with, the formation of the cross folds.

Character of the Rocks

The unaided eye can detect no difference between the rocks of the three zones *X*, *Y* and *Z*. They are typical Knox dolomites. In the zone *X* the intense shattering has obliterated all traces of bedding planes. Zones *Y* and *Z* are distinctly bedded. The strata are fairly regular and are from 1 to 2 ft. thick.

Zone *E-F* is evidently an impure limestone and is marked with crenulated bands an inch or more thick. The alternating bands are slaty blue and chocolate brown. The banding shows very distinctly on weathered surfaces, less so, in fact very faintly, on fresh surfaces. Between these limestones and the Knox there is no gradation, the transition being very abrupt. The ribbon limestones are parted by bands of nearly pure slate from an inch up to several feet in thickness. The thickness of the blue or ribbon limestones is not less than 100 ft.

The three sulphides in the order of their abundance are sphalerite, galena and pyrites. These minerals occur in veins as in *A-B, C-D* in irregular sheet-like masses in the bedding planes and as metasomatic replacements of beds of dolomite.

Location and Character of Mineralization

Just where mineralization would seem to occur naturally in the greatest abundance it is almost wholly lacking. This is the brecciated zone *X*. Occasionally there are traces of "face" mineral in the mass of the breccia, but this is rare, the mineralization occurring almost exclusively in the bounding fissures. This lack of mineralization in the breccias is probably to be accounted for in this way: The rocks were here subjected to differential shearing—indicated by the east and west fault lines—to the point of developing pressure planes, but not to the point of rupture. The loose condition noted at present is probably due to weathering, which has sought out and developed the original stress planes. Had these planes been fully developed previously there would probably have been signs of capillary flow at least.

The zone *E-F*, as has been pointed out, is not shattered at all. The lack of bedding planes, or, where these were present, the clay-slate partings, prevented the circulation of mineral-bearing solutions. This seems to be at least a plausible explanation, since where the northeast break occurs west of the mine, brecciation is intense in limited areas. In these breccias the zinc and lead are 10 to 15% of the mass.

The character of the mineralization seems to be determined by the channels of circulation. Where the channels are comparatively open, as in the fissures *A-B, C-D*, and along bedding planes, as shown in the pillars *I-I* and in zone *Y*, the structure is very coarsely crystalline, the minerals being at least 90% pure. There seems to be a tendency for the galena to occur in the middle of the vein, the blende on the sides; but this may not be persistent. In these veins pyrite seems to be lacking.

Where mineralization occurs in breccias the blende and galena are both "dirty," in addition to included fragments, coarse and fine, of the parent rock. I suggest that the "dirt" in the ore is due to finely comminuted rock that was neither swept out nor dissolved by the feeble currents that seeped rather than flowed through the interstices.

In blocks of limestone metasomatically replaced, the ores, almost exclusively blende, are also "dirty," but are due to another cause. The blende replaces the limestone to as high as 80%. At first sight the mass seems to be pure blende. Closer inspection with a pocket lens discloses grains of dolomite alternating with grains of blende, as if molecule by molecule the dolomite had been picked out and replaced molecule by molecule with blende. The texture is as fine-grained as pig iron, or even finer. Here is by far the greater amount of pyrites. There are to be seen now in the old mine blocks of this replaced ore the full size of the pillars. These beds thus appeared to have reached almost continuously across the entire width of the ore horizon. It is probably true that the points *K-K*, later referred to, are the evidences of the extent of these replaced beds. Farther back in the mine, to the east, the rock floor of the mine seems to have been raised, and here there are more than traces of replacement of small bands of the ribbon limestone.

The metasomatic replacement is very beautifully illustrated in many places in the mine. Beds of dolomite

partly replaced, appear as if a corroding stream had flowed over them, etching deep potholes, as before, molecule by molecule, and filled the etched space with a mixture of blende and dolomite. In places the blende appears in a cloudlike mass in the center of a stratum, with no apparent port of entry. The replaced limestone may be six inches or more in diameter, and from this down to mere grains of blende.

The tentative conclusion drawn from the mineralization is almost strong enough to be classed as positive and inevitable that it came from an upward-flowing stream, since all the various forms in which it occurs are directly connected with the two vertical fissures. If it is logically allowable to connect these fissures with the profound Appalachian orographic movement, they are, *a priori*, profound as well. Some fissures in this region have been followed 1200 ft. below base level of drainage, 200 ft. below sea level, and more or less mineralization precisely similar to that observed in the mine is found to the lowest point reached.

Length of Mineralization on Strike

About 600 ft. to the west of the section shown in Fig. 1 the slope of the hill cuts the unmineralized floor of the mine. East of the above-mentioned section the underground workings extend a maximum distance of 500 ft. The axial extent of the New Prospect mine is thus 1100 ft. For a distance of 800 ft. the orebody, save for zone Y, seems to have been worked for the full space between the two fissures 90 to 100 ft. To the west of this section (Fig. 1) the ores were all oxidized and the mine was worked as an opencut. Disregarding the slope of the hill, the cubic contents of the orebody, $1100 \times 90 \times 50$ ft., is 4,950,000 cu.ft.

As to the persistence in depth of the two main fissures of the mine, there is no direct evidence. About 1000 ft. to the west, east-and-west striæ were found to a depth of over 400 ft. This was in the pure Conasauga shales. Two miles or more SSW, striæ as before, in what appear to be well-defined fissures, were found 700 ft. below the surface. Two and one-half miles NNE the same phenomena appeared at a depth of 1200 ft. Geologically this equals a depth of 1350 ft. The fissures were in Conasauga shale. The fissures were followed from the surface to the bottom. It hardly seems to be reasonable to insist that the two New Prospect fissures will not extend as deep.

Coördination of Data

While freely confessing that I am convinced of the fact that the source of zinc and lead ores of the eastern Tennessee belt and of the entire limestone formation along the entire western foot of the Appalachian mountains has a profound-fissure origin, I have tried to state, without color, the salient features of the structure and occurrence of the mineralization of the New Prospect mine. It remains to coördinate the data presented herewith with other data with which they seem to be inseparably connected.

In the first place, attention is called to the general structure of the entire field. There are ENE strike folds and faults. In places these strike folds have terminated in great overthrust faults where the underlying eastern beds have been thrust over the upper western members of the formation. There is conclusive evidence that the Powell River flows on or near the crest of an eroded anticline. There is also evidence that there are other great folds where the underlying shales have been brought to the surface.

There is also indisputable evidence of cross-folds equally profound. From Lead Mine Bend on the Powell there is certainly an anticline reaching nearly due east to Straight Creek, a distance of 14 miles. Based on drill-holes, there is evidence of other easterly folds that have not brought the underlying shales to the surface; but the folds are certainly 500 ft. high. These folds are parallel to the Lead Mine Bend fold. The resultant of these two systems of anticlines is a series of folds similar to a system of groined arches.

It seems hardly possible that these forces, acting through a visible thickness of 1500 ft. and 1200 ft. below base level of drainage, could end in other than faulting equally profound. With such structural effects—not at all local but general—it would seem to be allowable to go still farther and to affirm that the movement must have extended at least through the entire thickness of the Paleozoic series to a depth of over 6000 ft. As a matter of fact, the movement in this series seems to be more reasonably classed as orographic rather than local, and to be inseparably connected with the movements which resulted in the great Appalachian mountain system. In this case the fissure depths would be far greater than the 6000 ft. of the Paleozoics. It is hardly necessary to call attention to the fact that the Appalachian resultant was a slow growth and development and was not at all cataclysmic.

With this tentative conclusion goes another of even greater economic importance. Whether the facts cited in my former paper of zinc and lead occurring in veins in the pre-Cambrian be allowed weight or not, the fact of lead and zinc occurring in fissures 1200 ft. below base level of drainage in the valley of the Powell must preclude the origin of these ores from downward-flowing waters. Even allowing for all possible changes in topography, the flow of circulating meteoric waters must have been from, not toward, this point.

Again, forging a more or less attenuated chain of reasoning, it seems that the two main lines of fissures in the New Prospect mine cannot prove to be an exception to the fact that adjoining fissures are deep and are mineralized as far as they have been tested. Of course it will be borne in mind that the fissures and their mineral contents occur on axes of, what at least seem to be, profound orographic movements.

Tentative Conclusions

If the facts cited in this paper are undisputed, the profound-fissure origin of the ores of eastern Tennessee is an established fact. The economic value of such a demonstration is great, but is not immediately available. The east and west length of the Powell and Clinch River fissures are known to be over 14 miles long, and are probably much longer. These lines are not continuously mineralized. There may be and probably are many more mineralized points than are now observable, since the greater part of the surface of the country is covered by a heavy mantle of residual clay. Were one to be convinced as to the truth of my deductions to the point of prospecting for an ore deposit, just where would he do his prospecting?

The superficial dimensions of the one completely known mine are as stated—1100 × 90 ft., a total area of 99,000 sq.ft. As to depth below the surface, this may be as great as or greater than 1200 ft.

The Straight Creek and New Prospect mines are the only ones now known in this section and in this position relative to the Knox at its base. Whether the numerous fissures which appear on the surface in this part of Tennessee will, with depth, make orebodies equal to these, is as yet unknown. In such a case a great future as a zinc field is certain. In considering this question practically, this must be remembered: There has been very little skilled geological study of this field. Little money has been available for careful and consecutive study. What this field would be today had it, for example, had the same careful study as has been possible in the States of New Jersey and New York, it is impossible to say. What is, is only evident after careful investigation, but is the "what" economic or the reverse?

Spanish Potash Deposits

A report from Consul-General C. B. Hurst at Barcelona, Spain, says that the stoppage of shipments of potash salts from Germany by the war has called attention to the potash deposits that were known to exist near Barcelona. Borings and analyses had been repeatedly made with reference to the region where the salts abounded in the Spanish provinces of Barcelona and Lerida. The results have been particularly favorable, but it will require the employment of capital and enterprise to make potash in this neighborhood a commercially profitable product.

In the various borings near the town of Sarria potash salts were found at depths between 121 and 197 ft. and another deposit at 426 ft. At 886 ft., the greatest depth attained, important quantities of potassium compounds were found to rest on a stratum of white salt not yet pierced. In the area tested by borings comprising some 2,690,000 sq.ft., there were estimated to be approximately 2,550,000 tons of carnallite and 1,150,000 tons of sylvinite, which should produce a total of 3,675,000 tons of potassium salts.

From the general characteristics of the region it is considered probable that there are further deposits in greater or less proximity to those already tested. In a stream running by the salt works of Cardona there is a large percentage of potash in solution, and it has been discovered that quantities of potash have already been allowed to go to waste in the salt mines that might have been profitably used.

On account of the exceptionally irregular geological formation of the country near Barcelona it is difficult to make exact valuations of the amount of potash salt that can be mined. Nevertheless, the presence of certain gypsum beds and the potash-holding streams will serve as a guide to determine the continuation of the potash deposits.

Particular interest has been displayed in these potash deposits by people in the United States. Persons have sought to buy concessions or land in which the deposits are situated, or have been willing to make contracts for regular shipments to the United States. One large tract is already owned outside of Spain, but in view of the great national importance of the deposits the Spanish Government is taking measures for their supervision, if not for their exploitation.

Because of the small available supply for use at the present time in Spain the export of potash from this country is forbidden provisionally.

In small quantity potash is obtained here by the evaporation of the water used in scouring wool and also in larger bulk from the residue left from the manufacture of beet-root sugar. Shipments of this latter variety, limited and known here commercially as black salts, have been made to the United States and to Great Britain.

Further advices from sources outside the report given are that boring and exploration have failed thus far to show potash salts in layers thick enough or of an extent sufficiently large to promise developments of great commercial importance. The real extent and value of the deposits are still to be ascertained.

Tin Exports from China

Consul-General G. E. Anderson at Hongkong writes that the course of the exports of tin from southern China in the immediate future is somewhat uncertain. The effects of the war in general are unfavorable, and the further fact that the tin coming out of Indo-China must pass through French territory, where it is regarded as contraband and subject to restrictions of various sorts when it is allowed to pass at all, have rendered trade even more difficult.

At the opening of the year there was on hand in Hongkong a stock of about 1000 tons of tin. Since then the stock has increased to about 1700 tons, in spite of the fact that the amount of tin coming out of Yunnan since the opening of the war is in materially smaller volume than usual. Explanation seems to lie in the disposition of the trade earlier in the year to move stocks when fair prices could be had. The exports of tin from the Mengtze district in 1914 were 5613 long tons, against 6414 in 1913. For the period Jan. 1 to May 15, however, the exports increased from 1566 tons in 1914 to 2034 tons this year.

At the close of the first quarter of the current year the Hongkong Government assumed control of the trade as that in contraband by prohibiting the export of tin to all destinations other than the United Kingdom and British possessions and protectorates. After several weeks' agitation permits were issued for the export of tin to the United States by making all consignments to the British consular officers in the American ports concerned so that the actual consignees might be known. The exports to the United States have been going forward in fair volume. The present quotation of the highest grade tin is $97 local currency per picul of 133⅓ lb., or at present exchange about 32.75c. gold per lb.

Ferromanganese Made in the Electric Furnace is being shipped from California, according to the "Iron Age." The Noble Electric Steel Co. has recently shipped two carloads, or about 60 tons, of ferromanganese produced at its plant at Heroult, Shasta County, Calif. The purchaser is understood to be an eastern Pennsylvania steel works and the price $100 per ton, f.o.b. The San Francisco company, it is stated, is now in a position to provide all the ferromanganese needed on the Pacific coast, as a second furnace is to go on ferromanganese. Two other furnaces are to make ferrochrome, for which the price is $200 a ton. The fifth furnace will be held in reserve. Ore for the manufacture of ferromanganese is being brought from Mendocino County, Calif.

Metal Losses in Copper Slags—II

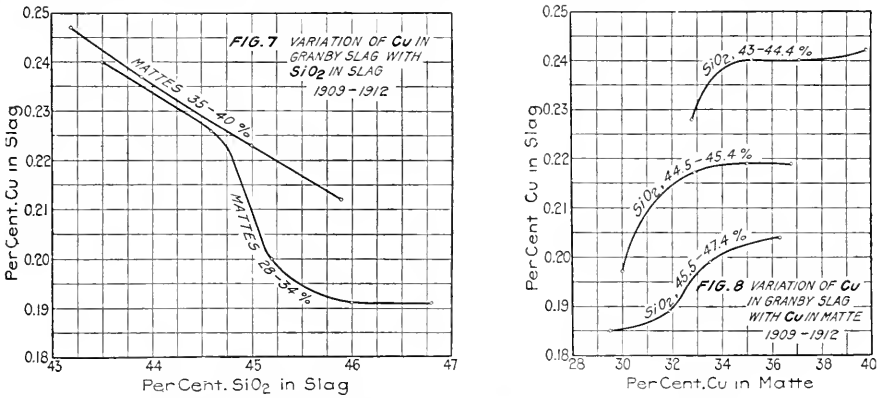
By Frank E. Lathe*

SYNOPSIS—The results of laboratory investigations are presented, together with numerous determinations on regular furnace products of the Granby works at Grand Forks, B. C., where extended settling experiments and deepening of the furnaces resulted in lower slag losses. The presence of sulphide copper in slags does not preclude the presence of oxidized copper, especially the silicate.

In my review of the laboratory investigations of the metal losses in copper slags will be included not only the results of my own experiments and the numerous determinations made on regular furnace products to obtain desired information, but also the graphic representation of results of commercial blast-furnace smelting as carried out at the Grand Forks, B. C., plant of the Granby Consolidated Mining, Smelting & Power Co., Ltd. As the Granby's practice covered by this paper extends over a period of seven or eight years, and certain metallurgical changes were made during that time a review of these will first be given. A more detailed report of operations up to December, 1909, will be found in my article in the *Journal* of the Canadian Mining Institute, 1910, Vol. 13, p. 273.

The original Granby blast furnaces were made (1900) 44x160 in. at the tuyeres, and 8 ft. 11½ in. from feed floor to center of tuyeres. They are enlarged to 44x213 in., and then after a considerable period of operation both lengthened and deepened, the new measurements of six of the eight furnaces being 44x266½ in. at the tuyeres, and 12 ft. 10 in. from feed floor to center of tuyeres. This resulted in a more uniform running of the furnaces, greater tonnage, less coke, hotter matte and slag, and owing to the weaker oxidizing action, a lower grade of matte and more siliceous slag. The effect upon the copper content of the slag will be considered later, although a cleaner slag, as a result of the new conditions is a foregone conclusion. Since that time no changes have been made in the furnace construction, but settlers of different sizes and shapes have been experimented with. The company is now adopting as its standard, a small tapered settler, and it seems desirable to have three or more of these in series, the slag cascading from one to the next. The advantage of the tapered form is that when the settler partly fills with metallics, which are usually formed under similar conditions of siliceous slag and high coke, the shell may be readily lifted off the base and the sow disposed of without difficulty. With these explanations the following pages will be more easily understood.

During a year (1907) of operation with low-ore column the average analysis of Granby furnace products was as follows: Matte, Cu, 40.94%; slag, Cu, 0.322%; SiO_2, 44.28; FeO, 21.60; CaO, 22.77; Al_2O_3, 7.23; MgO, 3.50. During this time slag samples from individual furnaces would occasionally carry abnormally high copper —up to 0.45% or higher—and in some instances these slags showed a distinct reddish appearance. They were believed to be the result of over-oxidation, an opinion founded on the unusual conditions prevailing at such times.



FIGS. 7 AND 8. VARIATION OF COPPER IN GRANBY SLAG, 1909-1912

During the five or six years since the furnaces were deepened no such appearance has been observed, and the number of foul slags, as well as the average copper content of normal slags, has been materially reduced. For a period of three years immediately following the deepening of the furnaces matte and slag averaged: Matte, Cu, 34.45; slag, Cu, 0.216; SiO_2, 45.07; FeO, 19.39; CaO, 22.64; Al_2O_3, 8.98; MgO, 3.60. All the weekly average determinations of copper made during this time, covering the production of three million tons of slag, have been classified according to the acidity of the slag and the grade of the accompanying matte. From the figures thus obtained the curves in Figs. 7 and 8 have been plotted. Fig. 7 shows the decrease of copper as the silica in the slag increased for mattes of 28-34% and 35-40% Cu, and in Fig. 8 the increase of copper in slags with the grade of matte for slags of 43.0-44.4% SiO_2, 44.5-45.4%,

*Chief chemist, Granby Consolidated Mining, Smelting & Power Co., Ltd., Grand Forks, B. C., Can.

and 45.5-47.4%. Each point as shown represents the result of smelting during a period of from 6 to 30 weeks, such averages being necessary to hide numerous small irregularities in the curves due to a variation in conditions other than those now being considered. Determinations of copper in mattes were made by the cyanide method, in slags by electrolysis, and silica in the slags by one evaporation only—the true silica is about 0.6% higher.

Copper Content of Granby Slags with Varying Silica

In considering the first series of curves, Fig. 7, it will be noticed that the decrease of copper in the slags with the increase of silica was very uniform when the higher mattes were being produced. The curve for the lower mattes almost coincides with this one till the slag reaches 45% in silica, when the decrease of copper is rapid. At 45-46% SiO_2 the difference of 6% in the matte is seen to have changed the copper content of the slag about 0.02%. Judging by the last two points on this curve one would conclude that with these highly acid slags the limit of copper reduction had been reached, as far as the influence of silica was concerned. This is probably not altogether true, as indicated by the more reliable curve in Fig. 9, although the viscosity of these slags increases more rapidly with each per cent. of silica than it does with the more basic slags. The average slag produced during this whole period gives oxygen ratios in acid and base as 2.32 : 1, 1.46 : 1, or 1.97 : 1, according as the alumina is classed with the acids, with the bases or omitted from the calculation altogether. The three ratios are given as metallurgists seem quite unable to agree upon any particular one.

The other series of curves, Fig. 8, is perhaps more interesting and instructive, though representing exactly the same practice. The silicas of the three curves average about 43.8, 45.0 and 46.2%, so that a difference of 1.2% in the silica corresponds to a change of about 0.02% in the copper. From the nearness of the two curves in Fig. 7, it may be seen that the grade of matte did not greatly affect the copper content of the slags with 43.5-44.5% SiO_2. This is demonstrated here by the very flat curve for low silica, but it also shows now that the constant value is particularly for mattes of 34-39% Cu. Within these limits all the curves flatten considerably, as did those[1] plotted by Messrs. Heywood, Wright, and Wanjukoff.

An attempt was also made to plot curves for the iron and lime content of these slags, but they did not show sufficient regularity, the effect of variation in either being obscured by the changes of silica. The averages did indicate, however, that the replacement of FeO by CaO had resulted in cleaner slags, as might be expected.

Recent Granby practice is covered by another curve, Fig. 9, the period of operation being from Oct. 6, 1913, to July 5, 1914, during which time daily electrolytic copper assays were made on the average slag from all furnaces. This curve has been called more reliable than those of Figs. 7 and 8 because conditions seldom change greatly within 24 hr., whereas a weekly average slag of 45% SiO_2 may occasionally be made up of others varying all the way from 41 to 47%. So also other conditions may have varied. Averages were also calculated for different grades of matte, the two classes 27-31% and 32-35% being made, but the copper content of the latter averaged only 0.003% higher than the former, with some irregularity, which made it useless to plot the values obtained. Hence all mattes of 27-35% are grouped together. The curve is seen in this instance to assume nearly the form of a straight line, and the decrease of copper with increase of silica is not nearly so pronounced as before. Comparing this curve with the one in Fig. 7 for mattes of 28-34% and silica of 44.5-45.0% one finds lower copper in the later slags by 0.015-0.003%. The greatest change in the method of operating during this time, as already indicated, was to provide additional facilities for settling, and the results thus obtained with a slag which would be termed already "clean" are well worth considering. These slags of not over 45% SiO_2 were the more fluid ones, and responded to the additional opportunities for settling to a greater extent than did the more highly siliceous slags. It should, however, be borne in mind that when those of 46-47% SiO_2 (Fig. 7) were being produced the experiments in settling were already under way and this part of the curve is thus transitional.

To summarize this discussion and show the steady progress that has been made for some years in reducing the copper losses the average copper in the slag for each year from 1907-1914 has been plotted in Fig. 10. The importance of these results is better seen by considering the amount of copper saved per year in this way by the Granby company, taking its annual output as one million tons of slag, a figure closely approximated when the smelting operation is not interrupted. On this basis, a saving of 0.01% Cu in the slag amounts to 200,000 lb. of the metal per year, so the 1914 practice was better than that of 1907 by 2,640,000 lb. With copper at 12c. per lb. these amounts are worth $24,000 and $316,800, respectively.

Copper Oxide in Granby Slags

The percentage of copper oxide in Granby slags, by calculation from the gold content, was studied. The amount of gold in Granby furnace products is not large, hence to be of any real value the figures should show an average over a considerable period of time. Those given below are made up of averages of the daily assays from August, 1909, to December, 1912. The gold in the slag was regularly determined by parting together the beads from 20 assay tons of sample. Silver contents are not shown, as the assay for silver in the slags was not made with regularity.

The method used is that suggested by Mr. Channing, and is based on the assumption that matte particles suspended in slag carry the normal amount of copper, gold and silver, and that if more copper is found there than would be indicated by the gold content it has probably been oxidized. This is best shown by giving the ounces of gold per ton of contained copper, and not per ton of matte or slag.

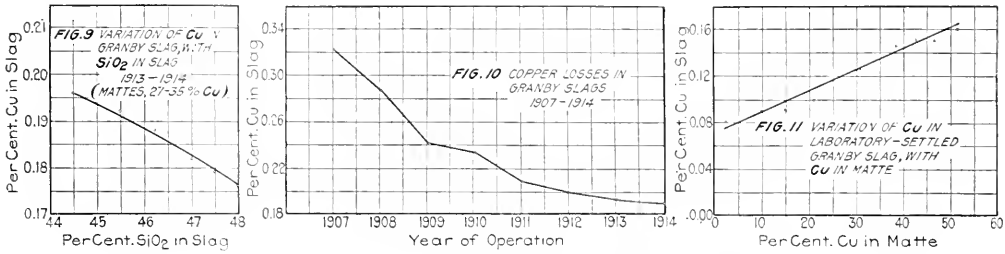
Gold per ton copper in Granby matte	4.412 oz.
Gold per ton copper in Granby slag	1.398 oz.
Per cent copper as sulphide in slag $\frac{1.398 \times 100}{4.412} =$	31.7
Per cent copper as oxide in slag $100 - 31.7 =$	68.3

In determining the percentage of copper oxide in Granby slags under different furnace conditions, a series of experiments was begun without a detailed knowledge

[1] "Engineering and Mining Journal," Aug. 7, 1915.

of Mr. Kiddie's method, and different strengths of sulphuric acid were tried for the decomposition of slags —from 2-25%. In each case the acid was boiled, and the results showed that high, though varying, quantities of copper had been dissolved. Apparently, as noticed later by Mr. Wanjukoff, sulphuric acid was not satisfactory as a solvent for copper oxide. In a private communication, however, Mr. Kiddie advised carrying out the experiments at a temperature not exceeding 80° C., suggesting that boiling had caused the formation of ferric compounds, which had in turn attacked the sulphides of copper. Following his advice the experiments were repeated, the time being varied from 1½-3 hr. and the temperature from 60-80° C., H_2SO_4 (1:20) being used in each case. The percentages of copper dissolved under these varying conditions agreed within 0.005%, a strong indication that the sulphide was not appreciably attacked. While such evidence was was due to sulphide passing through the filter than to a solution of the copper, for hydrogen sulphide was present in the liquid and this will cause a distinct turbidity with 0.00007 gram Cu in 100 c.c. of weak acid, as proved by trial. Even if it were a solution of copper it seems that the amount dissolved from the matte particles in two grams of slag would be negligible. The degree of solution of iron in the matte is seen by the fact that the residue filtered off gave only 3.4% Fe, as against 38.9% in the original matte. On the whole, there appears to be reason for believing that the copper oxide in slags, as determined by weak sulphuric acid, is less than the actual amount rather than greater.

Hydrochloric acid was also tried as a solvent. One gram of 38% matte was treated with dilute HCl (1:20) as in the case of the first sulphuric-acid experiment. As the acid solution could not be electrolyzed directly it was filtered, 7 c.c. H_2SO_4 were added, and the



FIGS. 9 TO 11 COPPER IN GRANBY SLAG AND IMPROVEMENT IN GRANBY PRACTICE, 1907-1914

at the time considered almost conclusive, it was decided later to investigate the question more fully, as the value of the results depended entirely on the accuracy of this determination.

One gram of 38% matte was treated with H_2SO_4 (1:20) for 1 hr. at 70° C. It was then allowed to stand over night at room temperature, when it was further warmed to 70° C. for 2 hr., having been thoroughly stirred every few minutes during the period of heating. There was at first a strong evolution of hydrogen sulphide, and at the end of the treatment the residue was black. Considerable finely divided cuprous sulphide was held in suspension, and when the solution was electrolyzed without filtering some of this seemed to deposit on the cathode. There was no appearance of metallic copper. After a current of 1.25 amp. had been passed for 3 hr. the cathode was removed, washed and placed in dilute nitric acid for a few minutes, when it regained its usual bright appearance. This solution was then electrolyzed and copper was deposited, bright in color, and weighing 0.0020 gram.

As it appeared that this result was due entirely to the adherence of cuprous sulphide and not to any solution of copper, another similar portion was treated with H_2SO_4 (1:20) for 3 hr. at 70° C., the residue was filtered off and the filtrate electrolyzed. The cathode lost its bright color during the electrolysis, but was much cleaner than in the previous experiment and again showed no metallic copper. The nitric-acid treatment and subsequent electrolysis were also carried out and this time 0.0004 gram of copper was deposited, being barely visible on the platinum. It seems more likely that this liquid was evaporated to white fumes. It was then diluted, boiled and electrolyzed, the treatment with nitric and redeposition being also carried out, when 0.0012 grams of copper was deposited. The residue of sulphide from the hydrochloric treatment gave no trace of iron. Mr. Kiddie suggested (private communication) that the total oxidized copper—even as Cu_2O—would be given by dilute HCl and NaCl. To test two grams of a slag giving 0.205% Cu as oxide by H_2SO_4 treatment out of 0.32% total copper were warmed at 70° C. for 2 hr.—decomposition appeared complete in ½ hr.—with HCl (1:20) and 1½% NaCl. The liquid was filtered, washed with more solvent and copper was determined in the filtrate by precipitation as sulphide, oxidation, solution in nitric acid and electrolysis. The result, 0.255% Cu, might appear to show the presence of Cu_2O, but against this are the close agreement of calculated oxide and oxide determined with H_2SO_4 on Granby slags, given in the next paragraph, and the slight solubility (?) of Cu_2S in HCl already mentioned. Hydrochloric acid was not further experimented with.

The treatment given Granby slags for the determination of CuO was as follows: Two grams were weighed into a tall beaker and digested for 2-3 hr. at 60-80° C. with 150 c.c. H_2SO_4 (1:20). The water-cooled slags decomposed readily under such treatment. At the end of the time the solution was electrolyzed without filtering, as there is always a loss in filtering Granby slags decomposed with H_2SO_4, owing to the large quantity of $CaSO_4$ formed. The copper was then dissolved in weak HNO_3 and redeposited before the final weighing. The sulphide was always found by difference, determinations being

made in the ordinary way for total copper on another portion of the sample. Additional details and precautions are given in my article[2] in the *Journal* of June 1, 1912.

Agreement of Copper-Oxide Determinations

The first effort was to learn if the percentage of oxide by this method would agree with that calculated from the gold value, previously mentioned. Unfortunately the samples had not all been kept, but an average was made up which represented normal running of the furnace at that time. Its composition was found to be: SiO_2, 45.3; FeO, 19.2; CaO, 23.5; total Cu, 0.235; oxide Cu, 0.160; oxide ratio, 68.1 : 100. This result is surprisingly close to the calculated value.

It was desired also to determine the oxide in some of the slags abnormally high in copper, which were made before the deepening of the Granby furnaces. These being slags from single shifts on individual furnaces had not been kept separated from others. Of the averages available one was chosen representing the slag from all furnaces for a period of one month, and it gave results as follows: Total Cu, 0.345; oxide Cu, 0.245; oxide ratio, 71 : 100. Here both the oxide and sulphide copper are higher and the ratio increased somewhat. The change in ratio is better seen when expressed as follows:

Sulphide copper	0.100 instead of 0.075, or 33.3% higher
Oxide copper	0.245 instead of 0.160, or 53.1% higher

This is what might be expected from the more oxidizing conditions with low ore column.

Occasionally slags from individual furnaces carry more than the normal amount of copper. For some months in 1912 all such slags, found in the daily colorimetric work, were saved, being put into two classes, those with about 0.30% Cu and those near 0.40%. An average of all those (51) of the former class, assaying 0.28% total Cu, gave 0.19% oxide Cu, or 67.9% of the total, practically the normal ratio. The higher slags (3) assaying 0.43% total Cu, gave 0.247% oxide Cu, or 57.4% of the total. This ratio is materially lower, and is instructive in showing that the higher loss of copper was due in great measure to poor settling, due probably to the slag being too cold for the proper separation of matte, as the Granby slags, which are unusually low in iron, have always a low specific gravity.

Normal slags in 1914 gave the following results: SiO_2, 47.0; FeO, 17.1; CaO, 22.2; total Cu, 0.195; oxide Cu, 0.115; oxide ratio, 62.5 : 100. It thus appears that not only have both the sulphide and oxide copper been reduced in quantity, but their relative proportions in normal slags have changed to some extent.

While discussing the question of loss of copper as oxide it may be mentioned that several times a siliceous ore, carrying chrysocolla and chalcocite, and normally used for lining the old acid converters, was added to the charge of the blast furnaces. In each case the copper lost in the slag increased materially, and the idea of smelting this ore in the blast furnaces when the Granby ores were sufficiently low in silica had to be abandoned. None of these slags have been available since this series of experiments was started, but apparently the copper charged as silicate did not entirely free itself from this combination in passing through the furnace.

[2] "Copper Determinations at Granby," by F. E. Lathe, "Eng. and Min. Journ.," 1912, Vol. 94, p. 1071.

The condition of copper in converter slags has been debated without much definite proof on one side or the other. The figures here given show the result of normal operation for a period of one week of the Granby's three basic converters: SiO_2, 21.85; S, 1.40; total Cu, 1.73; oxide Cu, 1.39; oxide ratio, 80.3 : 100. While the sulphur present was more than sufficient to combine with all the copper four-fifths of the latter nevertheless united with oxygen.

Experiments in Settling Granby Slags

While it is true, as pointed out by Mr. Grabill, that one cannot say definitely how his laboratory experiments in settling slags may have been influenced by time, temperature, container, furnace gases and all other artificial conditions, something may nevertheless be learned by this kind of work. It may point the way to the more encouraging lines of experiment in actual furnace operation if only one condition at a time has been changed in the laboratory. With this in mind the following experiments were tried.

Ten charges, as shown in Table 4, were made up in 20-gram fireclay assay crucibles, and these were fused in the firebox of an ordinary coal-fired assay furnace. The matte, copper and ferrous sulphide were in each case placed in the bottom of the crucible and the slag, crushed to 20 mesh, poured over them. The slag contained: Cu, 0.23; SiO_2, 45.3; FeO, 19.2; CaO, 23.5. The charges

TABLE 4. LABORATORY SETTLING EXPERIMENTS WITH GRANBY SLAG

Charge-grams				Products	
Matte 37.6% Cu	Copper 99.0% Cu	FeS	Slag	Matte % Cu	Slag % Cu
5	2	..	100	51.6	0.16
5	1	..	100	46.9	0.15
5	0.5	..	100	42.4	0.15
5	..	..	100	38.8	0.145
5	..	1	100	30.6	0.125
5	..	2	100	28.5	0.125
5	..	5	100	21.3	0.10
5	..	10	100	15.2	0.09
5	..	20	100	9.6	0.09
..	..	20	100	2.7	0.08

were kept in the furnace in the fused condition about an hour, at a temperature of 1250-1350° C. (The average temperature of Granby blast-furnace slags leaving the furnace spout is 1275° C.) They were then carefully removed, the contents being kept as quiet as possible and allowed to cool. When cold, the crucibles were broken, matte and slag separated, bucked and assayed. A calculation shows that there is some apparent discrepancy between copper in the various charges and that found. When this was observed the ferrous sulphide was tested and found to contain a small amount of copper. That the gases did not materially affect the grade of matte is best seen in the fact that when nothing but slag was fused with the matte its grade did not greatly change.

Analysis of Air-Cooled Slags

As these slags were air-cooled, ordinary methods did not suffice for their complete decomposition. Large platinum dishes not being available the following procedure was adopted:

Two grams of slag were warmed for 10 min. in a tall 200-c.c. beaker with 6 c.c. HNO_3. Then 2 c.c. HF were added, and the whole heated till the action diminished. After cooling, 8 c.c. H_2SO_4 were gradually added, and when the liquid became quiet it was transferred to a platinum crucible, in which it was evaporated to copious

fumes. (The whole operation may be made in beakers, but more HF is necessary and the glass is badly corroded.) It was then cooled, transferred to a beaker for electrolysis, warmed with a little water and diluted to 150 c.c. After the addition of 2 c.c. HNO_3 the solution was electrolyzed without filtering. The precipitated copper was dissolved in HNO_3 and redeposited, and the platinum cylinder—after the usual cleaning—was reweighed, to correct for any platinum carried over by possible traces of HF. The limit of experimental error by this method is probably about 0.01%.

Increase of Copper in Slag with Grade of Matte

The results have been plotted in Fig. 11 and the straight line drawn is seen to pass within 0.01% of each point. This nearly uniform increase of copper in the slag with the grade of matte is to be expected from the experience of ordinary furnace operation, but the peculiar thing about it is that the line does not point to the origin, and would cut the axis at about 0.07% Cu in the slag.

It is unfortunate that the copper oxide in these slags could not be determined accurately by Mr. Kiddie's method, owing to the incomplete decomposition with H_2SO_4. When the usual treatment was carried out the copper dissolved varied irregularly from 0.04-0.10% in the 10 samples, averaging 0.062%, or 51% of the total copper. Undecomposed slag could still be seen in all cases after the H_2SO_4 treatment, so that this percentage is lower than the actual one. It would have been interesting, had it been possible, to calculate the oxide from the gold content, as illustrated, but the amount of clean slag obtained in these experiments was far too small for an accurate determination of such minute quantities of gold.

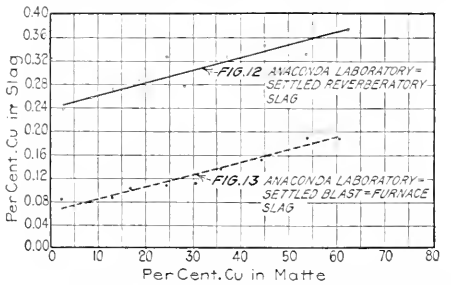
Comparing this curve with the middle curve of Fig. 8, which it approximates in composition, we see between 30% and 38% mattes an average difference of about 0.09% in the copper content of the slag, the copper remaining in the experimental slags being only 58% of that normally found in furnace operation. Even the settling of all the sulphide would not have produced a result so low as this, showing that some of the oxide must also have been reduced.

Experiments with Anaconda Slags

On visiting the Anaconda Copper Mining Co.'s smelting works at Great Falls and Anaconda, Mont., in the spring of 1914, I was given such samples as were requested for experimental purposes, and my thanks are due to the management of both plants for these and many other courtesies extended.

In Great Falls one furnace is 84x180 in. at the tuyeres, and 22 ft. 3½ in. from feed floor to center of tuyeres, the vertical section resembling that of an iron blast furnace. It is described and illustrated in Doctor Hofman's "Metallurgy of Copper," pp. 164 and 165. It receives at varying pressures about 17,000 cu.ft. of free air per min. from a constant-volume General Electric turbo-blower. The charge varies considerably, but the sulphur content will average about 15%. The furnace is provided with one 15-ft. settler. A sample of the slag, said to be typical, gave on analysis the following result: SiO_2, 36.6; FeO, 30.7; CaO, 20.8; total Cu, 0.280; oxide Cu, 0.140; oxide ratio, 50:100. While no real comparison can be made between this and Granby slags, which are formed under radically different conditions, it may be noticed in passing that this percentage of oxide copper is the same as that normally found in Granby slags of 0.21% Cu, though the ratio of oxide to sulphide is 1:1 instead of 2:1. Probably this is largely due to the fact that the percentage of sulphur on the charge is fully five times as great as at Grand Forks.

At the Washoe smelting works at Anaconda samples were obtained of both blast- and reverberatory-furnace slags. The averages for one month analyzed—all except copper by Washoe chemists—as follows: Reverberatory matte, Cu, 40.91%; reverberatory slag, SiO_2, 38.1; FeO, 42.3; CaO, 5.6; Al_2O_3, 7.4; ZnO, 1.7; total Cu, 0.425; oxide Cu, 0.315; oxide ratio, 74.1:100; blast-furnace matte, Cu, 44.48; blast-furnace slag, SiO_2, 39.0; FeO, 25.2; CaO, 24.2; Al_2O_3, 7.3; ZnO, 0.9; total Cu, 0.320; oxide Cu, 0.205; oxide ratio, 64.1:100. The higher percentage of oxidized copper in the first of these may be due to the oxidized charge, and it would be interesting to know if this is usual in reverberatory furnaces smelting roasted concentrates. The sulphide copper is almost the same in the two. In settling the sulphide the reverberatory furnace has the advantages of a lower matte and longer contact of molten matte and slag, the blast furnace that of lower specific gravity of slag.



FIGS. 12 AND 13. VARIATION OF Cu IN ANACONDA LABORATORY-SETTLED SLAG WITH Cu IN MATTE

In addition to the monthly averages, samples of one day's run in quantities of several pounds were secured. The reverberatory slag contained the following: Cu, 0.490; SiO_2, 36.3; FeO, 44.4; CaO, 4.6. With this slag a series of experiments in settling was carried out similar to the one described for Granby slag. Charges and results are shown in Table 5. Fig. 12 shows these results plotted, and though the irregularity is greater than that of the Granby slag similarly treated, the general form is still a straight line. This also does not point to the origin, but would indicate a low limit of about 0.23% Cu in this slag. With a matte of 41% the slag holds 0.335% Cu, or only 0.09% below the

TABLE 5 LABORATORY SETTLING OF ANACONDA REVERBERATORY SLAG

Charge-grams				Product	
Matte 32.2%	Copper 99.0% Cu	FeS	Slag	Matte % Cu	Slag % Cu
10	6	.	100	62.1	0.372
10	4	..	100	53.5	0.330
10	2		100	44.9	0.345
10	0.5		100	37.1	0.325
10	...	1	100	28.0	0.275
10	...	4	100	24.4	0.325
10	...	10	100	18.7	0.285
5	...	10	100	13.1	0.270
5	...	20	100	8.5	0.257
...	...	20	100	2.7	0.235

month's average already given. This shows the efficiency of reverberatory settling, in spite of a heavy slag. These experimental slags were but slightly attacked by ordinary acids, rendering the use of hydrofluoric acid necessary for their decomposition. The determination of copper oxide was not possible by the method adopted for water-cooled slags, so was not even attempted.

The results of a similar series of experiments with Anaconda blast-furnace slag are shown in Table 6 and Fig. 13. This slag analyzed: Cu, 0.305; SiO_2, 37.4; FeO, 25.1; CaO, 25.4. The line of Fig. 13 is similar

TABLE 6. LABORATORY SETTLING OF ANACONDA BLAST-FURNACE SLAG

Charge-grams				Product	
Matte 32.2%	Copper 99.0% Cu	FeS	Slag	Matte % Cu	Slag % Cu
10	6	0	100	60.2	0.185
10	4	0	100	53.5	0.185
10	2	0	100	44.2	0.155
10	0.5	0	100	35.4	0.135
10	0	1	100	30.2	0.110
10	0	4	100	24.1	0.105
10	0	10	100	16.7	0.100
5	0	10	100	12.8	0.085
5	0	20	100	8.0	0.070
0	0	20	100	2.1	0.082

to that of Fig. 11 for Granby slag, not differing by more than 0.01% Cu at any point. The slag with matte of 44.5% has 0.155% Cu, against 0.32% for the month's average blast-furnace slag. This is lower than the oxide copper in the monthly average and shows that some oxide was reduced.

While these experimental slags were slowly cooled they all decomposed readily either with HNO_3 or H_2SO_4. As this made possible the determination of copper oxide, it was carried out. Although the 10 slags were run together under exactly the same conditions of time, temperature, strength of acid, etc., there was little regularity in the results. The oxide varied from 25-61% of the total, and averaged 39.2%, considerably lower than the 51% of the Granby experimental slags.

Presence of Sulphide Copper Does Not Preclude Oxidized Copper

Some experiments were undertaken to determine the action of matte on copper oxide and silicate. The chief argument against the existence of copper in slags in the oxidized condition has been based upon the well-known reaction:

$$Cu_2S + 2CuO = 4\,Cu + SO_2$$

As this reaction may take place whenever copper oxide and sulphide are in contact at high temperature, it was determined to introduce a definite quantity of copper oxide into slags and see if the fusion with matte would eliminate it. But it seems unlikely that any copper oxide formed in slags remain uncombined, so the experiments were extended to cover silicates as well.

The materials used in these experiments were (1) the Anaconda reverberatory slag already experimented with, (2) a matte carrying 37.98% Cu, (3) pure CuO, 79.9% Cu, (4) specimens from a siliceous chrysocolla are, 18.86% Cu—pure chrysocolla contains 36.1% Cu. The following charges were made up: (1) 100 grams of slag were mixed with five five grams of chrysocolla ore, and fused over five grams of matte. (2) 100 grams of slag were mixed with five grams of chrysocolla ore and five grams of matte, and fused. (3) 100 grams of slag were mixed with one gram of copper oxide and fused over five grams of matte. (4) 100 grams of slag were mixed with one gram of copper oxide and five grams of matte, and fused.

All these charges were made up in fireclay assay crucibles and fused together in a gas furnace, out of contact with the flames. The temperature was raised slowly to about 1350° C., being over 1200° C. for an hour. At the end of that time the gas was turned off, the temperature falling rapidly, and the crucibles were removed only when cold. After the crucibles were broken the pieces of slag were separated carefully from the matte and heated to about 1000° C., when they were dropped into cold water. After drying they were bucked and assayed. Hydrofluoric acid was still necessary for their complete decomposition, so the copper oxide could not be accurately determined. However, all the slags were treated 8 hr. at 70° C. with H_2SO_4 (1:20) and were mainly, though not entirely, decomposed. Hence actual copper oxide is higher than reported in Table 7.

TABLE 7. ACTION OF MATTE ON COPPER OXIDE AND SILICATE

	Matte	Slag			
Exp. No.	% Cu	Total Cu	Oxide Cu	Normal Cu (Fig. 12)	Excess of Normal
1	49.4	0.505	0.325	0.353	0.152
2	61.2	0.505	0.270	0.380	0.125
3	51.2	0.480	0.300	0.356	0.124
4	60.0	0.420	0.270	0.377	0.043

All the mattes are much higher than those charged, and especially those that were mixed with the slag and copper oxide or silicate. These two experiments also show lower copper oxide in the slag, and a smaller excess over the normal amount. But the point which the four experiments seem to establish fairly clearly is that the presence of copper sulphide in molten furnace products does not prove the absence of either copper oxide or silicate. They also indicate that the silicate is reduced with more difficulty than the oxide, and that if either of them be formed in excessive quantity it will result in a slag with more than the normal amount of copper.

(To Be Concluded)

Explosives Produced in the United States in 1914

The production of explosives, excluding the amount exported, in the United States during 1914, according to figures that the Bureau of Mines received from manufacturers, was 450,251,489 lb., as compared with 500,015,845 lb. in 1913 and 489,393,131 lb. in 1912.

The production for 1914 is segregated as follows: Black powder, 206,099,700 lb.; "high" explosives other than permissible explosives, 218,453,971 lb.; and permissible explosives, 25,697,818 lb. These figures represent a decrease of 23,839,831 lb. of black powder, 23,932,573 lb. of high explosives and 1,987,952 lb. of permissible explosives, as compared with figures for 1913.

Current Japanese Metal Outputs

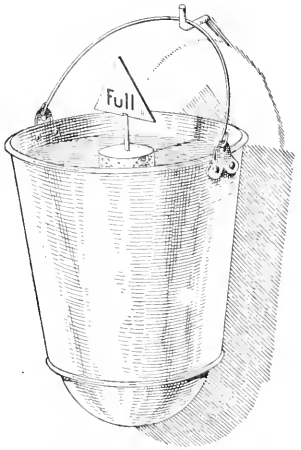
According to the Department of Agriculture and Commerce of Japan, the production of the principal mines and metals for the four months, January to April, 1915, inclusive, was: Gold, 2493 kg.; silver, 50,308 kg.; copper, 21,085 metric tons; iron, 16,011 metric tons; coal, 6,161,300 metric tons; petroleum, 151,687 hectoliters; sulphur, 16,469 metric tons. Coal, iron and sulphur show decreases; the rest show increases. The copper exports of Japan for the first four months of 1915 were 19,820 metric tons, as against 16,166 in the same period of 1914 and 13,824 in 1913.

Details of Practical Mining

A Fire-Bucket Float

. The accompanying illustration shows an ordinary fire bucket equipped with a simple and convenient contrivance for showing the amount of water in the bucket. The device consists of a cork or metallic float with a stiff wire spindle attached to it, on the top of which is fastened a triangular piece of sheet tin or aluminum, painted and lettered in colors that will contrast with the surroundings.

This saves the watchman from climbing on workbenches, up posts or the sides of the walls to see if the



FIRE BUCKET WITH SAFETY FLOAT

water buckets are full as required by the Insurance Associations.

When the bucket is full, the sign is visible for a considerable distance, but when the water has evaporated so that the bucket is only partly filled, the float disappears below the rim. These floats would also be an aid to the insurance inspectors when they visit plants where they have been adopted.—C. D. Parkhurst, in *American Machinist,* July 22, 1915.

Taking the Diamond Out of a Raise

By Frank S. Crawford*

In a four- or six-post raise the sets often become so out of shape as to look, in plan, like a diamond. To remedy this, put a level on the tops of the posts and it will be found that one or more of them are lower than the others. This results in their being drawn together, and the caps or girts are not level. Ascertain which posts are low and place a shim on the tenon of each so as to raise them to the height of the other posts, when placing the next set of timber. If it is too much to raise them in just one set, make them up in two sets. A shim is a piece of blocking or wedge cut to fit the mortise.

With the tops of the posts level, the caps and girts will be level; and with posts plumb, the sets will be square.

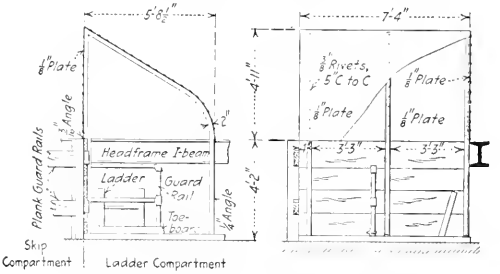
*(Lowell Sta.) Bisbee, Ariz.

Cover for Shaft Ladderway

By D. E. Charlton*

The sketch shows a substantial covering for a shaft ladderway, which serves as a protection to the men ascending and decending the ladders and which is being used at some of the mines on the Mesabi Range. While not so elaborate or expensive as some, it is giving good satisfaction.

The framework consists of three V-shaped standards made of ¼-in. angle iron, 2 in. wide. These are made with a welded joint at the apex forming the V, and on the bases the metal is pounded over so that it forms a flange through which a bolt fastens the frame to the planks covering the ladder compartment of the shaft. The shape is shown in the end view, and in the side view



SAFETY COVER FOR SHAFT LADDERWAY

the two upright standards on the right, in part section, reveal the method of fastening.

The covering is made of ⅛-in. plate riveted to the standards with ⅜-in. rivets on 5-in. centers. This covering extends from the planking on the shaft side to the apex and thence down to the I-beam, as shown in the end view. This forms the roof, and it will be seen that such a shape has an advantage over the semi-circular or dome-shaped roof, as any material striking it will be deflected from the shaft rather than into it. With the semicircular type a certain portion of the material would fall into the shaft. The end opposite the entrance is also covered with plate, which is riveted to the last standard. The sketch also shows the guard rail and toe board in use.

A Dirt Strainer made of a layer of muslin backed by coarse wire screen over the mouth of a compressor-intake will add to the life of the machine.

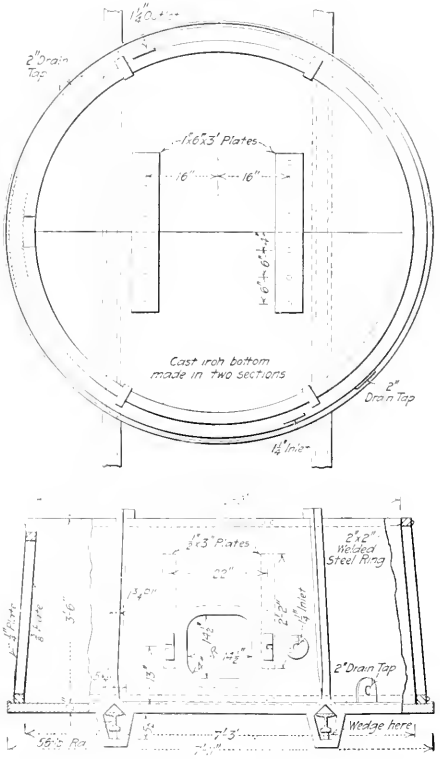
*Mechanical engineer, Virginia, Minn.

Details of Milling and Smelting

Granby Tapered Settler

By Frank E. Lathe*

The settling of furnace slag has received much attention at the works of the Granby Consolidated Mining, Smelting & Power Co., at Grand Forks, B. C. After experimenting with settlers of different sizes and shapes, the company is now adopting as its standard small



PLAN AND ELEVATION OF GRANBY SETTLER

tapered settlers arranged in a series of at least three, the slag cascading from one to the next.

The settler is 3 ft. 6 in. high and has an inside diameter at the bottom of 5 ft. 3 in. and at the top of 6 ft. 9 in. It rests on a cast-iron bottom plate 5 ft. 11 in. in diameter, made in two sections. The settler shell is held in place on the cast-iron base by the mild-steel tie-hooks, wedged over 56-lb. rails placed under the base-plate. The inside plates of the settler shell are of 3/8-in. steel and the outside plates of 1/4 in., a 2-in. water space being provided. The tapping block consists of two small water jackets which fit together, leaving a 3½-in. circular opening. Asbestos is packed around these jackets and further protection is afforded by 3/8-in. asbestos board placed between them and the brick lining.

Matte is tapped regularly from the first settler, and from the other settlers when it has accumulated to a depth of from 4 to 6 in. The advantage of the tapered form is that when the settler becomes partly filled with "metallics," which are usually formed under the conditions of siliceous slag and high coke, the shell may be lifted off the base and the sow disposed of without difficulty.

*Chief chemist, Granby Consolidated Mining, Smelting & Power Co., Ltd., Grand Forks, B. C., Canada.

Electric Precipitate-Melting Furnace*

The gold precipitate from the zinc-dust presses in the cyanide plant of the Alaska-Treadwell Gold Mining Co., Treadwell, Alaska, is treated by the lead-smelting method. About 3 or 4 tons of this precipitate is produced monthly, having a gold assay value of $40,000 to $60,000 per ton.

An electric furnace was constructed from an old steel acid drum by cutting off the top and introducing a cable, made from strands of bare copper wire, through the bottom and spreading the strands out fan-shaped on the inside of the drum.

Powdered graphite, obtained by grinding up old crucibles, mixed with 10% of cement was tamped wet into the bottom of the drum around and completely covering the copper wires. The graphite was carried up to the bottom of the furnace and acted as the lower electrode. The sides were built up of ordinary firebrick forming a melting chamber 14 in. diameter by 20 in. high.

The upper electrodes, of graphite or other carbon, are 3 in. diameter and 40 in. long, with joints enabling new electrodes to be connected without shutting down or wasting stubs. A screw feed was arranged for raising and lowering the upper electrode.

The cover for the furnace had three openings, one for feeding the charge, one for the escape of gases and one in the center for the introduction of the electrode. It was later found more practical to enlarge this center opening to 6 in. diameter to allow of a central feeding of the charge around the electrode.

The furnace is operated on the lighting circuit through a 50-kw. transformer, 60 cycles, 110 volts. Later a water rheostat was constructed to lower the voltage for use when starting the furnaces, or when there was a bath of metal in the bottom of the furnace.

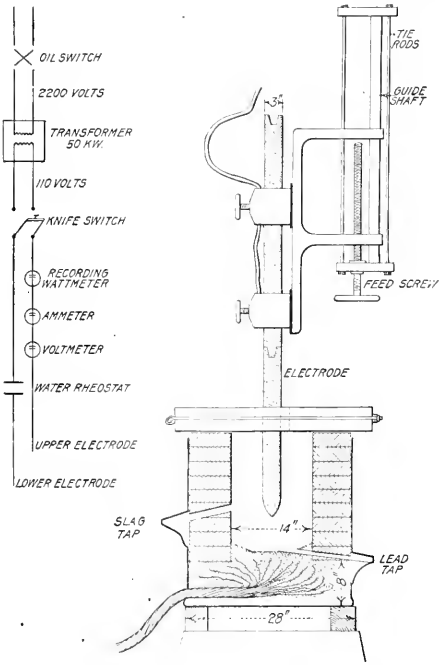
The material to be treated in the furnace is mixed in the following proportions: Refinery byproducts, 100 lb.; old reverberatory hearths, containing 60% CaO, 20 lb.;

*Excerpts from an article by W. P. Lass to be presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

litharge, 20 lb.; coke, 2 lb.; scrap iron, 3 lb. About 160 lb. of the mixture is added for a charge. Coke is added to the charge as a reducing agent, only a quantity sufficient to throw down the lead being used.

The charge is introduced into the top of the furnace through the central opening around the electrode without removing the slab cover. In starting, it is operated as an arc furnace, until thoroughly hot, when the charge, consisting of slag, brick dust, etc., is added, the electrodes being raised as the load in amperes increases, until the entire chamber is filled with the charge and the upper electrode extends almost a foot into the melt. As the charge continues to melt the electrode is moved down or up, keeping the amperage reading as nearly constant as possible.

At this stage the furnace is no longer operating as a simple arc furnace, but has automatically transformed itself into a resistance type of furnace, the semifluid or molten charge acting as the resistance, the current passing



ELECTRIC FURNACE FOR PRECIPITATE MELTING

from one electrode through the center of the charge to the other.

After the charge is in quiet fusion the power is turned off and the charge allowed to settle for 15 min. before tapping the slag. This allows the lead to settle out, the furnace acting as a forehearth. In operation, the molten lead and slag are tapped, as in the blast furnace. If the lead freezes, it is melted by diverting current from the upper electrode and letting it pass through the lead, the tapping rod playing as an arc on the side of the furnace or into the lead tap.

Both graphite and gas-carbon electrodes are used, the former costing $2.95 each and the latter $1.20. Power cost is less than 1c. per kilowatt-hour. The labor required for the operation of the furnace, including the work of charging and tapping, is one-half one man's time, when melting 1 ton in 24 hr.

The advantages of the electric furnace compared to the blast furnace for melting high-grade gold slags are: A saving in mechanical loss of gold in flue dust, because

OPERATING DATA

Total running time	128 hr. 40 min.
Average weight of charge added	160.5
Average fusion time of charge	2 hr. 25 min.
Total number of charges	53
Graphite electrodes used	1 per 24 hr.
Total power for 128 hr. 40 min., kw.-hr.	4410
Power used per hour, kw.	34.50
Power used per pound of material fed, kw.-hr.	0.52
Power used per ton of material fed, kw.hr.	1044.0
Acheson graphite used per hour, ft.	0.15
Material melted per hour, lb.	67.7
Material melted for 24 hr., lb.	1625.0

the melting is done in a quiet neutral atmosphere instead of in a rising blast of air; the obtaining of a lower grade slag, free from shot, by reason of the quieter melting action and the higher temperature obtainable, making a more fluid slag; the nicety of regulation of the melting temperature, and the benefit to the general health of the operating force.

Sampling Lead Bullion

At the Ohio & Colorado smelting works at Salida, Colo., the base bullion was originally sampled by taking a dip sample from the lead well, which was not satisfactory, says F. D. Weeks.[1] The present management built drossing kettles in which the bullion is stirred by compressed air, skimmed into a Howard press, stirred by hand and siphoned out into bars for shipment, after sampling by dipping "gum-drops," approximating ½ assay-ton in weight.

For some time the results were unsatisfactory. Although the copper had been reduced to 0.06%, the bullion had a dirty appearance, and "gum-drops" of the same dip would not check with each other, especially as to gold content. Consultation with men versed in the subject did not help. A remedy was finally found when the temperatures were determined by a pyrometer and the difficulties overcome by the following procedure: Take off heavy dross at 900° F.; blow until temperature reaches 680° F., skimming from time to time; raise the heat to 720° F. for sampling, and mold at 800° F. Since this method was adopted, there has been little trouble.

Ridge Roasting Furnace

H. M. Ridge, of London, has been granted a patent (U. S. pat. 1,143,438) for a multiple-hearth roasting furnace which will permit a certain part of the furnace to be put out of action without interfering with the working of the other part. This is accomplished by means of closable discharge openings in the hearths so arranged that while in normal working the ore may traverse the entire length of each hearth in succession, but should it be desired to cut out part of the furnace, the rabble shafts of that part are stopped and, without other alteration than the opening or closing of certain discharge outlets, the ore may be caused to traverse in succession the several hearths of the other part of the furnace. A variety of furnace constructions is covered, such as where the rabbles do not overlap, and vice versa.

[1]Excerpt from a paper entitled "The Salida Smelter," to be read at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

Company Reports

Tonopah Belmont Mine

Report of the Tonopah Belmont Mining Co. for the year ended Feb. 28, 1915, shows that the ore reserves consist of 226,921 tons of positive ore, 6355 tons of probable ore, and 61,808 tons of possible ore, a total in reserve of 295,084 tons. The year's development has proven the ores of the Belmont vein to be cut off by the Mizpah fault at the bottom and to terminate to the eastward, above the fifteenth level, against the glassy trachyte. Moreover, the ores of this vein, which almost entirely through the areas hitherto mined have been above the normal grade, have not continued of high grade to the lower and eastern limits of the deposit, as was expected, but instead diminish in tenor generally downward and to the east.

On the other hand, the development of the mine apart from the Belmont vein has been encouraging. Most notable was the discovery and exploitation of the Western vein, and the development of the Favorite vein on the 900-ft. level, where an orebody of good width and excellent grade is being proven.

The amount hoisted was 228,328 wet tons. From this 42,628 wet tons, or 18.67%, was thrown out as waste, and the remaining 185,700 tons—or 181,370 dry tons—delivered to the mill. The average value per ton was $16.747, made up of 0.234 oz. gold and 22.34 oz. silver. The total operating costs were $7.268 per ton, and the losses in mill tailings and in sales of concentrates were $1.274 per ton, making the total cost and losses $8.542 per ton. The profits per ton, exclusive of miscellaneous earnings, were $8.205, and the percentage of profits for Tonopah operations, 48.99.

MINING COSTS AT THE TONOPAH BELMONT MINE

	Amount	Per Ton
Development, direct:		
Miners	$74,602.03	$0.411
Muckers and trammers	37,181.14	.205
Timbermen and helpers	12,189.04	.067
Stoping, direct:		
Miners	91,186.88	.503
Shovelers	51,278.73	.283
Trammers	39,162.22	.216
Timbermen and helpers	126,647.39	.698
Filling	8,317.14	.049
Piston drills, repairs and maintenance	4,961.09	.027
Stoping drills, repairs and maintenance	6,967.43	.038
Steel and sharpening	13,810.70	.076
Explosives	81,128.93	.447
Hoisting to surface	36,750.25	.202
Auxiliary hoisting	149.47	.000
Ore sorting and loading	17,642.80	.097
Sampling and assaying	7,891.73	.044
Surveying	7,025.15	.039
Supt. and shift bosses	17,862.21	.098
Mine office	14,216.72	.078
Surface and plant	17,157.30	.095
Lighting	7,867.04	.043
Heating	9,663.19	.053
Drayage	3,421.95	.019
Maintenance and repairs, buildings	1,035.11	.006
Maintenance machinery and tools, shop tools	880.06	.005
Maintenance pipe lines and tanks	2,275.13	.013
Maintenance railroad spur	1,713.89	.009
Pumping	16,514.58	.090
Ventilation	5,918.05	.033
Total direct cost, mining	$715,417.65	$3.944
Administration	10,232.69	.056
Taxes and insurance	15,616.65	.086
Legal and traveling	2,556.85	.014
Bullion tax	23,500.00	.130
Depreciation	15,028.44	.083
Total indirect cost, mining	$66,934.63	$0.369
Total operating costs	782,352.28	4.313

During the year the property produced 3,714,861.91 fine ounces of silver. The average price received for the silver sold, 2,008,763 oz., was 55.16c. The highest price received was 59.125c. and the lowest price 48.25c. For the silver sold—combined with the silver in storage, which is carried at 50c. per oz.—the average price for the year is 52.84c. A gross tonnage of 228,328 tons of crude ore, of an average value about $13.61, was mined during the year. Of this, the Belmont vein furnished 77,730 tons, the Shaft vein furnished 63,887 tons, the Occidental vein 12,011 tons, the Favorite vein 18,883 tons, other veins making up the remainder.

There were 24,630 ft. of development work performed during the year, at a cost of $72.46 per ft. The drifting cost was $7.592 per ft.; the crosscutting cost, $6.228 per ft., and the raising cost, $8.326 per ft. The high cost of raising was due to the fact that there were heavy timbers used in the raises and many were on flat veins.

The items of labor, supplies and power, comprising the direct mining cost per ton, were $2.423, $1.231 and $0.29. The development cost was $1.168 per ton and the stoping costs were $2.777 per ton. The total direct mining cost was $3.944, while the indirect cost was $0.369 per ton. The accompanying table shows the operating expenses per ton and in total for the year.

*

Seoul Mining Co.'s Operations

The report of the Seoul Mining Co., Holkol, Chosen, for 1914 shows a total ore reserve of 1,206,133 tons having a gross value of $15,914,375. The ore is complex, containing gold and copper, and it is noteworthy that in the present estimate copper is calculated at only 12c. per lb. The usual dividend of 50% on the capital stock was paid during the year.

The Suan mine has a total ore reserve of 236,536 tons, containing $9.13 in gold, 1.12% copper and 1.7 lb. of bismuth, or a total value of $12.86 per ton. In this estimate copper is calculated at 12c. per lb., and bismuth at 60c. per lb. The mill treated 74,450 tons of ore during the year, after discarding 7922 tons as waste. The actual running time of the mill was 338 days, 15½ hr., or 92.77% of the possible time. The stamp duty per day was 5.5 tons. After a series of tests the flotation process was installed for treating the pulp from the tube mills. This was put in operation toward the end of April, and the copper extraction was increased from 20% to about 75% and gold extraction from 82% to about 88%. The total yield from the mill was $701,-181.75.

At the Tul Mi Chung mine the total ore reserve is 963,500 tons, containing $8.14 in gold, 1.59% in copper and 0.8 oz. of silver per ton. Further details of this mine and its milling plant are given on p. 275 of this issue.

The power station at Pyeng Yang, the transmission lines and motor installation were not completed until

the end of the year on account of high floods which delayed the transportation of material and wiped away a section of the transmission line.

Early in 1915 the change from steam to electric motive power was effected at the Suan mine and mill, and the plant is now working satisfactorily. The operating costs per ton are shown in the accompanying table.

OPERATING COSTS OF THE SEOUL MINING CO.

Mining	$1 38
Starting and transporting ore to mill	10
Milling	1 00
Concentrating	49
Office expenses	24
Agencies	09
General expenses	09
Insurance	02
Freight and transportation	04
Messengers and police	04
Livestock	03
Surveying	02
Traveling expenses	04
Cables and telegrams	04
Bullion expenses	04
President's and secretary's office	13
Legal	01
Hospital	10
Total	$3.90

During the year 36 tons of high-grade ore, valued at $2520, was shipped to England. Since the installation of the flotation process at the Suan mill it is not likely that any more high-grade ore consignments will be made from the Suan mine. The average receipts per ton from all ores were $9.44, the operating costs $3.90, and the profit per ton $5.54. Operations are continuing and ore reserves are being increased regularly.

Round Mountain Mining Co.

The report of the Round Mountain Mining Co., Round Mountain, Nev., for two years ended Mar. 31, 1915, shows that in July, 1914, the capital stock of the company was increased from 1,000,000 shares to 1,500,000 shares of $1 each. The total outstanding shares at the end of the year amounted to 1,188,019, leaving a balance of 311,981 in the treasury. The land holdings of the company now approximate 800 acres, of which 241.9 acres are patented.

For the year ended Mar. 31, 1914, the mines produced 57,187 tons of ore at an average value of $5.28 per ton. Tailings losses were 73.5c. per ton, leaving a net recovery of $4.55 per ton, or 86.1% of the value contained in the ore. Net operating profits were $13,357.

During the year ended Mar. 31, 1915, the mines produced 48,230 tons having an average value of $6.57. Tailings losses were 87c. per ton, leaving a net recovery of $5.70, or 86.8% of the total metal contents. Net operating profits were $44,931.

Development work for the year ended Mar. 31, 1915, amounted to 4707 ft. at an average cost of $8.40 per ft., compared with 4173 ft. at an average cost of $7.27 during the previous year.

Following placer mining operations conducted by lessees from 1906 to 1915, resulting in a gross production of $339,589 from hydraulicking 218,818 cu.yd. of dirt, having an average value of $1.55 per cu.yd., the company is to undertake these operations itself. An estimate of hydraulic ground tributary to the main tailrace is estimated to contain 1,508,445 cu.yd. of an average gross value of 81. This estimate covers 66,776 acres with an average depth of 14 ft. No estimate has yet been made of other placer ground owned by the company, some of which is 40 ft. or more to bedrock. To supply water for this work a pipe line is being constructed from Jett Cañon. The first section of this line from the intake in the cañon consists of 14,000 ft. of riveted steel dipped pipe, varying from 30 in. in diameter at the head to 15 in. The second section consists of 28,000 ft. of lap-welded steel pipe $\frac{1}{4}$ and $\frac{5}{16}$ in. thickness and 15 in. diameter; the third section is 3336 ft. of riveted steel pipe 15 in. diameter. To guard against freezing, this pipe will be laid 41 in. deep. Only 7550 ft. of this pipe will be slip-jointed, the remainder being fitted with bolted forged steel joints. As surveyed, the total length of the line is 45,336 ft., and the estimated cost of construction is $145,000. An ample water supply will be assured, and it is estimated that from 1000 to 1500 cu.yd. of dirt per day can be washed. Measurements of the flow indicate that the pipe line will operate to full capacity for at least from four to five months of the year.

Union Copper Land & Mining Co., Michigan, reports that the company had $1169 on hand on Jan. 1, 1915, and that since that date it has received a payment of $8960 on a contract for the sale of timber which was made in 1913. The company still owns 6366 acres of land.

New Baltic Copper Co., Houghton, Mich., for 1914 reports an income from interest, etc., of $500 and after expenditures amounting to $353.8, a balance of $869 in cash on hand. The management intends to resume exploration work, and to provide funds an assessment must be levied on the outstanding stock or a sale of some stock effected.

The Broken Hill Proprietary Co. now has its works at New Castle, N. S. W., in full operation. Up to May 15 the total output was 12,763 tons pig iron, 2652 tons of openhearth steel, 1551 tons blooms and 429 tons rails. Two openhearth furnaces are in operation. A considerable number of orders for billets, rails and structural steel are in hand.

Seven Troughs Coalition Mining Co., Seven Troughs, Nev., shows a net profit of $145,035 for 13 months ended Apr. 30, 1915, and dividend payments of $36,075. The company ended the year with $76,864 in cash on hand and in bank, $45,000 in notes receivable, and $1819 in accounts receivable. No statement is made in the report as to the amount of ore treated.

The Davis-Daly Copper Co., Butte, Mont., for the quarter ended Mar. 31, 1915, states that receipts were $6439 and disbursements $57,224. Expenditures consisted of $44,249 for development, $2613 for mining, $4128 for equipment, $3604 for general expenses and $2630 for Boston expenses. Shipments consisted of 1135 tons of ore, averaging 3.7% copper and 7.2 oz. of silver per ton. Development work amounted to 1663 feet.

New Arcadian Copper Co., Houghton, Mich., for 1914 reports a balance on hand Jan. 1, 1914 of $24,557, receipts amounting to $13,238 and expenditures of $27,364, leaving a balance of $10,431 in cash on hand at the end of the year. There was also $6606 of assessments to be collected. The shaft was sunk from the 750-ft. level to 900 ft. Development work consisted of 710 ft. of crosscutting and 795 ft. of drifting. Some ore was stoped for a test run which is to be made on the ore recently opened up.

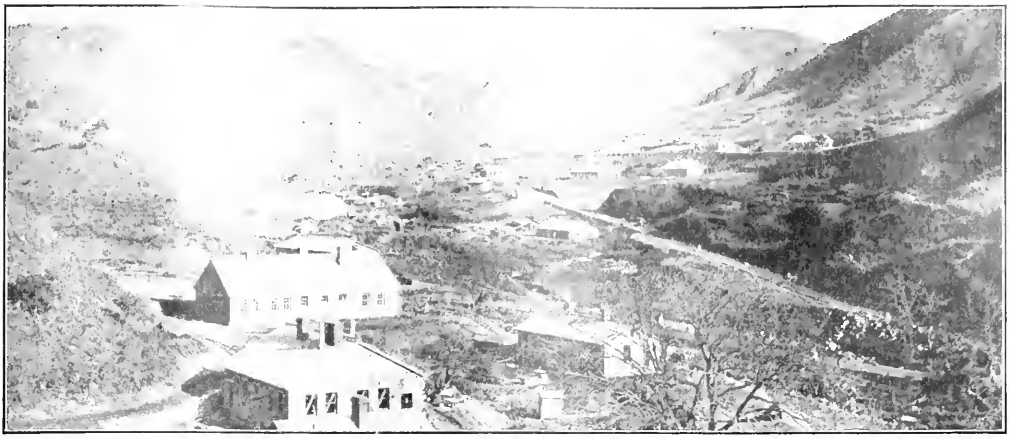
Saint Mary's Mineral Land Co., Houghton, Mich., for 1914 reports total receipts amounting to $20,376, of which $11,400 was from the sale of wood and timber, $2810 from ground rents, $6101 from interests receipts and $65 from miscellaneous sources. All expenditures amounted to $129,349. The real property of the company consists of 93,032 acres of land and mineral rights to 14,112 additional acres. Its principal source of revenue is from a one-half interest in the Champion Copper Co., which paid no dividends last year.

New Idria Quicksilver Mining Co., California, for 1914 reports a loss of $45,010. A dividend of $10,000 was paid. Ore produced amounted to 62,578 tons, which furnished 6550 flasks of quicksilver. There were 12,367 ft. of development work performed. During the first eight months of the year the average price received for quicksilver was $76 per flask. For a short time after the war started it rose to $75, but steadily declined to $48, and the average price received was $41 per flask.

Photographs from the Field

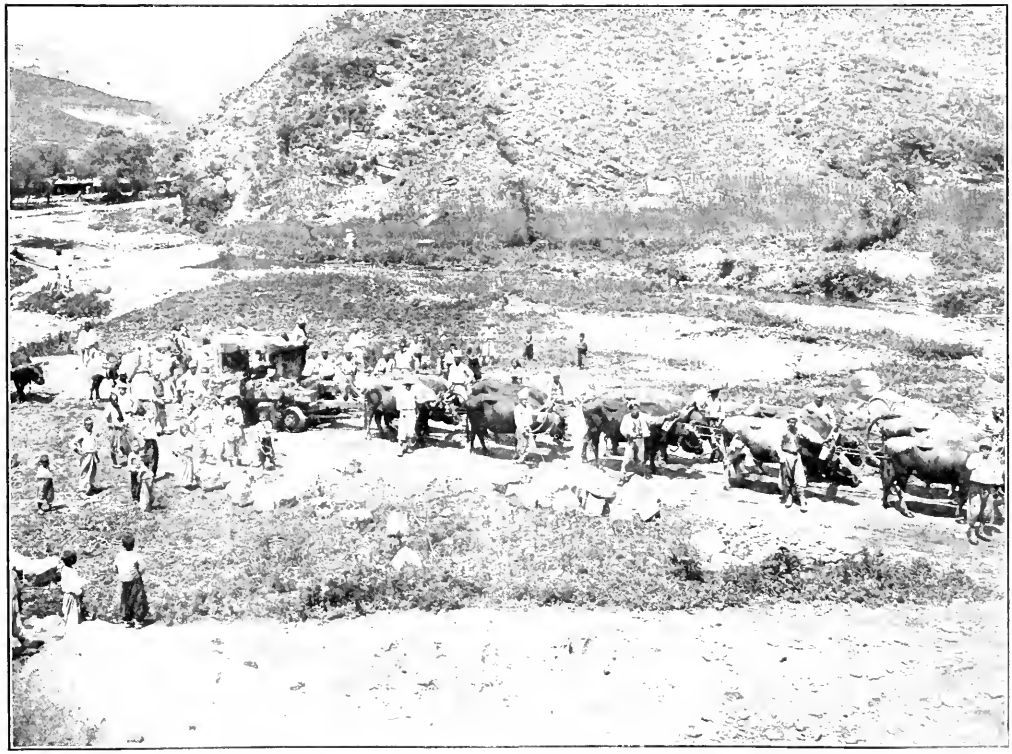
IVANHOE ZINC MINES, WYTHE COUNTY, VA.

Upper view shows the Wis[illegible] mine, also formerly operated [illegible] great limestone pinnacles



GENERAL VIEW OF CAMP OF TUL MI CHUNG MINE, SUAN CONCESSION OF SEOUL MINING CO., CHOSEN

During 1914, $229,457 was expended on this mine, and the total capital expenditure to Jan. 1, 1915, was $358,648. There are over four miles of drifts, etc. Positive ore is given at 614,900 tons of a value of $7,796,546 and probable ore at 348,700 tons of a value of $4,108,009. The value of the positive ore is divided as follows: Gold, $5,189,756; silver, $245,960; copper, $2,360,830. Probable ore: Gold, $2,657,094; silver, $139,480; copper, $1,311,525. The assays are: Positive ore, Au, $8.44; Ag, 0.8 oz.; Cu, 1.60%. Probable ore, Au, $7.62; Ag, 0.8 oz.; Cu, 1.57%. The deepest level working on ore is the 300-ft., which is said to be in excellent condition and to give great promise.



TRANSPORTING HEAVY MACHINERY FOR THE SEOUL MINING CO., CHOSEN

A 30x18-in. rock breaker, weighing 9½ tons, hauled by a team of 28 bullocks, en route to the Tul Mi Chung mill. The mill will be about 3000 ft. from the portal of the main adit. The first unit of the plant will have a capacity of 100 tons per day, and should have begun operating in July. Grading was completed in April. It is expected that the mill will ultimately will treat 400 tons per day. The Tul Mi Chung mine is considered by its owners to be the premier mine of Chosen, and is unique in that it is the only profitable mine in that territory in which no work by the natives was going on at the time it was discovered.

Gold Precipitation on Paper

By Douglas Lay*

SYNOPSIS—Former methods of electrolytic precipitation have had the disadvantage of a costly separating system for recovering precious metals. This description is of a method of using paper, which can be burned, leaving no impurities in the bullion.

Apart from any other inherent advantages which electrolytic precipitation may possess over the chemical systems, the former method merits attention at the present time on account of the high price of zinc. Hitherto electrolytic precipitation appears to have received the cold shoulder, doubtless because of the many extravagant claims made on its behalf which have not been realized in practice.

Weakness of Former Electrolytic Processes

In my experience, electrolytic precipitation on sheet-lead cathodes proved highly satisfactory, precipitation being just as complete as when zinc was employed. But electrolytic precipitation on a metallic cathode and chemical precipitation by means of either filiform zinc, zinc dust or aluminum, all involve, subsequent to precipitation, separation of the precipitated precious metal from the lead, zinc or aluminum, as the case may be, before the precious metal is recovered in the form of bullion.

The method of electrolytic precipitation on paper cathodes, herein described, has been evolved with the object of eliminating as far as possible the separation of the precipitate from the precipitant. If precipitation on paper cathodes proves to be satisfactory—and experimental work gives ground for high hopes—then it would appear to be a step in advance of precipitation on a metal, owing to the simple operation required after precipitation to yield the precious metal in the form of bullion.

Before proceeding to a detailed description of the method, it is well to say that I am far from laying claim to any originality in the matter of making a nonconductor, such as paper, a conductor of electricity. The art of making nonconductors conductors has been known for more than half a century. Originality, if originality there be, lies in the manner of application of this known art to the cyanide process, that is, in precipitation on a combustible cathode.

Further, no claim is made that this method has yet emerged beyond the experimental stage, inasmuch as time and opportunity have not permitted an actual cleanup on a full commercial scale. At the same time, all experimental work herein described was carried on with actual mill solutions and in an electrodeposition tank of full commercial size, containing 3500 sq.ft. of sheet-lead cathode surface. Opportunity only permitted of the trial for 30 days of a limited number of paper cathodes. These latter were hung from the negative crossbar, side by side with lead cathodes, and appeared to receive a deposit of precious metal just as readily as the lead cathodes.

Briefly, the process consists in the electrolysis of the clear cyanide solution, and the precipitation of the precious metals on paper cathodes. Whenever it is desired to make a cleanup, incineration and melting of the cathodes will yield the precious metals in the form of bullion.

Preparation of Paper for Electrodeposition

Any paper of reasonable stoutness and having a smooth surface, such as the pages of the *Engineering and Mining Journal*, answers well. It is cut into strips of the required size, preferably not more than 2 or 3 in. in width. These strips are immersed momentarily in melted beeswax. Before the wax has solidified, the sheets are dipped in flake graphite (not plumbago), which is thus made to adhere very firmly to the paper. When the latter has cooled, more graphite is rubbed on the surface of the paper until the latter appears highly polished. The function of the beeswax is twofold—it not only renders the paper waterproof, but also serves as a bed for the graphite. It is advantageous but not absolutely necessary to dip the sheets, prepared as described in alcohol and again in water, to remove any air adhering to the surface. The cathode is now ready for immersion in the electrodeposition tank. Electric connection is established with the negative main in the following manner: Each cathode strip is clamped at the upper edge between two strips of sheet copper about ¾ in. wide, by means of small clips (ordinary tie clips answer very well). A copper hook soldered to one of the copper strips suspends the cathode from the negative crossbar.

Details of the Electrodeposition Tank

As has already been mentioned, the great majority of cathodes employed were of sheet lead, opportunity not permitting of a trial of more than a limited number of paper cathodes. The tank had a total cathode area of 3500 sq.ft., giving it a capacity of 2 tons of solution per hr., that is to say, solution flowing through it at this rate was entirely robbed of its precious-metal contents. The tank was constructed of 3-in. plank and was 35 ft. long, 5 ft. wide, 3 ft. deep, all these being dimensions in the clear.

Anodes were of No. 10 sheet iron, 5 ft. 1 in. long by 2 ft. 8 in. deep, and were fitted into saw cuts in the sides and bottom of the tank. To promote thorough circulation and ionization alternate anodes were raised 2 in. above the level of the solution, the remaining anodes being fitted into the bottom of the tank. Each alternate pair of anodes, therefore, formed a water-tight compartment, consequently the whole of the solution was caused to flow over one anode and under the next. The distance between anodes was 3 in. Anodes were enclosed in cheesecloth to prevent chance of short circuiting. Electrodes were connected in multiple. Anode connections below the level of the solution are gradually eaten away. These connections were thoroughly insulated in the following manner: The positive main to which each

*Mining engineer, 14 Westbourne Road, Forest Hill, London, S. E., England.

of the anodes was connected was carried along the top of one side of the tank in a plow-way. The anodes projected ½ in. into the sides of the tank. From the bottom of the plow-way, ½-in. holes were drilled to the tops of the anodes, electrical connection being effected by filling these holes with molten lead after the anodes and positive main were in place. On top of this side of the tank was tacked a strip of wood, 3 in. wide, running the entire length of the tank. On this strip rested the ends of the cross-bars, which carried the cathodes. The other ends of the cross-bars rested on the negative main which passed along the other side of the tank. Cross-bars were placed midway between anodes so that the distance between anode and cathode was 1½ in. Cathode crossbars were of ⅜-in. round common iron.

The manner of connecting the paper cathodes to the negative crossbars has already been described.

The action of the electric current is gradually to oxidize the anodes. In this particular case the anodes were of iron and the anode product consisted mainly of floating flocculent hydrated ferric oxide which accumulated in the anode compartments. The removal of this floating anode product was readily effected by the following device: Above the level of those anodes which projected 2 in. above the level of the solution, the tank had at its outlet end an overflow lip. Below this lip at the normal level of the solution was the normal outlet pipe. By closing a valve on this latter pipe the level of the solution could be raised above the tops of the projecting anodes, causing a direct flow throughout the tank and the rapid and complete removal of the floating anode product over the flow lip into a sump tank. The only labor involved in this operation was the opening and closing of a valve. This operation was found necessary only once in every 24 hr. It is to be noted that the anode product always carries high precious-metal values, which however are loosely held, and which rapidly pass into solution again in the sump tank.

Efficient sampling of the solution heads and tails was effected by pet-cocks at the inlet and outlet ends of the tank. These pet-cocks were kept open slightly so that there was a constant drip into a vessel placed to receive the sample for assay.

A weak current was used, the current density being 0.02 amp. per sq.ft. of cathode surface, and the pressure from 3 to 4 volts.

Noteworthy Features of the System

The following appeared to the writer to be advantageous features: The small amount of attention required; the ease and cheapness with which a cleanup could be made as compared with other methods of precipitation, incineration and melting of the cathodes yielding the precious metals in the form of bullion; the continuous nature of the process. A cleanup entails no stoppage of operations whatever. Cathode sheets may be removed as often as desired and replaced by new ones without switching off the current. The precipitated precious metals adhere firmly to the cathode. There is no danger of mechanical loss from particles dropping off. At first consideration it might be thought that a paper cathode would rot after lengthy immersion in the solution. The reverse of this takes place. As the deposit of precious metal increases, the paper cathode becomes more and more metallic in appearance and properties. After 30 days' immersion, paper cathodes were found to ring, when tapped with a piece of metal. There is a small consumption of electric power and the cost of precipitation is low.

Antimony Production of the World

In *Engineering* for July 9 there was a very good summary of the world's antimony production, excerpts from which, together with some comments, constitute the following:

During the autumn of 1914 the war demand developed. Russia bought in Great Britain, Japan and the United States, the total Russian demand being in excess of 2500 tons. At least an equal quantity was purchased on behalf of other nations.

Metallurgy of Antimony

The process of extracting antimony from the ore is a simple one, but there are several processes employed. The crude commercial antimony is the ore separated from the associated earthy gangue; this operation is performed by simple fusion. From this there are several means of obtaining the regulus of antimony. The raw antimony, whether obtained direct from the ore or from the purified sulphide, must be calcined, in order to separate such impurities as arsenic and sulphur. In the direct process of obtaining antimony, the ore is smelted with some alkaline slag and old scrap iron. When this combination has completely fused, it is poured into conically shaped molds, and this mixture, after cooling, consists of impure antimony and sulphide of iron. There are several methods available for purifying the regulus; one of the simplest is to charge each of a number of crucibles with this regulus along with soda, common salt and pure oxidized antimony ore. When sufficient heat has been applied, the foreign impurities, or metals, become oxidized and scorified, and the antimony is thus obtained. It is a bright, silver gray metal, brittle, and readily pulverized.

The roasting of antimony is very similar to the roasting of lead matte; until recently it was roasted either in hand reverberatory furnaces or in single-hearth furnaces. The essential point of the furnace is the absolute control of temperatures. In roasting antimony, should the temperature rise to about 350° C. in the early stages of the roast, there is a tendency towards fusion; but later in the roast the temperature may be raised considerably beyond 350° C.; it is, in fact, quite possible to do so without any difficulty arising. The fusion takes place in the early part of the roast. The control of temperatures in improved furnaces enables the heat of the sulphur to be utilized when present. The older system of hand reverberatory furnaces entailed a large fuel consumption.

[The article does not refer to the modern process of antimony smelting, developed in France by Herrenschmidt, wherein the antimony is burned off in kilns, the oxide being collected in bag filters, and subsequently converted to metal by reducing smelting. This process gives a high extraction of metal and a product of excellent quality.]

World's Production of Antimony

Of the world's total output of antimony three-fourths of the ordinary 99% grade comes from China; the cost of production is lower than in any other country. No less

than 100 mining companies have been established, and eight smelteries have been erected, but they are not as yet all at work. The important companies are the Wah Chang Mining & Smelting Co., of Changsha, and the Pao Tai Mining & Smelting Co., of Wuchow. Antimony is not at present known to occur in northern China, the main source of supply is the western central region; the trade routes by means of which the mineral wealth of Central China reaches the coast are the Yangtse River, the Shanghai at the estuary, and the West River. The total exports exceed 12,000 tons of metal yearly, besides several thousand tons of ore, the main portion being shipped from Changsha and the smaller quantities from Yochow, Hankow, Wuchow and some other ports. Amoy is a district from which antimony may be exported in considerable quantities in the future.

Much of the Chinese output is shipped as crude ore, to be smelted and refined in Europe. Reliable returns for 1914 are not yet available; for recent years the Chinese exports have been as follows:

	1910, Tons	1911, Tons	1912, Tons	1913, Tons
Ore	5,665	6,700	2,020	4,250
Crude	6,535	6,875	13,310	12,820

[It may appropriately be added that a great deal of the Chinese antimony, especially that of the Wah Chang company is a high grade of metal, its analysis being superior to certain British brands which sell for higher prices. The Wah Chang company is under the direction of H. Y. Liang, who studied metallurgy in New York and London and gained experience in antimony smelting with Herrenschmidt in France. In his works the oxide-baghouse process is employed.]

Mexican Antimony Possibilities

There are both mines and smelteries in Mexico, one is in course of erection in San Luis Potosi; by the time mining and transportation conditions permit ore to be produced it will be ready for operation. The smeltery will have a capacity of 3000 tons per annum of refined antimony and will employ at least 150 men. The output is more likely to go to America than Europe. The ores to be worked up will be obtained from mines in Queretaro and San Luis Potosi. At present there is only one antimony smeltery working in Mexico, located at Wadley, a small station about 100 miles north of San Luis Potosi. The Wadley smeltery is not equipped for finishing the product, and its output has been exported to Great Britain for further refining. This smelter has worked for about 14 years, and has drawn a large part of its ore from the Catorce district.

The quantities of crude antimony and regulus sent from Mexico to Great Britain have been as follows:

	Tons		Tons
1910	2788	1912	3296
1911	3997	1913	2345

[A large deposit of antimony ore occurs in Mexico, about 9 miles north of Zimapan, on the upper slopes of the lower half of the great Moctezuma cañon. This is of lead-antimony ore and is known as "La Sirena." It was described by Dr. R. W. Raymond in the *Journal* of Jan. 2, 1915.]

French antimony, reduced both from native and imported ores, supplies the home demand, and before the declaration of war found a market in the United States. The output may be approximately estimated to be as follows:

	Tons		Tons
1910	4550	1912	5430
1911	4790	1913	5900

Canadian Production

In Canada there has been a small output of antimony from Nova Scotia; but no Canadian antimony has been sent to Great Britain since 1911, and then only in very small quantities.

A few years ago interesting and apparently important deposits were found in the northern portion of the Yukon territory. They are limited in their occurrence, so far as ascertained, to a small area 8 or 10 square miles in extent, known as Carbon and Chieftain Hills, about 33 miles above the point where the Wheaton River flows into Lake Bennett. The deposits are not more than 10 or 12 miles north of the sixtieth degree of latitude, forming the British Columbia-Yukon boundary. The deposits can be reached from Vancouver by steamer, then rail followed by road. The veins (of stibnite) vary in width from a few inches to 5 ft. The gangue material is generally quartz.

The other important antimony producing country is Australia, which exports from 1000 to 2000 tons of ore per annum to Great Britain. The production of Japan and Hungary has dwindled to insignificance. A small quantity of ore used to be exported annually from Turkey. The production of the United States—never large—has been trifling in recent years. The antimony smeltery at Chelsea, Staten Island, N. Y., has been idle for a long time. In England smelting and refining is carried on by seven important companies, the works being located one each in Runcorn, Newcastle-on-Tyne and St. Helens and four in London, with a branch in Patricroft, near Manchester.

Mineral Production of Peru

The mineral production of Peru for 1912 and 1913 has just been officially reported in the *Boletin* del Cuerpo de Ingenieros de Minas, No. 81, 1915, as follows:

Substance	Unit	1912	1913
Coal	Metric ton	278,927	273,945
Petroleum	Metric ton	233,600	276,147
Gold	Kilogram	1,435	1,429
Silver	Kilogram	324,352	299,132
Copper	Metric ton	26,970	27,778
Lead	Metric ton	4,050	3,927
Zinc ore	Metric ton	...	22
Vanadium ore	Metric ton	3,048	...
Bismuth (fine)	Kilogram	51,038	25,300
Tungsten ore	Metric ton	195	290
Mercury	Kilogram	400	460
Borax	Metric ton	1,674	2,001
Salt	Metric ton	23,292	24,433

The total value of the minerals produced in 1913 was 4,494,806 libras, as compared with 4,627,963 libras in 1912; 1 libra = $4.8665.

Gold-Bearing Conglomerates in the Philippines are reported to have been discovered along the Dekelan River near Iligan in Mindanao. This new gold field is not in the valley of the Cagayan River, on the other watershed of Mindanao, which has long been known to have gold and whose placers have been frequently described. The new field lies on the western slope of the range which separates the Cagayan Valley from Iligan Bay. The claims which have been located in this new field are situated about 11 miles northeast of the town of Iligan. Assays show from $1 to $25 per ton. The natives have for years obtained a small amount of gold from the gravel in the Dekelan River. The conglomerates are said to resemble those of the Witwatersrand.

Editorials

Recent Developments in the Mexican Situation

At last the policy of "watchful waiting" is to be abandoned and the affairs in Mexico are to be put in order in one way or another. Villa and Zapata appear to be tractable, but Carranza breathes defiance, and once more the *cientificos* are sticking up their heads. However, if we may believe the Washington dispatches all opposition is to be brushed aside and Uncle Sam, with the collaboration of the A B C powers—up to a certain point—is to do things. It is even foreseen that there may have to be armed intervention, but if it comes to that the A B C powers are going to let the United States do it alone.

But there has entered into the situation a new and troublesome consideration. Whatever government be set up in Mexico, it must have funds, which must be supplied by the bankers—that is, by the public. Yet where are the investors to be found who will put their money into an unguaranteed Mexican loan? The New Englander would as lief lend on the security of the codfish swimming in Massachusetts Bay. The idea of guaranteeing such a loan is a new one in Washington, which heretofore has been gleefully telling American investors that when they put their money in a foreign country they did so at their own risk.

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Zinc Smelting in Great Britain

In view of the shortage of the spelter supply existing in Great Britain since the beginning of the war, along with the plethora of zinc-ore supply in Australia, the condition that causes us to marvel is the apparent absence of any general and serious effort to increase the zinc-smelting capacity of Great Britain. We have not been able to make a comprehensive survey of the present status of the British smelteries, but from reading of the British papers and our other information, we have not received the impression that anything energetic has been undertaken. We know, of course, that the capacity of Seaton-Carew is being increased, but on the other hand we heard but recently from another famous smeltery that its operator was still in the market for nothing but calamine ore, not yet possessing any blende-roasting furnaces, nor having any intention of building them.

The backwardness of British metallurgists in zinc smelting is one of the strange things of metallurgical history. The art of zinc smelting is supposed to have originated in India, from where it was carried to China, where zinc smelting is still done on a small scale by the primitive methods that date back hundreds of years. In the sixteenth century zinc was brought to Europe from China and the East Indies under the name of tutanego (whence the English term tutanegue), and it is likely that knowledge of it was obtained from that source at an earlier date. A few years previous to 1740 Dr. Isaac Lawson is said to have gone to China to study the method of zinc smelting there practiced, and to have brought the knowledge to England. Be that as it may, a patent for a process of distillation downward was granted to John Champion in 1739, and in 1740 he erected works at Bristol and actually began the manufacture of spelter, though his production was small, the chief part of what was used in Great Britain still being brought from India and China. For a good many years the process of making zinc at Champion's works was kept rigidly secret, but toward the end of the century the art was learned by Johann Ruhberg, who supposedly went to England for the purpose, returned to Upper Silesia, and in 1798, or 1799, made the first attempt at zinc smelting at Wessola in that province.

In spite of the great advances in the art that were made in Upper Silesia, in Rhenish Prussia and in Belgium, the British smelters continued to use their peculiar, clumsy and uneconomical furnace until the middle of the nineteenth century, and neither in that century nor later did they ever assume a leadership in this branch of metallurgy which they had introduced from the East. British supremacy passed away in this even earlier than it did in the metallurgy of copper and of lead. Only in the metallurgy of iron and steel has Great Britain held its own, and in this field the place of the country which gave the world both the Bessemer and the Thomas-Gilchrist processes is admittedly a fine one.

The reasons for the decadence of Great Britain in non-ferrous metallurgy would be an interesting subject for analysis and study. But of immediate concern is the question why its zinc smelters have failed to rise during the year of their country's need. They have the coal, they have the refractory material, and the ores could be brought to their seaports as well as they have been to those of the Continental countries. The reasons are perhaps to be looked for in the pernicious practices and baleful attitude of the British laboring man; and in the disinclination to take any chances involving the litigious Australian ore contracts.

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New Jersey Iron Mines

Notwithstanding the depression in the iron trade last year, there has been considerable activity among the old iron mines of Morris County in New Jersey. The Mount Hope mines which are the oldest in the state, and, with two or three possible exceptions, the oldest in the United States, have been supplied with new machinery and made ready for a large output from the orebody uncovered a year or two ago. These mines have been supposed several times to be approaching the end of their life, but it is understood that the ore now in sight is greater in quantity than ever before and a large production is expected.

The Richard Mine at Wharton, now owned by the Thomas Iron Co., is to be further opened by a new concrete-lined shaft, equipped with new machinery, which

will reach a new ore lens and will enable the operators to increase the monthly production of ore to double the present production, or even more. Though not so old as the Mount Hope, the Richard has been worked for a number of years.

British Muddling Over New Jersey Zinc Co.

The obsession in Great Britain respecting the control of the metal markets of the world by the great metal merchandising concerns of Germany produces some humorous results. One of these was the birth of the myth that the zinc industry of the United States is controlled by German houses, who conspired to make the British pay an extortionate price for spelter. Another is that the pending investigation of an alleged spelter trust by the State of Missouri has something to do with this. The latest is the charge by London *Financial News* that the New Jersey Zinc Co. is the chief element in the alleged trust (the existence of which our contemporary takes for granted), that it connives and coöperates with the German houses, and that indeed itself is one of the enemies. "The view that it is of enemy character," says the *Financial News,* "is strengthened by the fact that one of its directors is, or was, August Heckscher, who was active in consolidating conflicting interests on the other side and so building up a big organization."

Here we have a lucid piece of reasoning. In the eyes of our London contemporary, there is a spelter trust in the United States, for the attorney-general of Missouri is assumed to say so; out of its own inner consciousness it evolves the idea that the aforesaid trust is controlled by Germans. The large number of concerns engaged in the American zinc business "does not by any means indicate competition," but "illustrates the measures taken by the Germans to secure control of a most lucrative, though complicated, business, while creating the appearance of freedom of trade." In other words, the organization of a large number of operating properties was to create a smoke to blind the eyes of the public. The New Jersey Zinc Co. is in the thing, of course, for is not August Heckscher a thoroughly Teutonic name?

This attack upon the New Jersey Zinc Co. led the London solicitors for that company to write to the *News* that neither it nor its subsidiaries are affiliated, directly or indirectly or by implication, with any other company. To this the *News* retorts that if the solicitors for the New Jersey Zinc Co. will assure it that their company is not a codefendant in the Missouri case, it may possibly believe that the New Jersey Zinc Co. is not to be numbered among the foes of England and the whole empire.

This is something like the famous inquiry addressed to a prisoner at the bar: "Have you ceased beating your wife? Answer me yes or no."

For the information of our contemporary in London, the *Journal* will assure it that the solicitors for the New Jersey Zinc Co. told the truth. Moreover, that the "nefarious Frankfort trio" is only moderately interested in the zinc industry of America; that it was stupidity in buying that put the price for zinc up to £100 per ton; that the State of Missouri is not proceeding against the zinc smelters on the charge that they are combined in a trust, but simply is conducting an inquiry to find out if such a trust exists; and that the aforesaid inquiry was instigated not to hunt out the "nefarious Frankfort trio," but to satisfy the Joplin producers of zinc ore, who wailed that they were not getting a fair share of the high prices for spelter.

On Zinc Poisoning

In a discussion of occupational diseases in the *Journal of Industrial and Chemical Engineering* reference has been made to the form of zinc poisoning known as "spelter chills." Zinc smelters are less subject to metal poisoning than are lead smelters; so much less indeed that some persons are disposed to deny that zinc vapor is poisonous, attributing the trouble experienced by brassmakers to copper vapor alone.

H. W. Gillett appears, however, to have brushed aside that hypothesis in an effective manner. He cites the evidence of Lehman, who produced "spelter chills" in several persons, including himself, by the inhalation of fumes arising from c.p. zinc and found the symptoms to be identical with those of "brass shakes." He cites, moreover, the evidence that "spelter chills" existed at Lasalle, Ill., among the smelters in 1910.

Mr. Gillett makes it rather uncomfortable for his opponents when he suggests that they emulate Lehman, by heating a pound or so of zinc to 920° C. in a small unventilated room and inhaling the fumes for a few minutes—pointing out that if their ideas be correct there should be no ill after-effects.

The obsession of the London market for standard copper still obtains, especially since it has become an open market again by the lifting of the embargo against exports. Its effect upon our copper market is rather upon the imagination of copper buyers than it is upon the producers, while its influence upon the stock market is not inconsiderable. All these things interlock.

Thus, certain persons surmise, or have definite knowledge, that there is going to be a demand for copper for ammunition contracts, let us say, which is likely to stimulate a rise in the price for the metal. Those possessing such knowledge may buy copper stocks and produce a rise in them before anything is done in the metal. Then comes a decline in the London market for standard copper, and the prospective buyers, affected sentimentally, hold off, copper stocks go off and pessimism prevails.

But of course the copper will be bought later if it be needed and the upward movement in the metal will be started, though perhaps from a lower level than was hoped in the first place. Naturally, in the long run the price for copper is determined by demand and supply, and by nothing else.

The question whether the time has not come when the barrel as a unit for portland cement may be dropped and the bag substituted in its place is raised by *Engineering News.* Its arguments in favor of the bag are rational, and the *Journal* unites with its contemporary in advocating the change, but why not have a bag of 100 lb. net instead of the existing standard of 94 lb. and obtain a unit that is easy of combination with other units?

BY THE WAY

The sluggishness of the copper stocks during the last three months has been a subject of wonder. The zinc and lead stocks have figured prominently among the "war brides." The copper stocks have been back among the wallflowers.

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A fitting memorial to Barton Sewell, late president of the Braden Copper Co.—in which he took such an active interest in the later years of his life—has been created by a resolution of the directors of the company, "That one of the company's towns in Chile be hereafter named and called Sewell." In accordance with this resolution, Pope Yeatman gave instructions that the reduction-works town, formerly known as Molino, be changed to Sewell.

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A German metallurgical manager, writing to a friend in this country recently, remarked that his works were necessarily running at a reduced rate owing to shortage of labor. However, he expected soon to receive a consignment of Russian prisoners which would enable him to get things going again on a good scale. We have previously made some remarks on the subject of captive labor, which appears to be rather an important factor in the industries of Germany at present.

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In the *Saturday Evening Post* for July 31, 1915, Charles E. Van Loan describes Virginia City—one of the ghost cities of the West, he calls it. His account is far more accurate than is the common essay of this sort by the tenderfoot. Perhaps Mr. Van Loan is not a tenderfoot at all. Anyway his article is mighty interesting. Here is one of his stories:

> Not long ago a Japanese diplomat visited the West and in the course of his wanderings came to Virginia City. He was received with all courtesy—and when it comes to courtesy no state in the Union can give points to Nevada—and shown the various points of interest.
>
> "This," said the guide, "used to be the shaft of the old Con. Virginia. They took sixty-five millions out of that hole in the ground. . . . . Over there used to be the California—forty-seven millions. . . . . Here is where the old Mexican mine used to be. . . . . This is the Enterprise office. Mark Twain used to be a reporter on this paper." And so on.
>
> The visitor was very polite, but somewhat noncommittal. At the end of the afternoon the guide thought to prod him into a direct statement. "Well," said he, "what do you think of Virginia."
>
> "I think," said the Japanese, still politely, "that it is a very great used-to-be."

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Ignorance, carelessness or haste often causes ludicrous blunders in the typing of reports and the printing of mining prospectuses. When one of the latter speaks of the "typographical" features of a mining property, a reader may be pardoned for entertaining the suspicion that the promoters are running a "printing press" mine. The inadvertent transposition of two letters in a report made "ore reserves" change to "ore reverses." This was unfortunate but true, as the company was unable to raise the desired cash to raise the ore to raise more cash to raise the spirits of the stockholders who were already in. In a letter which embodied what was in substance an offer to sell for money, marbles, chalk or promises, an enthusiastic tropical booster stated that he had 22 "gold placed" claims in the Republica de ——, which showed values running from 8c. to $00 per cubic yard; ideal either for dredging, hydraulicking, sluicing or panning. The fair typist may have been merely careless, or she may have had a private hunch; but if the gold was indeed "placed" on the claims by the claimant, it certainly was a grievous case of topographical error.

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Teniente Topics is the title of a sprightly magazine now being published by employees of the Braden Copper Co. in Chile. The initial number, dated June, 1915, presents the "Early History of the Braden Copper Co.," by William Braden, and contains besides some interesting descriptions of hunting expeditions and sports participated in by members of the Braden staff. It has a section in Spanish, and in many respects is more interesting than many more pretentious magazines. It is officially published by the Teniente Publishing Co., at Sewell, Rancagua, Chile. J. F. Pearce is president and business manager, L. E. Grant editor and A. T. Ward assistant editor. They are to be congratulated on the successful start they have made. The name of the magazine, *Teniente Topics*, was selected by ballot, and it is interesting to note some of the alternatives that were suggested, such as: El Aguila Americana, La Prensa Braden, Andes World, La Voz de Molino, Capos de Nieve, El Tesoro de Teniente, El Grito del Minero, Khaki-People Dope, Dinamita y Concentrados, Snow Flakes and El Tango. The successful name, *Teniente Topics*, was suggested anonymously by S. S. Sörensen, general manager of the Braden Copper Co.

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The New York *Herald* on July 28 published a frightening article to the effect that the shortage of zinc is a greater menace to the arms output than is the labor fight. The writer qualifies as an expert by offering the following remarks:

> Until last winter Belgium produced two-thirds of the world's supply of zinc spelter, obtaining all the ore therefor from the Hartzig Mountains on the borderland of Germany. With the flooding of the mines, all of which are in the war zone, this source of supply has been cut off, it is said, for at least five years. The entire production of zinc ore thus has been restricted to the ore mines at Joplin, Carthage and Web City, Mo., and the Arkansas field.
>
> The maximum capacity of the zinc smelters in the world for making spelter is 1,100,000 tons a year. The capacity of the eight smelters in this country is 350,000 tons. The amount required to fill contracts American munition makers have taken from abroad is 950,000 tons. It requires 18 months to build a zinc smelter, but not one is being built, for the reason that no spelter to operate it could be obtained.
>
> Here is the statement of the American & British Manufacturing Co.:
>
> "There are two brands of zinc spelter—the Edgar and the Horsehead. The Edgar brand is made by the Edgar Zinc Smelting Co., of St. Louis, Mo., and Cherryvale, Kan., and the Horsehead by the New Jersey Zinc Smelter Co. The Edgar Co.'s productive capacity is 2700 tons a month, or a little more than 30,000 tons a year.
>
> "For 20 years the average price was $41 a ton for zinc concentrated ore, 60% metallic contents, with a recovery charge of $35 a ton. Since it has been selling at $120 a ton, the increment in the valuation of the acreage of the Joplin, Carthage and Web City fields has been more than $6,000,000,000. All the gold mines in the world cannot furnish gold enough to pay for that. And these fields are not owned by one or several corporations, but by thousands of individuals.
>
> "It will take five years to get the water out of the zinc mines in the Hartzig Mountains, so that, even though they may be in Germany's hands, she can reap no immediate advantage from them except negatively. But the zinc problem will hit the munition makers harder and sooner than the 8-hour day question."

This was intended to be a serious discussion of the spelter situation, but in fact it is humorous.

Henry R. Merton & Co., Ltd.

The London *Financial News*, of July 27, 1915, states that Henry R. Merton & Co., Ltd., has a nominal capital of £1,000,000 in 30,000 preferred and 70,000 ordinary shares of £10 each. A total of 25,000 preferred and 70,000 ordinary shares have been issued and are fully paid. The directors are: S. Baer, H. Gardner, O. Langenbach, E. R. Merton, Z. Merton and M. Wilson. Alfred Merton and Richard Merton, both of Frankfort-on-the-Main, were formerly directors, but a revised copy of the register of directors filed on Aug. 15, 1914, stated that these two had vacated their seats, owing to non-attendance, "as on Jan. 1, 1914."

Among the shareholders at Oct. 29, 1914, were:

	Shares	
	Pref.	Ord.
S. Baer	1,516	2,500
Mrs. A. Baer	1,000	....
H. Gardner	750	2,575
O. Langenbach	550	....
E. R. Merton	419	2,187
Z. Merton	655	7,978
Metallgesellschaft, Frankfurt-am-Main	....	11,875
Z. Merton, C. E. Gebhard, O. Gebhard	2,675	....
Mrs. Helen Merton	2,738	1,140
Merton Metallurgical Co., Ltd.	....	1,240
E. R. and Mrs. Helen Merton, C. W. A. Key	3,600	965
T. R. Merton	1,405	360
Alfred Merton	....	100
Richard Merton	....	100
Metallbank and Metallurgische Gesellschaft A. G., Frankfurt-am-Main	....	18,600
Schweizerische Gesellschaft für Metallwerke, Basle, Switzerland	....	11,875
Heinrich Schwarz	....	1,250
H. Gardner and S. Baer, C. L. Budd	2,657	6,665
Ludwig Aron and Samuel L. Mandleberg	500	....
Salomon and Emil Bruhl	200	....
Salomon Bruhl	400	....
Nathan Baer	400	....
E. Gebhard	600	....
A. Mohr	25	....
D. Landauer	500	....
G. E. Schuster	....	405
Mrs. H. Wolff	400	....
Sigismund Sussmann	200	....

Chino Copper Co.'s Second Quarterly Report, 1915

The Chino Copper Co. reports the following production of copper in concentrates for the second quarter of 1915: April, 5,027,548 lb.; May, 6,442,977 lb.; June, 6,984,977 lb.; total, 18,455,502 lb. This gives an average monthly production of 6,151,834 lb., compared with an average monthly production of 3,910,836 lb. for the first quarter of 1915. The total tonnage of ore treated in the three months was 592,200, an average of 6507 tons per day, but the daily average for June was 7317 tons. The average content of the tonnage treated was 2.38% copper. The average extraction for the second quarter of 1915 was 65.31%, corresponding to a recovery of 31.16 lb. of copper per ton of ore milled. For the first quarter the average extraction was 66.12%.

There were produced 11,735 dry tons of concentrates averaging 22.11% copper, as against 21,401 tons of concentrates averaging 27.41% copper for the previous quarter. The ratio of concentration for the second quarter was therefore 14.19:1 as against 18.97:1 for the first quarter of 1915.

The cost per pound of copper produced for the quarter, after allowing for smeltery deductions and crediting all miscellaneous income, was 6.10c., as compared with 6.38c. for the first quarter of 1915. These costs include as usual all operating, administration and general charges and the regular charge of 30c. per ton of ore treated for the extinguishment of mine development and stripping expense.

The financial results of the company's operations for the second quarter were therefore as follows: Net profit from milling operations, $1,937,951; miscellaneous income, rent, etc., $68,597; total, $2,006,548. Dividends paid amounted to $652,455, leaving a net surplus over dividend requirements of $1,354,093. During the quarter there was moved a total of 1,208,360 cu.yd. of material in place. Of this amount there was 871,615 cu.yd. of stripping, while the remainder was equivalent to 643,088 tons of ore. The per-pound costs for this quarter are the lowest that have been made since the property began full operation.

Chronology of Mining for July, 1915

July 1. New wage scale agreed on by miners and mine operators of Joplin.—New workmen's compensation law of Montana went into effect.

July 3. Judge Bourquin in United States Court, Helena, Mont., signed decree ordering sale of Alice Gold & Silver Mining Co.

July 5. New 15-stamp mill of Plumbago Mine, Croesus Mining Co., Alleghany, Calif., went into commission.

July 7. New Jersey Zinc Co. increased its capital stock to $35,000,000.

July 12. Striking miners at Joplin, Mo., returned to work.—Dr. Joseph A. Holmes, Director of the United States Bureau of Mines, died.

July 15. Business section of Valdez, Alaska, destroyed by fire; loss, $500,000.—Coniagas Mine, Cobalt, Ont., celebrated the completion of a decade of mining.

July 17. Property of Iron Mountain Mining Co., Montana, purchased by Federal Mining & Smelting Co.

July 20. Ontario Government appointed a commission to inquire into the feasibility of refining nickel ore entirely within the province.—Work commenced on a 1300-ft. tunnel to carry water from Upper Annex Lake to provide extra power for the operation of the Alaska Gastineau mill at Thane, Alaska.

July 21. New Jersey Zinc Co. paid stock dividend of 250%, amounting to $25,000,000.

July 26. Beginning of suit of the North Star Mines Co. vs. Empire Mines & Investment Co.—Theodore B. Comstock, well-known geologist, died.

July 27. Franklin K. Lane, Secretary of the Interior, announced that the production of radium from Colorado carnotite had passed the experimental stage and was on a successful manufacturing basis.

July 30. Receivers appointed for Ohio Copper Co., following suit of Empire Trust Co. as trustee under the mortgage bond.—Mill of Idaho-Continental mine destroyed by fire.

July 31. Books of the Amalgamated Copper Co. closed, thus terminating its official existence.—Strike at Aluminum Co. of America plant, Massena, N. Y.

Molybdenum Mining in the United States

Owing to the great demand for molybdenum which began a little before the European War, there has been an active search for molybdenum minerals, of which only two, molybdenite (the sulphide) and wulfenite (lead

molybdate), have been found in commercially valuable quantity, says the Geological Survey. In the first half of 1915 the Primos Chemical Co. began producing molybdenite concentrates from a mine near Empire, Colo. This is the first American mine to be extensively operated for molybdenite, though there have been many lesser attempts at mining the mineral.

Steel Production in the United States

The total production of steel in the United States for the year 1914 is given by Bulletin No. 4 of the American Iron & Steel Association at 23,513,030 long tons, which is a decrease from 1913 of 7,787,844 tons; from 1912 of 7,738,273 tons; from 1911 of 167,073 tons. The details of the production are shown in the following table in long tons:

	Acid Tons	Acid %	Basic Tons	Basic %	Total Tons
Bessemer (converter)	6,220,846	26 5			6,220,846
Openhearth	903,555	3 8	16,271,129	69 2	17,174,684
Crucible	80,869	0 4			80,869
Electric	24,009	0 1			24,009
Miscellaneous	3,622				3,622
Tot. l.	7,241,901	30 8	16,271,129	69 2	23,513,030
Total, 1913	10,556,248	35 0	20,344,626	65 0	31,300,874

Of the total production given above, 22,819,784 tons were ingots and 693,246 tons direct castings. Included in the basic openhearth production are 835,690 tons of duplex steel, made from metal partly treated in bessemer converters and finally treated in openhearth furnaces.

The quantity of alloy treated steel reported in 1914 was 646,953 tons, 577,107 tons in ingots and 69,846 tons in direct castings. Of this total, 577,462 tons was openhearth steel.

The total production of steel in 1914 exceeded that of pig iron by 180,786 tons; it was practically the same. This indicates a heavy use of scrap in the openhearth furnaces.

Steel production in the United States for 10 years past has been as follows, in long tons:

	Openhearth Tons	Bessemer Tons	Crucible, etc. Tons	Total Tons
1905	8,971,376	10,944,375	111,196	20,023,947
1906	10,980,413	12,275,830	141,893	23,398,136
1907	11,549,736	11,667,549	145,309	23,362,594
1908	7,836,729	6,116,755	69,763	14,023,247
1909	14,493,936	9,330,783	130,302	23,955,021
1910	16,504,509	9,412,772	177,638	26,094,919
1911	15,598,650	7,947,854	129,602	23,676,106
1912	20,780,723	10,327,901	142,679	31,251,303
1913	21,599,931	9,545,706	155,237	31,300,874
1914	17,174,684	6,220,846	117,500	23,513,030

In the 10 years there has been an increase from 14.3 to 73% in the proportion of openhearth steel.

Finished Iron and Steel

The production of finished rolled iron and steel in 1914 is given in long tons in the accompanying table. It was the smallest since 1908, and was exceeded in seven out of the preceding 10 years.

Articles	Iron, Tons	Steel, Tons	Total Tons
Rails		1,945,095	1,945,095
Plates and sheets	56,590	4,662,656	4,719,246
Nail and spike plate	4,725	33,848	38,573
Wire rods	731	2,430,983	2,431,714
Structural shapes	1,981	2,029,143	2,031,124
Merchant bars	563,171	1,960,460	2,523,631
Bars for reinforced-concrete work		288,471	288,471
Skelp, flue, and pipe iron or steel	264,340	1,718,091	1,982,431
Long angle splice bars, tie-plate bars, etc	50,295	372,757	423,052
Hoops		211,028	211,028
Bands and cotton ties	180	345,739	345,919
Rolled sheet piling, not including fabricated		35,314	35,314
Railroad ties		33,249	33,249
All other finished rolled products	223,802	714,116	937,918
Rolled forging blooms, forging billets, etc	500	331,024	331,524
Exports of blooms, billets, sheet bars, etc	1,461	90,446	91,907
Total Gross tons.	1,167,776	17,202,420	18,370,196

In addition to the rolled-steel piling given in the table, 11,183 tons fabricated piling was reported. Of the finished rolled products given 93.6% was of steel and 6.4% of iron.

Miscellaneous

The production in 1914 included 1,939,185,000 lb. of tinplates and 146,195,000 terneplates, a total of 2,085,980,000 lb., which is an increase of 240,850,000 lb. over 1913, and is the largest output ever reported, with one exception, that of the year 1912.

The production of pipe and tubes in 1914 was 1,737,701 tons; 1,525,551 tons being of steel and 212,147 tons of iron. The make of seamless steel tubes was 90,595 tons.

The production of iron and steel forgings in 1914 was 341,121 tons; only 3675 tons of this quantity being of iron, while 337,446 were steel.

The production of cast-iron pipe in 1914 was 1,160,780 long tons, a decrease of 105,465 tons from the preceding year, or 9.09 per cent.

The production of hammered charcoal iron blooms and billets in 1914 was 39,925 tons, of which only 26 tons were sold as billets, the rest being used by the makers.

Pig Iron Made in 1915

A supplementary Bulletin of the Association gives the production of pig iron for the first half of 1915, in comparison with that of 1914. The figures in long tons are as follows:

	1914 First Half, Tons	1914 Second Half, Tons	1915 First Half, Tons
Basic	5,010,647	4,660,040	5,259,614
Bessemer	4,378,098	3,481,029	4,238,587
Foundry	2,454,540	2,078,714	2,207,375
Malleable	383,139	288,632	278,512
Forge	197,483	164,168	138,789
Spiegel and ferro	86,154	99,864	90,310
Miscellaneous	26,033	23,703	20,604
Total	12,536,094	10,796,150	12,233,791

Of the iron made in 1915, a total of 8,578,625 tons, or 70.1% was for the makers' use; 3,655,166 tons, or 29.9% being merchant iron, for sale.

According to fuel used in the first half of 1915, there were 12,061,808 tons made with coke; 42,487 tons with anthracite and 129,496 tons with charcoal. Low-phosphorus iron is included with bessemer in the table.

U. S. Barytes Output in 1914

The production of crude barytes in the United States in 1914 was 51,547 tons, an increase of 6249 tons over 1913. Stocks on hand at the close of 1914 were 7809 tons of crude domestic barytes, as compared with 9181 tons at the close of 1913. Missouri produces about 65% of the total output of the United States.

There has been considerable recent development in the manufacture of barium salts in this country, according to the Geological Survey. At Melrose, Calif., the Barbour Chemical Works is making barium sulphite, hydroxide, nitrate and chloride. A plant has recently been erected at Charleston, W. Va., and expects to begin the manufacture of barium oxide, hydrate, sulphide, nitrate, chloride and dioxide.

Gold Exports from Colombia in 1914 were 460,238 oz. of crude bullion, equal to 247,326 oz. of fine gold, or $5,122,224. These exports probably represent very nearly the production for the year.

PERSONALS

Pope Yeatman has returned to New York from Chile.

Harry J. Wolf, of Denver, is investigating mining property in the Cripple Creek District.

George O. Argall, manager of the Iron-Silver Mining Co., Leadville, has been in Denver on business.

Howard S. Lee, of San Francisco, was in New York, Aug. 8, and expects to remain there a few days.

Robert Flaherty has gone to Hudson Bay to make explorations on behalf of the Mackenzie & Mann interests.

C. B. Lakenan, general manager of the Nevada Consolidated, has been spending about three weeks in New York.

J. A. Durfee has been appointed metallurgist at the South Side works of the Jones & Laughlin Steel Co. in Pittsburgh.

Daniel L. Beck, Colorado School of Mines, '12, assayer for the Tomboy company, Telluride, is spending his vacation in Denver.

J. E. Chilberg is to examine Samuel Silverman's property on the Stikine River, 140 miles from Wrangell, in British Columbia.

Henry P. Lowe, manager of the Cariman Mining Co., Cardinal, Colo., while visiting in Denver was taken ill Aug. 3 and is in St. Luke's Hospital.

Justin S. De Lury, formerly assistant professor of geology in Idaho University, has been appointed lecturer in geology at the University of Manitoba.

T. T. Read, late associate editor of the "Mining & Scientific Press," has resigned and has accepted a position with the Engels Copper Co., at Engels, California.

Allen H. Rogers has returned from a four months' journey the purpose of which was to inspect the Bawdwin mines in Burma. He made the trip around the world.

J. P. Keane, of Sandon, B. C., with associates is operating the Ivanhoe concentrator as a custom plant and is there concentrating lead-zinc ores from Slocan mines.

Bruce Williams, who has been with W. George Waring for the past seven years, is now associated with him in the Waring & Williams Laboratories at Webb City, Missouri.

H. T. Durant, a well-known British mining engineer and a frequent contributor to the "Journal" is now a lieutenant in the 13th Hampshire regiment and expects to go to the front soon.

O. H. Hahn, whose name is well known to American lead smelters, writes us from Germany that he has been suffering from protracted illness, which has prevented him from doing much work.

A. M. Hunt, W. C. Peyton and Donald E. Fogg, the last formerly of the Thiogen company, have formed a firm for the practice of general chemical and metallurgical engineering at 55 Liberty St., New York City.

Guilford D. Scholl, who has been engaged in leaching and electrolytic work for Phelps, Dodge & Co. at Douglas, Ariz., has gone to Boston, having accepted a position with Walter E. Lummus, chemical engineer.

F. W. McNair, president of the Michigan College of Mines, Houghton, Mich., was entertained at a reception and banquet by the local alumni at the University Club, Salt Lake City, Aug. 4. Twenty alumni were present.

Frank H. Probert announces a change of address to Hobart Building, San Francisco, Calif., where he will continue in practice as consulting mining engineer and in the examination and valuation of mines and mineral lands.

E. E. Campbell, consulting engineer Granby Consolidated, has been in Juneau, Alaska, visiting the different properties. He returned to the company's mines at Hadley, Alaska, and Anyox, B. C., after a week's stay in Juneau.

Albert Burch has resigned as consulting engineer to the Goldfield Consolidated Mines Co. and as vice-president and general manager of the Aurora Consolidated Mines Co. He intends to devote more time to general engineering practice.

W. H. Wright, for several years superintendent of the Ashburton Mining Co. at Folsom, Calif., and a dredge operator of wide experience, has recently joined the engineering staff of the Malm-Wolf Co. of Denver. Mr. Wright has gone to Idaho on professional business.

Clifford E. C. Smith, consulting mining engineer, Toronto, Ont., has been elected a member of the Institution of Mining & Metallurgy, London. He was also recently elected a governor of the School of Mining and College of Applied Science, Queen's University at Kingston, Ont.

Captain Hart Martin, of the Coniagas Mine, Cobalt, Ont., was recently presented with a giant leaf of silver, suitably engraved, on the 10th anniversary of the beginning of mining operations at the Coniagas. The presentation was made by Major Leonard, president of the company.

Milo W. Kreeji, formerly metallurgist at the Boston & Montana Reduction Works of the Anaconda Copper Mining Co., has been promoted to the position of assistant superintendent. He is succeeded in his former position by E. S. Bardwell, who has been general foreman of the concentrator.

J. K. Cram, formerly in charge of operations at the Consolidated Mining & Smelting Co.'s Highland mine, near Ainsworth, B. C., is now superintendent at the company's Sullivan group lead mine in East Kootenay, succeeding C. H. McDougall, who has been transferred to Trail, where the company is making important additions to its smelting works.

A. E. Custer, assayer and chemist, has opened an office at 31, Postoffice Place, Salt Lake City. He was formerly chief chemist of the Bingham Consolidated smeltery at Midvale, and was with the United States government assay office in Salt Lake for four years. Mr. Custer obtained the first option on the alunite deposits at Marysvale, Utah, now known as the Custer Group, which the Mineral Products Co. is developing.

G. W. Riggs of the U. S. Bureau of Mines, first-aid department, is giving first aid and rescue demonstrations to miners in several mining towns along the Mother Lode. Teams from Jackson, Angels Camp, Jamestown and others will take part in the field meet at the Exposition in September and Mr. Riggs' visit is in response to requests for additional instruction and coaching. These teams were formed during the recent visit of the rescue car to California mines.

The Minister of Lands, Forests and Mines of Ontario has announced the appointment of the commission to investigate the nickel industry, which was authorized some time ago. The chairman is George T. Holloway, of London, England, a consulting metallurgist who was recommended by the British authorities. The other members are Thomas W. Gibson, deputy minister of mines of Ontario; Dr. Willett G. Miller, provincial geologist; and Dr. McGregor Young, professor of constitutional law in the University of Toronto.

OBITUARY

Robert Parrish died at Covington, Va., July 23. He was prominent in Virginia mining and had been president of the Oriskany Ore & Iron Co. for some time.

A. H. Henrietta died at Knapp's Creek, N. Y., July 30, aged 71 years. He was for many years a prominent oil operator in New York and Pennsylvania.

William Sterling Porter, second vice-president and general manager of the Associated Oil Co. of California, died at San Francisco, Aug. 9. He was 49 years old. Besides his executive position with the Associated Oil Co., he was vice-president of the Amalgamated Oil Co. and was associated in the directorate of several other oil concerns. In April, 1910, in company with George C. Priestley, he organized the Central Fuel Co., a $15,000,000 corporation. This company held options on a large acreage of Oklahoma oil lands, and it was announced would contract to furnish fuel for the Southern Pacific. Through Samuel Untermyer much of the capital for the company was raised in London.

R. M. Wright died at Marigold, Calif., July 22. He was born at Council Grove, Kan., 62 years ago and was buried there. He was a mining man of the old school in Colorado and for 10 years was employed as underground foreman at the Smuggler-Union at Telluride. He was one of the foremost men in the Smuggler-Union defense against the strikes and rioting of the Western Federation of Miners. In the past 10 years he was employed by the same interests as bookkeeper for the Ashburton Gold Dredging Co. at Folsom and the Marysville Gold Dredging Co. at Marigold, Calif. His wife was in Philadelphia at the time of his death and his son, W. H. Wright, mining engineer, of San Francisco, carried the remains back East for burial. Mr. Wright's death was due to asthma, from which he suffered for several years.

George G. McMurtry, of New York, died at Atlantic City, N. J., Aug. 6, aged 78 years. He was for many years well known in the Pittsburgh steel trade, and under his charge as manager the extensive works of the Apollo Steel & Iron Co. at Vandergrift were built. When the company was

absorbed by the American Sheet & Tin Plate Co. he became a director and president of the consolidation, and later chairman of the board. After the change he removed from Pittsburgh to New York. He was interested in other companies and was a director of the American Can Co., a director of the Chicago, Rock Island & Pacific Ry., the Pittsburgh Trust Co., and the Rock Island Trust Co. He was a member of the Metropolitan and Sleepy Hollow Country Clubs and the Automobile Club of America. He is survived by his widow, who was Miss Clara Lothrop, and by three sons. The works at Vandergrift which he built were the first in the Pittsburgh district in which careful provision was made for the safety and comfort of the employees.

Dr. Thomas Bliss Stillman died in Jersey City, N. J., Aug. 10, aged 63 years. He was born at Plainfield, N. J., studied at Rutgers College, at the Fresenius Laboratory at Wiesbaden, Germany, and at Stevens Institute, Hoboken. From 1883 he was instructor in analytical chemistry at Stevens Institute, and later professor. In 1903 he was made professor of engineering chemistry and in 1909 retired from active work as an instructor. For several years he had been at work on a revision of his book on "Engineering Chemistry." Professor Stillman held many important positions in New Jersey. In 1884 he was appointed state inspector of oils, in 1911 he was appointed city chemist of Jersey City and Bayonne, and held those offices until his death. Professor Stillman was also appointed an examiner in chemistry for the Municipal Civil Service in 1911, and was later appointed chemist to the Medical Milk Commission of Newark, N. J. He was a member of the American Chemical Society, the Society of Chemical Industry of London, the American Institute of Mining Engineers, the International Association for Testing Materials, the American Electro-Chemical Society, the Société Chimique de Paris and the fraternity of Phi Beta Kappa. Professor Stillman was also a corresponding member of the Edinburgh Society of Arts and Sciences and the Deutsche Chemische Gesellschaft. He leaves a wife, two sons and a daughter.

Alexander Milne, who died Aug. 1 at his residence, White Plains, N. Y., aged 82 years, was senior member of the firm of A. Milne & Co., New York, Boston and Chicago, steel and iron merchants. Mr. Milne was born in Montrose, Scotland, but went to Sheffield, England, when about 19 years of age and entered the employ of Henry Roessel & Co., steel manufacturers and merchants, and later with the well-known firm of Vickers Sons & Co., Ltd., who in 1869 sent him to this country to promote the sale of its steel in America. Two years later he was associated with the firm of Naylor & Co., and became a member of the firm in 1883; while associated with them he took an active part in the management of the Norway Steel & Iron Company, Boston, Mass., where his practical knowledge of the manufacture of steel acquired in Sheffield proved of great value in the development of the business of that company. He withdrew from the firm of Naylor & Co. in 1887 and established the firm of A. Milne & Co., iron and steel merchants and representing Alrutz & Co. and their successors, C. & J. Svedberg, of London and Stockholm. He was well and favorably known among the iron and steel manufacturers of this country, remaining in active business up to the time of his death. Mr. Milne was interested in religious and charitable matters and was the first president of the Y. M. C. A., of White Plains. He is survived by his wife, a son, Alexander Milne, Jr., and a daughter, the wife of W. Russell Silvers, of Cranberry, New Jersey.

INDUSTRIAL NEWS

Gullén & Dole, Sucesories de José Juliá, Trujillo, Honduras, would be interested in receiving catalogs concerning mining equipment and stamp-mill machinery.

E. M. Sargent, of Balfate, Honduras, via New Orleans and Trujillo, is interested in the installation of a cyanide plant, and would like to receive catalogs of cyaniding machinery and equipment.

The Calumet & Hecla Mining Co. has installed 23 more large Hardinge mills, 16 of these for their new regrinding plant, six for the Ahmeek Mining Co., and one for the Lake Mining, Smelting & Refining Co.

The Morse Bros. Machinery & Supply Co. of Denver recently shipped seven carloads of machine tools to various manufacturers in the East engaged in war contracts. Most of the equipment was turret and engine lathes.

A new method of recording the cost of various conveyor belts in operation has been worked out by the B. F. Goodrich Co., of Akron, Ohio, in the interest of belt users, which will send on request a card giving the details of the system.

The Mesta Machine Co. is distributing a blue-print giving the solution in graphic form of various gear and pulley problems. That is, in gearing, if the horsepower transmitted is given, with the revolutions per minute and pitch speed, the pitch diameter and pitch load may be determined.

The Morse Bros. Machinery & Supply Co. of Denver have recently installed a complete flotation testing plant in its Denver storeroom, the use of the plant being offered free to those wishing to make their own tests and experiments along this line. Competent assistance is also given to those desiring it, and free preliminary tests will be made on any ores or tailings sent them. Quite a number of the recent flotation installations in Colorado have had their inception at their plant.

The Spray Manufacturing Co., which was recently incorporated to construct spray cooling systems, gas scrubbers, odor and fume condensers, etc., will carry on general engineering work involved in the use of spray systems, and owing to the broadening of the scope of its work, has changed its name to the American Spray Co. The personnel of the company remains unchanged, with A. G. Eneas president and chief engineer. Offices remain at 201 Devonshire St., Boston.

Edward M. Hager, whose election as president of the Hager Portland Cement Co. has been announced, was graduated from the Massachusetts Institute of Technology in 1893. In 1899 he was appointed manager of the cement department of the Illinois Steel Co. The manufacture and sale of universal portland cement was carried on by the Illinois Steel Co. until 1906 when the Universal Portland Cement Co. was formed with Mr. Hager as its president. Mr. Hager resigned the presidency of the Universal Portland Cement Co. in February of this year to form a new company for the purpose of acquiring a chain of Portland cement plants extending aeross the country.

TRADE CATALOGS

Carbo Steel Post Co., Chicago, Ill. Catalog. Steel Poles. 20 pp., Illus., 9¼x4 inches.

Blackmer Rotary Pump Co., Petoskey, Mich. Catalog. Rotary Pumps. 32 illus., pp., 6x9 inches.

The Gardner Governor Co., Quincy, Ill. Circular A-C 13. Air Lift Pumping System. 16 pp. illus., 6x9 inches.

Kerr Turbine Co., Wellsville, N. Y. Bulletin No. 54. Economy Turbo-Generators. 32 pp., illus., 6x9 inches.

De Laval Steam Turbine Co., Trenton, N. J. Catalog F. Centrifugal Blowers and Compressors. 64 pp., illus., 6x9 inches.

R. D. Nuttall Co., Pittsburgh, Penn. Catalog No. 12. Mine and industrial gears, pinions, trolleys. 62 pp., Illus., 7x9 inches.

Bethlehem Foundry & Machine Co., S. Bethlehem, Penn. Pamphlet. Tantiron. Chemical Resistant Metal. 8 pp., 6x9 inches.

The Du Pont Nitrate Co., of Wilmington, Delaware, is installing a 24-in. and 48-in. Symons disk crusher in the nitrate fields of Chile.

Chicago Pneumatic Tool Co., 1010 Fisher Building, Chicago, Ill. Bulletin E-36. Duntley Electric Grinders. 8 pp., illus., 6x9 inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1632. Centrifugal Pumps and Centrifugal Pumping Units. 44 pp., illus., 7½x10½ inches.

Hardinge Conical Mill Co., 50 Church St., New York. Pamphlet. Reprints of Articles from Technical Papers on Hardinge Mill. Illus., 6x9 inches.

Stephens-Adamson Mfg. Co., Aurora, Ill. Section 5, General Catalog No. 19. Sand and Gravel Washing Plants, Screens, Cars, Hoists, Etc. 622 pp., illus., 6x9 inches.

Chalmers & Williams, Inc., Chicago Heights, Ill. Bulletin. Section U, Fourth Edition. Symons Disk Crusher. Spanish translation of Bulletin, Section R. 24 pp., illus., 7x9 inches.

National Tube Co., Frick Building, Pittsburgh, Penn. Catalog J. "National" pipe for steam, air, gas, water, "Kewanee" unions and specialties, iron and brass fittings, valves, etc. 394 pp., Illus., 5x7½ inches.

Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog U. Brownhoist Transfer Cars and Larries. 32 pp. illus. 9x6 in. Illustrations and brief descriptions of some of the important transfer cars built by this company for important metallurgical plants.

Editorial Correspondence

SAN FRANCISCO—Aug. 4

A Receiver for the Presidio Mining Co. has been asked in the U. S. District Court by minority stockholders. The plaintiffs are Captains W. S. Overton and Carl A. Martin, of the U. S. Army, who appear also for other stockholders residing in the East. These include also Gen. Anson Mills, U. S. A., retired, of Washington. The plaintiffs represent 22,753 shares of the total issue of 150,000 shares. The complaint alleges that William S. Noyes owns or controlls 97,933½ shares and that he has so manipulated the finances as to obtain title personally to mining property in Texas which should belong to the corporation. The suit demands an accounting. Judge W. H. Sawtelle sitting at San Francisco issued a temporary restraining order and an order to show cause why a receiver should not be appointed.

Chrome Deposits in California are attracting attention of investors. Clarence M. Oddie and associates, of San Francisco have recently purchased claims near Dunsmuir and near Willows. It is reported that French investors are associated with Mr. Oddie in these purchases. Chromite occurs in 15 counties in California, and nearly all of the recorded claims have produced some ore. The industry has been largely retarded by lack of transportation facilities, the mines or deposits generally being situated at such distance from railroads as to make freight transportation expensive. The industry has produced about 31,000 tons of ore of a total value of approximately $400,000 since 1887. The production in 1913 amounting to 1180 tons came from Calaveras and Shasta Counties. The 1912 production of 1270 tons came from Fresno, Shasta and Siskiyou Counties. San Luis Obispo County was at one time a large producer and up to 1890 had produced 11,000 tons which was shipped to Baltimore and Philadelphia.

The First Team to Win, as a prize, the privilege of representing its state and section in the Third Annual Joint Field Meet and Demonstration of the United States Bureau of Mines and the American Mine Safety Association, to be held in San Francisco, Calif., Sept. 23-24, is the Lehigh, Oklahoma, team. This team won the interstate championship of the Southwest in the contest held recently at Kansas City between teams representing six Southwestern states, these teams having been selected as a result of state-wide meets previously held in the various states. At the Kansas City meet, which was held in Convention Hall, the following scores were made, out of a possible 900:

Lehigh, Oklahoma, team	888
Frontenac, Kansas, team	883
Hocking, Iowa, team	843
Texas team*	824
Bevier, Mo., team	823
Calhoun, Okla., team (representing Arkansas)	812

*The regular Texas team did not appear at the contest, the team listed being a scrub team picked from the audience in order to make the six teams. This team did not compete for the grand prize.

Apex Litigation has been started by the North Star Mines Co. of New Jersey against the Empire Mine & Investment Co. of San Francisco. Both companies operate at Grass Valley, Nevada County. It was believed for a time that the controversy might be settled out of court, or before getting into court. Engineers were employed by both sides but it appears that no satisfactory settlement could be reached without a law suit. The complaint filed in the U. S. District Court alleges that the Empire has invaded the North Star by two shafts known as the Empire and the Pennsylvania which are situated east of the North Star property. It is claimed that $10,000 worth of gold-bearing ore has been taken out through the Empire shaft and $5000 worth by drifts from the Pennsylvania shaft. The lowest level of the North Star at 4600 ft., incline, disclosed a vein of good ore. The Empire claims apex rights to a part of this vein. This claim is based mainly on the results of the suit of the Pennsylvania against the W. Y. O. D. in which the plaintiff obtained a verdict and absorbed the defendant company. Both these companies were later absorbed by the Empire. That litigation was costly and showed a complex vein structure, which may or may not aid in the settlement of the present suit.

Mount Lassen Mud promises to make some amends to the farmers for the devastation of crops and tillable ground. The mudflow from the big eruption on May 21, covered large areas in Hat Creek valley, filled up the stream causing overflow to alfalfa fields. Many of these fields have produced extraordinary crops of alfalfa which has come up through the mud. In some places the alfalfa is a foot and a half high and will make a ton and a half to the acre. In some cases the alfalfa was too young to push through the mud, but the soil has not been killed. Another advantage resulting from the filling up of Hat Creek is that a crooked stream has been made straight by digging a canal and changing the meandering course of the creek. In the lower part of the valley out of the range of the mudflow the crops have never been better. And this in spite of the fact that the sulphur fumes extended far beyond the flow of the mud. Mount Lassen is now a good mountain. At any rate Mr. Diller of the U. S. Geological Survey says that the eruption late in July may be counted as the last of any importance. The fact is that none of these eruptions have been important from a geological viewpoint. It has been somewhat interesting to travelers, many of whom have preserved bottles of fine crushed stone or dust which the self-styled guides have called ashes. Since there has been no fire there have been no ashes. It is pleasing to reflect that after all the farmers will benefit from Mt. Lassen's behavior.

The Apex Controversy between the Kennedy Extension Mining Co. and the Argonaut Mining Co. in Amador County may be finally settled by the purchase of the Muldoon mine by the Argonaut. The claim of the Kennedy Extension that the apex of the Argonaut ledge was in Muldoon ground was denied by Judge Wood in the Superior Court after a long and expensive trial. Subsequently the plaintiff endeavored to reopen the case and this was also denied. A notice of appeal to the Supreme Court was filed but the appeal has not been taken and it is now intimated that the ground owned by the Kennedy Extension will be purchased by the Argonaut, not so much for its value as for ridding the Argonaut of further annoyance of lawsuits. The question of apex was stirred up a good many years ago by Mr. Muldoon the owner of the Muldoon mine and the Argonaut could have purchased the entire property at that time for a sum not exceeding $50,000. The manager of the Argonaut at that time did not consider the Muldoon of sufficient importance either as a mine or a neighbor to buy it at any price. The subsequent law suit has cost the Argonaut a large amount of money and has retarded development and operation to an extent that would have been very disastrous to any other than a large producer. While it is not believed, by persons acquainted with the legal status and the geological conditions, that the Kennedy Extension will ever carry the case to the Supreme Court, it may be the part of wisdom to get rid of such a possibility by purchasing the Muldoon property outright.

DENVER—Aug. 5

Production Cripple Creek District for June, according to reports from plants treating its ores, was $1,127,685 in gold, from a gross tonnage of 82,050. Of this tonnage, about 62½% was of high-grade ores shipped to outside plants for smelting and cyanidation.

Colorado Fuel & Iron Co.'s steel works at Pueblo are doing record business, working to capacity with 3190 men on the payroll. Large orders for 90-lb. rails are being filled for the El Paso & Southwestern, Salt Lake & San Pedro and the Denver & Rio Grande railroad systems. The merchant mill department is busy with important shipments to the Chinese government.

Deposits of Gold at the United States Mint, Denver, during the fiscal year ending June 30, 1915, amounted to $430,000,000 (in round numbers), an increase of about 15% over the preceding year. This gold was received from a greater number of mining camps than ever before.

Roosevelt Tunnel Will Be Pushed 8500 ft. from its present breast at the western margin of the Cripple Creek basin near the Elkton mine. Work will be done on company account instead of, as contemplated, under contract and will be superintended by C. H. Fuller who was superintendent of the project during the original contract held by A. E. Carlton. It is estimated that the advance will cost $20 per foot. Contemplated terminal will be in Golden Cycle territory where it appears certain that drainage will have been established for the whole district. The directors of the drainage enterprise

are A. E. Carlton, William Lennox, Irving Howbert, John T. Milliken, James F. Burns, Irving T. Snyder, A. J. Zang and Richard Roelofs. Last two members have just been appointed to fill vacancies caused by resignation of A. L. Burris and the death of Frank F. Castello.

Mine Operators Are Preparing for the new workmen's compensation law. Any employer may elect not to carry indemnity insurance for his employees, but he must public announce this decision and must be prepared to protect himself in suits brought against him for injuries sustained by employees and he will have practically no defense left him under the law. There are four ways in which he can comply with the insurance features of the new law, viz., by establishing his responsibility and satisfying the commission that he is able to carry all such risks; by purchasing policies for his employees from companies writing liability insurance; by purchasing such insurance protection from the state's compensation insurance fund; or by cooperating with other employers in forming a mutual insurance company to be approved by the insurance commissioner. Regular insurance companies have been so eager in soliciting patronage that the state's commission found it necessary to announce a resolution forbidding all insurance concerns from offering or giving any rebates, refunds or profit-sharing endorsements. This means that numerous contracts already entered into must undergo revision and that the flat rates as published must be rigidly adhered to. W. W. Greene, manager of the state's insurance fund, says that he has already arranged for indemnity insurance on $5,000,000 of payroll to metalliferous miners and expects to receive applications for insurance on approximately $2,000,000 more payroll.

Empire Zinc Co. has purchased the holdings of the Eagle Mining & Milling Co. near Belden, Eagle County, Colo. The property comprises two mines, aërial tramways, water rights, hydro-power line and fine mill on the main line of the Denver & Rio Grande R.R. in the cañon of Eagle River. W. H. Paul, manager of the Empire company, will have control of future operations with Mr. Boyd as superintendent, and plans are made for doubling the output. The properties comprising the mining group were formerly owned by two distinct companies that worked their respective groups for gold-silver orebodies, which occur as irregular masses in pitching sedimentaries. During early operations, the ores were thoroughly oxidized and yielded well in the native metals. As depth was gained sulphides became abundant and sphalerite proved so predominant that it precluded profitable mining under the then prevailing penalties exacted by smelters. This handicap was but half the trouble that closed down the Iron Mask and the Rocky Point mines. The workings of the former mine were within a geological series underlying that containing the Iron Mask orebodies. Following their oreshoots into the mountain, owners of the Rocky Point mine delved within the boundary planes of the other company's holdings. Litigation ensued and both mines remained idle for many years. Meanwhile, efficient methods for concentrating zinc ore having been invented and the market for such material having been created, these properties were brought to the attention of S. N. Hicks of Denver, who purchased them outright and, with the coöperation of Charles H. Hanington, reopened the mines and added the equipment that has been treating an increasing tonnage for several years past. The run-of-mine averages about 17% zinc and 1.5% lead. Milling includes pulverizing, roasting in two six-hearth Dewey units, cooling,, magnetic separation, regrinding, sizing and table concentration. One ton of galena concentrate is produced with each 10 tons of sphalerite concentrate. The former will average 75% lead, the latter about 48% zinc. Average daily tonnage of ore treated during last year was about 120 tons and earnings were more than $250,000. The plant includes a 120-hp. Pelton wheel.

SALT LAKE CITY—Aug. 5

The Salt Lake Stock & Mining Exchange is showing considerable activity, with inquiry and trading in local stocks from outside points. During July there were traded in 1,973,319 shares, with a valuation of $279,969, the sales for the last week being valued at $82,860. The heaviest months trading recently was in June, when the transactions were valued at $380,964.

Tenth Biennial Report of State Coal Mine Inspector, J. E. Pettit, for the years 1913 and 1914, shows that coal produced during the latter year amounted to 3,149,491 short tons, coke to 348,806 tons, an increase of 10% over 1913, the hydrocarbon production to 17,480 tons. There were employed 4068 coal miners, who worked an average of 196 days during the year. For each accident that occurred 20,720 tons of coal was mined, and one life was lost for every 165,236 tons mined. Carbon County had the largest output and Emery County next.

The Utah Power & Light Co., which serves a large part of Utah, Idaho, and Colorado, has completed plans for extending its electric power and light service into Emery and Carbon counties in eastern Utah. The company's transmission lines will be extended from the present system; and power will also be developed from hydro-electric plants. It is proposed to erect a steam-turbine generating station in the center of the district, pending the completion of the water-power plants. The Scofield electric-light plant and a power site on the Price River near Helper have been purchased.

A New Mill at Park City is to be constructed by C. C. Broadwater of the Merrill Metallurgical Co. and San Francisco interests to treat tailings on the Grasselli Chemical Co's property, recently secured under bond and lease. Plans are being drawn by Kirk & Leavall of this city; and it is understood that the mill will be similar to that of the Big Four Exploration Co. just completed to treat tailings at Atkinson. Work will be started shortly on the millsite northwest of the tailings. A part of the machinery in the 125-ton mill now on the property will be used. Beside straight concentration, flotation equipment will be installed. The dumps are estimated to contain 300,000 to 400,000 tons of tailings carrying zinc and lead-silver.

Suit against the Ohio Copper Mining Co., Clark Grove, Edward McCormick, and Charles T. Clark as trustees in bankruptcy for the Ohio Copper Mining Co., the Bingham Central Ry. Co., and the Utah Power & Light Co., was filed in the district court July 16, by the Empire Trust Co., as trustee, to foreclose a mortgage given to secure $2,000,000 worth of bonds. It is stated that $1,242,000 of the outstanding bonds are entitled to benefit under the mortgage, and that the remainder have been retired, or are held by the trustees in bankruptcy for the Ohio Copper Mining Co. and not entitled to benefit. The court is asked to appoint a receiver to handle the property, to order a foreclosure, and to quiet title to the property as against the various properties claiming interest in it. The bonds were issued by the Ohio Copper Co., and were secured by mortgage on the company's Bingham properties. The company went into the hands of receivers September, 1914, and was later turned over to a board of trustees in New York, who leased the property to A. Frank and associates, now operating it.

SEATTLE—Aug. 2

A Ledge Carrying Free Gold has been found in the Tolovana district and has been traced for nearly three miles along the left limit of Livengood Creek, where gold was first discovered in the camp. The ledge is 12 ft. wide and promises to develop into a big proposition.

Striking Miners in Fairbanks have concluded that $4 for eight-hours' work is better than idleness and have gone back to work. The strike which was a matter of a week, for a time assumed serious proportions and threatened to curtail the output of the camp which is generally expected to be larger this year than last. The operators issued an ultimatum that they would pay only $4 for eight-hours' work and no more and would close down the placer camp for the entire season if necessary. Every claim that was in operation before the strike is now working again to capacity; many of the operators having put on extra crews to make up for the lost time, so that no effect is likely to be shown in production of the camp.

Fifty Dredges in Operation on the Seward Peninsula is the prediction of several of the placer operators in the Nome district who state that there is no question of the future of the dredging industry in that section. Last year 42 dredges operated successfully on the peninsular and this year two more are to be installed and by the end of the year it is expected that 50 will have been constructed. The newest enterprise to arrange for the installation of a dredge on the peninsula is that of A. J. Jarmouth and associates of New York. They will install a 5-cu.ft. bucket Bucyrus gold dredge on Cripple Creek 12 miles from Nome. The machinery is to be shipped north this fall so that the dredge can be put up next spring where they have secured several miles of good placer ground which will be worked systematically.

More Mining Work Is Going on Around Valdez this summer than at any time in the last 10 years. Mines in the interior are also being opened and developed. The Rutherford-Ramsay property near the Valdez Glacier is working 20 men, while at the Granite a crew of 70 men is employed, operating the two big mills and blocking out ore for future crushing. The Tenas Pontius property near the Columbia Glacier is working a crew of men and several bricks valued at $11,000 were recently brought to Valdez from the claims. The Granby copper mines in Solomon basin are being developed and the big equipment on the claims placed in shape for handling the ore that will be taken out this fall. The Ellamar copper mine is working more men than at any time in the history of the mine and many new properties are being investigated.

SEWARD, ALASKA—July 28

Moose Pass, a district but forty-five miles north of Seward, has been the cause of considerable excitement lately because of the arrival of a couple of well-known prospectors bringing some exceptionally rich specimens of gold-bearing quartz. Various small ledges carrying sufficient free gold to be visible to the naked eye have been known to exist in this section, certain prospectors having made high wages by crushing the quartz in a hand mortar and separating the gold by panning. Early in July J. B. Slater, operating a small arrastre, took out $150 in a week's time. The samples of the new strike now on exhibition are far richer than those hitherto reported, the quartz being studded with lumps of gold as large as duck shot. Like most of the ledges thus far discovered in the district, the one just located is rather narrow, its maximum width not being over 14 in. The discoverers have exposed the vein for about 60 ft. and estimate that for this distance, the ore will average at least $1000 to the ton. Some of the crushed quartz has yielded $3 to the pan and it is asserted that a man can easily mortar an ounce of gold per day out of the solid rock.

KELLOGG, IDA.—Aug. 2

Stock Sales by the 20 Brokers who are members of the Spokane stock exchange aggregated not less than $1,500,000 in July, and it is believed this record will be eclipsed in August. From the best information obtainable the number of transfers during the month was greater than for any previous month in the history of the organization, but the value is less, as the principal trading has been in the low- and medium-priced issues, while in former periods of mining activity, particularly during the "boom" of 1906, the high-priced securities were the leaders.

A Bureau of Mines Coöperative Experimental Laboratory to investigate the proper treatment of the zinc-lead ores of the Coeur d'Alenes will be established in Idaho. D. A. Lyon, metallurgical expert of the Bureau, who, with F. G. Cottrell, visited the district last week, is credited with the announcement of intention, providing the State University succeeds in getting the right man for head of the mining department. An effort will also be made to develop a method of producing metallic lead and zinc from their ores without smelting, in line with the experimental work now being done at the Bunker Hill & Sullivan. Doctor Lyon stated that some of the mines in the West were saving only 50% of the metals in their ores and that the Bureau of Mines hoped to develop special processes of treatment by which the extraction could be raised to 80%. He also stated that it was planned to establish experimental laboratories in the Coeur d'Alenes even if none should be placed at Moscow.

HOUGHTON—Aug. 10

As An Example of Prosperity in the copper country, recently two of the men on a railway payroll were down for checks of $110 each for two weeks work. Business houses report a large number of Calumet contract miners' checks running in the vicinity of $100 for the half-month pay day.

The Production of Copper from Various Lake Superior Mines for the month of July, based upon rock tonnages, estimating return in stamp mill and refinery are: Calumet & Hecla, 8,050,000 lb.; Quincy, 2,000,000, Copper Range Consolidated, 5,400,000; Winona, 200,000; White Pine, 450,000; Houghton Copper, 70,000; Tamarack, 450,000; Osceola Consolidated, 1,900,000; Ahmeek, 2,300,000; Wolverine, 700,000; Mohawk, 1,300,000; Franklin, 270,000; Centennial, 280,000; Allouez, 850,000; Mass Consolidated, 500,000; Superior, 360,000; Hancock, 175,000; La Salle, 125,000; Victoria, 260,000.

A Record Production of 27,000,000 lb. of copper was made in the Lake Superior district in July and 28,000,000 lb. seems assured for August. While it is stated on the best authority possible that the bulk of the copper produced here is sold up to September and in some cases to October, the fact remains that the metal is beginning to accumulate at some of the docks, particularly the Dollar Bay dock of the Calumet & Hecla subsidiaries and at the Copper Range dock. The amounts are not disconcerting as yet and a few vessels could clean them up, but, after the rush of a few months ago when every scrap of copper was cleaned out in a hurry, these dockage evidences occasion some talk locally among copper-share owners.

ISHPEMING, MICH.—Aug. 8

The Pittsburgh & Lake Angeline Iron Co., which has operated the Lake Angeline mine at Ishpeming since 1864, and which owns considerable land in Northern Michigan, will offer all of its holdings in the state for sale at public auction on Sept. 15, 1915. All of the property of the company, real, personal and mixed will be sold. This will mark the end of one of the famous Michigan iron companies, as the Lake Angeline mine has long been a producer of high-grade bessemer iron ores, and is now about played out. For the past year the company has been operating the mine with a small force and getting out the little ore that remained. The Mitchell mine, at the Winthrop, also belongs to the company and will be sold. It is believed that the property of the Pittsburg & Lake Angeline Iron Co. will be bid in by the Jones & Laughlin Ore Co., which owns a part of the Lake Angeline stock. The two companies have been working together and have been under practically the same management for years. The Lake Angeline mine has produced 9,003,000 tons of iron ore. The profits have been well up into the millions, as the ores were the richest mined in the Lake Superior district and always commanded a premium in the market. Some mining men believe that there is a possibility of finding more ore in the east end of the mine and it would not be surprising if the Jones & Laughlin company should start exploring there if they come into possession of the company's holdings.

DULUTH—Aug. 7

Iron Ore Shipments from Duluth-Superior harbor to Aug. 1 were 2,126,807 tons ahead of same period in 1914. Figures are as follows:

Dock	1915	1914
D. M. & N.	6,710,660	2,949,285
Iron Range	3,993,704	2,898,771
Gt. Northern	2,686,778	5,423,034
Soo	388,052	272,005
N. P.	25,344	43,636
	13,714,538	11,587,731

Figures for the month of July are:

	July, 1915	July, 1914
D. M. & N.	2,414,849	1,169,410
Iron Range	1,413,456	1,162,315
Gt. Northern	1,150,310	1,806,273
Soo	143,344	175,153
N. P.	19,784	6,807
	5,143,743	4,319,958

JOPLIN—July 31

Joplin Mines Cannot Be Unionized. The outstanding event in this district last month was the total collapse of the miners' strike following a strenuous campaign to unionize the mines. About the middle of June some labor agitators from the Southeastern Missouri lead fields came to this district and with the assistance of a few local malcontents began organizing locals of the American Metal Miners Union. On June 28 they began visiting the more important mines throughout the district and ordered the miners to cease work after presenting an arbitrary wage scale which the operators almost without exception refused. At the end of the week approximately 4000 were out, many of whom joined the new union. Mine owners made no attempt to operate and in a number of instances voluntarily shut down. In a few days the fact began to dawn on our local miners that they had been bluffed into quitting good jobs at the highest wages they had ever received, by a lot of outsiders who had neither interest or residence in this district. Merchants throughout the district immediately notified the miners that they would not extend credit to men who had quit work. The first Saturday found both empty pockets and empty larders in many miners' homes. Before the end of the second week miners began holding meetings in the various camps of the district, from which the strike leaders were barred, with the result that operators were petitioned to reopen the mines at the wage scale in force when the strike started, and hundreds of miners who had been coerced into joining the union tore up their cards. On July 12 operations were resumed all over the district, and the strike leaders took their departure. This district cannot be successfully unionized, for the reason that a majority of working miners are always carrying an interest in some prospect and as soon as these prospects develop into mines the miners leave their jobs and go to work in their own diggings, thus becoming employers of labor instead of employees, under which conditions they have no use for the union.

TORONTO—Aug. 7

The Recent High Prices for Zinc has turned attention to the ore deposits of this metal in Ontario. A mining engineer representing certain Toronto interests passed through Fort William en route to Rossport, a village in this district located on the north shore of Lake Superior, to inspect the abandoned Zenith zinc mines, 12 miles from that town. If his report on the property should be favorable it is the intention of the syndicate to reopen the mine and to operate it as long as the present remunerative prices obtain. Although there are several well-known deposits of zinc in the Province, past low prices have not encouraged mining operations. Government reports show that since 1910 no zinc has been mined in the Province

The Mining News

ALASKA

GRANITE GOLD (Port Wells)—Lower adit finished and raise to mine workings started.

KOOTZAHOO INLET (Juneau)—J. C. Hyde, C. J. Gundlach, John Sandman, and Peter Carlson are sinking shaft on 4-ft. dipping vein of coal (grade between lignite and semi-bituminous) at Kootzahoo Inlet. Expect to diamond drill property later.

ALASKA CONSOLIDATED (Juneau)—H. K. Welch has been examining Harrington claims, adjacent to Alaska Gastineau and Alaska Gold Belt properties, and has also been examining Auk Bay properties. Mr. Welch expects to return to New York in near future to report on his work to directors of company.

ALASKA INDUSTRIAL (Sulzer)—Ex-governor Sulzer of New York has been in consultation with General Manager Charles A. Sulzer regarding plans for extension of Sulzer mine. Plans are to drive lower adit tunnel to avoid hoisting ore. Sulzer mine has been continuous producer for 14 years, with exception of few months just after start of European War.

ALASKA GOLD (Juneau)—Annex Creek power-project tunnel to tap upper lake started July 23. Tunnel will have circular section 8 ft. in diameter. Distance to drive, 1200 ft. before raising to lake bed. Water will be conducted from mouth of tunnel through pipe to power house on beach about a mile and a quarter from tunnel. H. L. Wollenburg, chief engineer, John Wilcox, superintendent, and Byron Olson in complete charge of tunnel.

ARIZONA

Cochise County

CALUMET & ARIZONA (Douglas)—Smeltery with two blast furnaces, three reverberatories and twelve roasters made output of about 7,250,000 lb. of copper in June, establishing new high record.

Gila County

INSPIRATION (Miami)—Is now treating 2500 tons of ore daily and next month expects to reach 7000 tons daily. Reported saving 27 to 28 lb. of copper per ton compared with 25 lb. estimated.

Greenlee County

ARIZONA COPPER (Morenci)—Is installing Callow system, after having investigated other methods of flotation.

Pima County

CLEOPATRA and HALL (Jerome)—These properties, have been under option to United Verde Copper Co. It is said that formal transfer has been made. Said to involve approximately $1,000,000.

NEW CORNELIA (Ajo)—Announcement from C. & A. offices that Jas. H. Maxey, of Yuma, has been awarded contract to build 44 miles of Tucson, Cornelia & Gila Bend railroad from mine to S. P. main line at Gila Bend. Contractor was lowest of 11 bidders.

IMPERIAL (Ray)—American Smelting & Refining Co. is reported to hove ordered examination of this mine in Ray district with view of purchasing. Imperial was recently purchased by Lee Goldschmidt, of Tucson at sheriff's sale. The property has record of producing more than one million dollars worth of ore. The ground to be thoroughly explored by churn drills in order to determine extent of copper deposit.

Pinal County

KELVIN-SULTANA (Kelvin)—Company is shipping three cars of concentrates a month to Hayden. Leasers recently shipped car of carbonate ores. South crosscut on 500 level has been advanced 195 ft.

CALIFORNIA

Eldorado County

LATROBE, a mining town and railroad station in the southwestern part of the county, was almost entirely destroyed by fire recently. It has been an important shipping point for mines in the Nashville and Plymouth districts. The fact that the citizens declined outside assistance is evidence that the town will be rebuilt and resume its place as an important point on Southern Pacific R.R.

FROG POND (Garden Valley)—Installation of 10-stamp mill being arranged for. Underground work at present consists of sinking and crosscutting. Headframe and hoist have been installed. About 200 tons of ore on dump is reported to assay $10 to $15 a ton. F. C. Levitt is superintendent.

UNION AND WARD (Placerville)—These gravel mines, recently bonded to J. Willmans, will be reopened and will be operated by drifting methods. Both properties are equipped with mills.

Inyo County

TUNGSTEN DEPOSITS west of Bishop secured by lease and purchase option by John MacIver are being prospected. Ore will be handled by jigging.

Kern County

WERINGER (Woody)—Reported that A. P. Peake of Butte, Mont., has purchased an interest in this copper mine and that equipment necessary for development to 500-ft. point, consisting of hoist and compressor plant, will be installed immediately.

San Bernardino County

ATOLIA (Atolia)—Installation of new mill for treatment of accumulated tailings is in progress, which will double tungsten production of these mines. Mill will be electrically driven and camp electrically lighted. Twenty-five tent-houses are being built for company employees. Leasers on company ground report excellent results. There is an air of progress at Atolia which is situated about five miles from Randsburg.

SALISBURY (Zabriskie)—Eleven 6-ton autotrucks manufactured at Salt Lake have been contracted for, to be used in hauling ore from this lead-carbonate mine. Seven of the trucks have already arrived at Zabriskie which is on Tonopah & Tidewater R.R. Distance from mine to railroad station is 25 miles. Two trips will be made daily, handling 150 tons. Hauling contract calls for delivery of 50,000 tons.

Shasta County

MAMMOTH COPPER (Kennett)—Construction of road from upper tram terminal to Friday-Lowden mine, owned and being developed by Mammoth company, has begun.

GREENHORN (Redding)—Property being developed by M. E. Dittmar under bond and lease and shipping 10 tons a day. Mine is situated four miles west of Tower House.

DREDGE LANDS ON CLEAR CREEK, south of Redding, owned by Gibson, Peterson, McMullen and other farmers, negotiated for by Lawrence Gardella of Oroville. Installation of dredge contemplated.

BELL COW (Redding)—This and other claims on Arbuckle Mountain near Ono have been secured under purchase option by Frank S. Greene of Ono. Glenn and Colusa men are interested with Greene. Thomas P. Ames will superintend development work.

Sierra County

RED LEDGE (Alleghany)—Quartz mill being installed by Barnhart & Hathaway of Nevada City, Calif.

MINER'S HOME (Howland Flat)—Gravel property which has long been in litigation to be reopened by W. C. Hendricks of Sacramento.

ORIENTAL (Alleghany)—Materials are being placed on ground and all preparations made to resume work by Croesus Mining Co. of New York. W. B. Pearson in charge.

BIGELOW (Sierra City)—To be reopened and ore extracted through No. 9 tunnel of Sierra Buttes mine which cut Bigelow ledge 20 years ago, when owners disagreed upon working terms and operation ceased.

Sonoma County

CULVER-BAER (Cloverdale)—Walter Smith and associates of San Francisco have taken bond and lease on this quicksilver mine. There are nine claims in group, embracing 1800 acres of land. Installation of machinery and furnaces is contemplated immediately. Exact terms of transaction have not been made public. Deal was made by Ida I. Davis of San Francisco.

Tuolumne County

JUMPER (Jamestown)—In 10 months that leasing system has been in operation, seven sets of leasers, totaling about 35 men, have taken out $10,000. The leasers pay royalty of 25%, and $1 a ton for milling. L. E. Grant is superintendent.

COLORADO

Boulder County

REPPY (Jamestown)—This molybdenum property has been investigated and explored by H. F. Linnenbrink and J. F. Scofield, of Pittsburgh, Penn., with encouraging results. The owners have decided to inaugurate development work on a larger scale.

Dolores County

RESOLUTE (Rico)—New company, eastern stockholders, has acquired holdings of M. T. Chestnut, of Denver. Chestnut claim was pioneer producer of rich silver ore.

Lake County

ROBERT E. LEE (Leadville)—This old Fryer Hill mine, producer of rich silver-iron ore, now outputs splendid zinc carbonite that constitutes main supply for local zinc works.

Park County

LONDON (Alma)—Numerous leasers who mined during past winter and spring are finally able to market their stocks of ore, wagon roads being now practically free from snow. Several four-horse teams are hauling over seven-mile road to Alma and returning with coal and other supplies for coming winter. This mine is on an isolated mountain, above timber line.

San Juan County

WILFLEY-MEARS MILL (Silverton)—Flotation equipment has been added to this plant which was erected to treat siliceous tails from old Silver Lake mill high up on mountain at mine. Last year flumes were built to convey tails from dump in lake, over precipice and down long slope to new mill along railroad and Animas river. Specially designed Wilfley tables, of unusual size and capacity were chief units in original installation.

San Miguel County

SMUGGLER-UNION (Telluride)—Ground has been broken for addition to mill at Pandora, anticipating increased production from Sheridan adit of Humboldt mine.

OPHIR RANGE GOLD (Ophir)—Prospecting and development operations are under way. Company has decided to remodel Suffolk mill and tramway preparatory to resumption of active operations. W. H. Staver is manager of enterprise and E. V. Davies will have charge of mill.

DELAWARE

Kent County

SOUTHERN ZINC & MINING CO. (Dover)—Has been incorporated with a capital stock of $1,000,000 to acquire and operate zinc mines. Incorporators are W. E. McCarthy, W. M. Pyle, and G. G. Stiegler.

IDAHO

Bonner County

IDAHO-CONTINENTAL (Porthill)—Fire of unknown origin completely destroyed mill, 26 miles from Porthill, July 30, entailing loss of $50,000. Plant was insured for $20,000. Compressor plant was located in mill, and this also was destroyed. The boarding house, storages and other camp buildings were in danger several times, but they escaped serious damage. President A. Klockman stated that he did not know if plant would be rebuilt, and that no decision would be reached until the directors met and canvassed situation, but it is believed that another concentrator will be constructed. There are 100 men employed at property.

Shoshone County

HYPOTHEEK (Kingston)—Plans and surveys being made for an aerial tramway.

SUCCESS (Wallace)—Gross earnings for July were $183,759. Operating expenses did not exceed $30,000, making estimated net earnings $150,000. It is believed that dividend rate will be increased to 8 or 10c. a share.

LUCKY CALUMET (Mullan)—Property includes 10 claims lying in Mullan copper belt between National and Snowstorm mines. Assessment has been levied and contract has been let for driving lower adit 500 ft. farther. Development in lower workings aggregates 4000 ft., at maximum depth of 1200 ft.

NORTHERN LIGHT (Kellogg)—No. 2 vein, recently tapped by crosscut from 200-ft. level and explored by shoot east and west drifts, is said to show more than foot of lead ore of good grade. B. G. Harmon, engineer in charge, will recommend to owners that shaft be sunk another 200 ft., in belief that mine will then be in position to maintain regular shipments.

H. E. M. (Wallace)—Hoped to have new 100-ton mill, for which machinery is arriving, ready to run by first of October. Ore will be delivered at mill, half-mile from tunnel portal, by electric haulage. Ore-shoot in No. 3 tunnel has been proved for length of 600 ft. Considerable ore was shipped from this level several years ago but expense of getting to railway precluded profit. Crosscut 2300 ft. long driven from Revenue Gulch side, cuts vein 400 ft. below No. 3 tunnel.

HECLA (Wallace)—Capital stock of company being unpaid to extent of $75,000 and considering it to be for best interest of stockholders that stock should become fully paid under laws of State of Washington, board of directors by unanimous vote levied assessment of 7½c. per share upon all capital stock of company of record July 28, 1915, and at same time declared special dividend of 7½c. a share on same stock. Each stockholder of record of that date has been charged with assessment and credited with dividend, account thereby being balanced and closed.

MICHIGAN

Copper

MOHAWK (Mohawk)—Notwithstanding bonuses paid and maintenance of normal scale of wages, cost of rock production has been reduced 30c. since last year. This showing is particularly creditable to improvements in operations.

NEW ARCADIAN (Houghton)—Second test-rock shipment is showing closer to 40 lb. than 30, in mineral, according to rumors which cannot be verified. South drift on 900 level is in good ground. On upper level, closest to New Baltic, has been found best rock of all, less than 60 ft. from line.

ONONDAGA (Houghton)—First drill is in ledge. Will locate individual beds on Nonesuch lower rim. Doctor Lane, formerly Michigan state geologist, is working with President Pryor in geological analysis of situation and R. C. Allen, state geologist, is expected here soon on similar work.

CALUMET & HECLA (Calumet)—Maintained higher rock tonnage during July than in June, and June was best record in history of property, notwithstanding fact that tailings and regrinding plant was put out of commission by short-circuiting about middle of month.

ISLE ROYALE (Houghton)—Now has No. 7 shaft down to bedrock. This has been one of most difficult tasks of kind ever put through in this district. No. 1 shaft now is timbered down below twelfth level. Men say that there is enough broken rock there more than enough to repay for reconstruction of this shaft.

Iron

BAKER (Iron River)—Work has been resumed after idleness of over one year. Ore hoisted is being shipped.

BENGAL (Iron River)—Mine has entered shipping column; 80 men are now employed.

MARY CHARLOTTE (Negaunee)—About 100 new hands have been added here. Mine is producing to capacity. All of ore that can be got out has been sold. Other Breitung mines are also working strong.

WARNER (Amasa)—Pickands, Mather & Co. will explore this old property. Water is to be removed from workings. New headframe has been erected. In case sufficient ore is found, machinery from Hemlock, close by, will be transferred. Hemlock was closed several months ago.

IRONWOOD—Heavy shipments are being made from Gogebic range. All mines are shipping strong. Chicago & Northwestern railway handled 200,000 more tons up to Aug. 1, than for same period last year. Newport mines will ship about 1,000,000 tons. Oglebay, Norton & Co. will move everything in stock. Steel Corporation is working almost to capacity. It is predicted that range shipments will equal best year in past. Gogebic will be ahead of Menominee and Marquette ranges for year, as latter two are just hitting their stride now.

MINNESOTA

Duluth

MINNESOTA STEEL (Duluth)—Eleven hundred men at work rushing completion of steel plant and cement plant. Additional men being employed at rate of 25 daily, preference being given to Duluth residents. At Morgan Park, the model city, street and public work being pushed vigorously. Hospital and large office building planned.

Mesabi Range

GLEN (Chisholm)—After being idle two years, mine active. Underground operations being extended rapidly. Shipments total 75 cars daily.

QUINN-HARRISON (Nashwauk)—First ore was put through washing plant last week. Mine is working two shifts. About 250 men are employed.

MAHONING (Hibbing)—Orders have been received to ship 2,600,000 tons of ore from here this year. Thus far about 800,000 tons sent out. Largest shipping year for mine was 1907, when 1,564,000 tons was shipped.

CROSBY (Nashwauk)—Cleveland-Cliffs Iron Co. has commenced construction of its concentrator. Waste material will be washed from ore, making it more saleable. Large dam has been built across stream to afford water supply. Ore will be shipped late in season.

ELBA (Elba)—Three 8-hr. shifts are now being worked. Corsica, which is worked in conjunction with Elba, is operating with two shifts. High-grade bessemer ore is being shipped. New timber shaft is being sunk at Corsica. Main shaft is being deepened 75 ft. Another orebody lies underneath one now being worked.

VIRGINIA—Over 400 Serbians, Montenegrins and Bosnians left Mesabi range last week for Winnipeg, Can., to join small army of 9000 men which were transported to Europe by the British government. Men were from Chisholm, Hibbing and Virginia district. Further departures are apt to cause shortage of miners. Plenty of common laborers, but miners are scarce.

MONTANA

Deer Lodge County

GEORGETOWN MINING DISTRICT—Fred Tuescher who has a lease and bond on Marguerita claim and on Gold Coin group has uncovered ore of Marguerita that is assaying $14 a ton in gold. Klaus and Fliegler, who have lease on Butte and Anaconda Consolidated properties, are doing considerable development work.

Fergus County

KENDALL (Lewistown)—One section of old Kendall mill at Lewistown has recently resumed operations after shutdown of several years. Within short time other sections of mill will go into commission. Part of Kendall mine was leased some time ago to several miners after it was discovered that big orebody in North Mocassin of Barnes King extends directly into Kendall ground. There are now 25 miners drifting towards North Mocassin body; 10 others are engaged in getting ore from opencut.

Lewis and Clark County

DISTRICTS TRIBUTARY TO HELENA—Rosenfield brothers and associates, who have bond and lease on Bert Lathrop property in Mitchell Gulch, have cut lead in their shaft 3 ft. wide carrying copper sulphide and gold, assaying $30 to $400. Several carloads have been shipped to smeltery. At head of Ten Mile Creek, 25 miles southwest of Helena, 10-stamp mill of James Breen is running regularly on ore from porphyry dike, said to average $3 per ton. It is mined from opencuts and trammed directly to mill. It is rumored that the Anaconda company experts have been examining the dike property and making investigations regarding the water supply. It is said that if water question can be settled satisfactorily, Anaconda company may take over the porphyry dike and establish a large milling plant. The Valley Forge property in that district is one of the best developed mines and has a tunnel nearly 3000 ft. long that cuts lead at depth of 900 ft. below surface. Two cars of ore a week have been shipped from property for many months. In Scratch Gravel district, Huffaker & Hill are steadily at work on Eastern Bell mine which they bonded from Helena mining bureau. Spokane-Butte-Helena syndicate, which is developing extension of Franklin Dead, has drifted east and west of shaft and found lead continuous and containing ore of commercial value. In Bald Butte section of Marysville district, old Bald Butte mine, which paid $1,500,000 in dividends, is in fair way to repeat its former record. Crosscut to new rich streak of ore is almost completed. Bald Butte mine is thoroughly equipped. Mill and power plant are in first-class condition. Helena mining bureau has installed machinery and unwatered 100-ft. shaft of Silver King mine near Clancy. Crosscutting to lead is now in progress.

Mineral County

WILSON MINING & SMELTING CO. (Saltese)—Company is developing two groups of claims on Silver and Big Thunder Creeks, about two miles from Saltese. Claims said to be promising. One group consists of six claims on lead and silver vein which is developed by two tunnels 200 and 300 ft. long. Other group consists of eight claims on which several tunnels and crosscuts have developed rich shoot of copper ore. William Burk of Saltese is president of company.

Silver Bow County

RAINBOW LODE DEVELOPMENT (Butte)—The financing of this company has been completed and funds are now in sight for resumption of operations, a mortgage for $400,-

000 on the company's properties having been filed July 6 with the county clerk. Principal property is the Butte & London mine which it is the intention to develop with the new funds.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Estimated production for month of July, 33,200 tons; gross extraction, $275,000; operating expenses, $170,000; net realization, $105,000.

ATLANTA (Goldfield)—Experiments now being conducted with oil flotation on low-grade Atlanta ores in Goldfield Consolidated mill. Reported that 89 ore is being treated at a profit.

CHAMP d'OR FRENCH GOLD (Goldfield)—Jean Pierre Charra, of Paris, France, consulting engineer, who has been in Goldfield for several months looking after interests of company in southern Nevada, today announced sale of local plant, known as French mill to Elmer E. Clapp, of Boston, Mass. Mr. Charra also announced that William Dunphy has been granted two-years' lease on company's Orleans property in Hornsilver district and Nicholas Theo lease of like duration on its holdings in Tokop district.

Nye County

TONOPAH ORE PRODUCTION for week ended July 31 amounted to 10,407 tons valued at $213,286, compared with 11,137 tons week previous. Producers were: Tonopah Belmont, 3382 tons; Tonopah Mining, 2200; Tonopah Extension, 1860; West End, 1002; Jim Butler, 1100; Montana, 107; and Midway, 56 tons.

TONOPAH EXTENSION (Tonopah)—Injunction granted against the West End Co. until Sept. 1, when modifications will be made permitting the West End Co. to continue work on California vein, subject to inspection of plaintiff company and supervision of court, in apex litigation over Egyptian and California veins.

Storey County

JACKET MILL (Gold Hill)—Received 1043 tons dump rock and shipped one bar of bullion to smeltery.

COMSTOCK PUMPING ASSOCIATION (Virginia)—Cut drain and laid track and sills on 2700 level of Mexican.

OPHIR (Virginia)—At Central tunnel tramway and rock-breaker installation completed. Mill bins are being filled.

UNION CONSOLIDATED (Virginia)—West crosscut on 2650 level in porphyry and quartz; north drift on 2500 level reopened.

OPHIR AND CON. VIRGINIA (Virginia)—On 2500 level reached winze and will equip station for operating below 2700 ft., in east vein.

BELCHER (Gold Hill)—Raise on 1300 level and stoping of mill rock started. Mill rock also saved from Crown Point northeast crosscut. Water being successfully lowered.

MEXICAN (Virginia)—From 2300-level understope 37 tons taken averaging $6. West crosscut 2700 level is in porphyry and quartz stringers of low assay value. Comstock drift on 2500 level has been reopened total of 550 ft.

NEW JERSEY

Sussex County

NEW JERSEY ZINC (Franklin Furnace)—Sussex County Board of Taxation has issued instructions to make substantial increase in assessment of property of New Jersey Zinc Company, in Franklin Borough. Board believes that present assessment of $2,025,000 is not as large as it should be. Board is of opinion that valuation is too low, and has been for several years, although it was fixed by State Board. Zinc company declared stock dividend of 250%, capital stock increased from $10,000,000 to $35,000,000. It is reported that Assessor of Ogdensburg Borough, has also been ordered to make increase in Zinc Company's assessment in that Borough.

NEW YORK

Saint Lawrence County

NORTHERN ORE (Edwards)—Completed its new mill last spring and for last few months has been making commercial shipments of blende. About carload of concentrates is going out of Edwards each day, an output that can be maintained readily enough from mine now worked which is opened to depth of 500 ft. In addition to this mine, company has second shaft nearby which has not been placed in production although opened in good body of ore; besides it controls under ownership or lease a large acreage that shows more or less mineralization.

TENNESSEE

Polk County

TENNESSEE COPPER (Copper Hill)—Plans being made for large additions to acid plant. Arrangements have been made with International Agricultural Corporation, which now has contract controlling sulphuric-acid output of Tennessee company whereby benefit from increased acid output to be sold to Allies will be shared mutually.

UTAH

Beaver County

SOUTH UTAH (Newhouse)—Ore at this property has been difficult to treat; and investigations are now under way with view to finding suitable treatment for large accumulations of tailings, as well as for ore in mine.

MOSCOW (Milford)—July output was unusually large, amounting to 17 cars of first-class ore valued at about $25,500. New shaft has been sunk 1000 ft. in past year, and ore has been opened in new ground. Production at rate of 10 to 12 cars monthly has been kept up throughout work.

PALOMA GOLD & SILVER (Milford)—Eight inches of high-grade lead-silver ore have been opened in shaft which is being sunk to reach downward extension of ore, developed to south. Shaft has been sunk 300 ft. on incline following contact of limestone with monzonite. Fissures occur in limestone south of shaft, mineralized with iron, silver and lead.

Juab County

TINTIC ORE SHIPMENTS for week ended July 31 totaled 163 cars, estimated at $150 tons valued at $200,000, compared with 193 cars last week. There were 19 shippers.

RIDGE & VALLEY (Eureka)—Shipments were resumed at this property, week ended July 30. Mine has not been worked on company account for some time, though leasers have made shipments. Both lead and zinc ore are being mined on the 1650 level.

Salt Lake County

MICHIGAN-UTAH (Alta)—Arrangements are being made to resume work at this property, which at present is being largely worked by leasers.

MONTANA-BINGHAM (Bingham)—Streaks of ore carrying copper, silver and some gold have been cut in main tunnel, which is now in over 3900 ft.

LAST CHANCE (Salt Lake)—Work to be started at this property in Big Cottonwood, west of Cardiff. Location is one of oldest in district. F. O. Horne, James Hauerbach et al. are interested.

ALTA CONSOLIDATED (Alta)—Silver-copper ore, 12 in. in width is still exposed in face of No. 2 east drift, 345 ft. east of raise from main tunnel level. Braine fissure has been opened for total distance of 675 ft.

SOUTH HECLA (Alta)—New ore has been opened in Kate Hays fissure on east side of property. Development in this section is being done from Quincy tunnel. Ore on 250 level is producing most of shipping product, which at present amounts to 40 tons a day. Two shifts are working on 500 in driving for Wedge oreshoot on this level.

CARDIFF (Salt Lake)—Shipments amounting to 3420 tons have been made since orebody was cut in lower tunnel last October. These brought $145,350. Fifty-five teams are hauling at present, and upwards of 100 tons a day are being shipped. New boarding house and other surface improvements have been practically completed. Electric power line is built nearly to camp.

BINGHAM-EMPIRE (Provo)—This company was incorporated July 31 for development of property in Bingham district. Capitalization is $10,000 divided into shares of 1c. each. Jesse Knight holds 510,000 shares. There are 484,000 shares in the treasury. Incorporators and directors are: Jesse Knight, president; A. M. Knight, W. L. Mangum, K. S. Jordan, G. A. Storrs, E. G. Jensen.

Tooele County

THERE IS MUCH ACTIVITY IN DRY CAÑON near Stockton. More men are being worked, and more ore shipped than at any time during past five years. Mono, under lease to R. C. Ferguson, is shipping lead-silver-copper ore. Big Four Exploration Co. is making regular shipments of zinc ore from its lease on Queen of Mills; copper and silver-lead ore is being developed. Lynch and Travis lease on Hidden Treasure is working 25 men, and making shipments. Dry Cañon Consolidated is extending its long tunnel in mineralized ground. Leasers are working on Utah Queen, Big Lead, Wandering Jew, and Thad Stevens claims; and most of them are breaking ore.

IN SILVER ISLAND DISTRICT near Wendover active work is being done at Utah-Wyoming, Hole in the Wall, and Wendover Wonder properties.

PROMONTORY POINT (Ogden)—Articles of incorporation prepared by Ogden men for company to work group of 35 zinc claims on Promontory Point. Those interested are: A. S. Condon, C. A. Boyd, D. C. Lawson, G. W. Green, D. Marshall, A. Smith, R. E. Boyd, and George Barry.

WISCONSIN

Ashland County

CHARCOAL & IRON CO. OF AMERICA (Ashland)—Blast furnace resumed operations Aug. 1 after idleness since May, 1913. Formerly controlled by the Lake Superior Iron & Chemical Co.

SOUTH AMERICA

Chile

CHILE COPPER (Chuquicamata)—Is now treating between 4000 and 5000 tons daily. Full capacity of 10,000 tons will not be reached for several months.

BRADEN (Rancagua)—During June mill treated 91,029 tons of 2.10% ore, produced 7249 tons concentrates, 19.37%. Minerals separation treated 88,633 tons of 1.71% tailings making 19.94% concentrate. Copper produced 1271 tons.

AFRICA

Belgian Congo

TANGANYIKA CONCESSIONS (Katanga)—Produced 13,-$64,000 lb. of copper during first half of 1915. This compares with 21,444,000 lb. turned out in 1914, and 30,000,000 lb. made in 15 months ended Dec. 31, 1913. It has been difficult, as well as costly to get mine product from several hundred miles inland to coast, and thence to England for refining and market. Last year company operated two furnaces; increase up to June last was due to blowing in of third furnace. Two more furnaces, each with 30% to 35% greater capacity than those now in operation, are expected to be placed in commission by end of 1915, making possible 50,000,000 lb. production in next year. More than $25,000,000 said to have been spent in development and equipment to date.

Rhodesia

GOLD PRODUCTION OF RHODESIA in June was 57,269 oz., being 859 oz. more than in May, and 624 oz. more than in June, 1914. For the six months ended June 30 the total was 401,817 oz. in 1914, and 438,740 oz. in 1915; an increase of 36,839 oz. Other metal production for the six months was 87,140 oz. silver; 1633 tons copper; 15 tons lead. Output of other minerals was: Chrome ore, 22,079 tons; asbestos, 514 tons; coal, 184,062 tons. There were also 71 carats of diamonds reported.

The Market Report

Metal Markets

NEW YORK—Aug. 11

All of the principal markets declined sharply during the last week, lead and spelter exhibiting something akin to demoralization.

Copper, Tin, Lead and Zinc

Copper—At the beginning of our week of record, producers made small sales at 18c., regular terms, but customers were few and far between, and sharp concessions in price were made in order to attract business; but buyers scenting the situation were coy. A bid of 17½c., regular terms, was declined on Thursday. Later when the producer wanted to accept it, the buyer declined. During the second half of the week, sales were made at 17½c., regular terms. Export orders were taken which probably will net less, but in view of the conditions of freight, insurance, exchange, etc., it is impossible to reckon what the sales will net until they are settled for. Some of the principal producers are out of the market, or are maintaining a nominal asking price above the market and covertly soliciting bids.

The inquiries upon which such great hopes were based a week ago failed to materialize in business. It is believed that they still exist potentially, some new and large ammunition orders having been placed. However, the ammunition manufacturers are apparently taking more time for covering their metal requirements than they did a little while ago. At the close copper was freely offered at 17½c., regular terms, or about 17.35c., cash, New York.

The great demand upon electrolytic refinery capacity is evidenced by the fact that $20 per ton has been paid for refining in some recent blister-copper contracts.

Copper Sheets bring 24@25c. per lb.; no base quotations are made by the principal maker. Wire is quoted at 19½@20c. per lb., carload lots at mill.

Visible Stocks of Copper in Europe, July 31 are reported as follows: Great Britain, 23,959; France, 5554; afloat from Chile, 1900; afloat from Australia, 3700; total, 35,113 long tons, or 78,653,120 lb.; an increase of 2195 tons over the June 30 report.

Tin—The unfavorable political developments caused a decline in price in the early part of the week. Sellers in the East refused to meet the lower prices. Learning this, buyers came in at the lower level and toward the close there was a rally.

Lead—Throughout the week producers were trying to find a level at which buyers would become interested, but met with no great success. The A. S. & R. Co. reduced its price from 5c. on Aug. 7 to 4⅝c. on Aug. 9, and to 4½c. on Aug. 10. At all times previous to the last cut, independent producers offered to sell at ¼c. below the A. S. & R. Co.'s price, but it seemed as if lead would have to be given away in order to interest anybody in taking it. On Aug. 10 sales were made at 4.45c. which lent encouragement in the idea that the market might be beginning to steady itself.

Spelter—This market declined steadily throughout the week and showed all the earmarks of demoralization. Speculators who wanted to liquidate, manufacturers who had overbought and wanted to resell, and the weaker producers exerted pressure, all of these factors contributing to the sharp decline, which, however, did not result in much business being done. On the other hand, there were some producers who are not trying to sell, being firm in the belief that they are going to see 25c. spelter once more.

It is estimated by one smelter that the production of high-grade intermediate spelter by distillation of prime western is going on at the rate of 3000 to 4000 tons per month.

Butte & Superior's production of blende concentrates in July was 13,000 tons.

Zinc Sheets are in good demand and sales are steady. The base price is $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras are charged.

Nickel—There is no change, although demand is very good. Ordinary forms are 45@50c. per lb., according to size and terms of order. Electrolytic is 3c. higher

Other Metals

Aluminum—Business has been on a fair scale and the market is firmer. Quotations are 32@34c. for No. 1 ingots, New York.

Antimony—The market has been very quiet, with hardly more than a retail business doing. Ordinary brands sell at 35@36½c. per lb. Cookson's is nominal at 48@50c. per lb., with few sales.

Quicksilver—Business has been rather quiet, though prices remain strong. New York quotations are $92@94 per flask of 75 lb. for large orders, with $95@98 for small lots. San Francisco reports by telegraph a weak market, with $87.50 @90 per flask quoted. London price is £18 2s. 6d. per flask, with £18 named from second hands.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			17 70		4 75	4 70	13 50
5	4 7606	47	@17 80	35	@5 00	@4 90	@14 50
			17 50		4 75	4 70	13 25
6	4 7625	47⅛	@17 70	34⅞	@5 00	@4 90	@14 25
			17 50		4 75	4 70	13 25
7	4 7600	47⅛	@17 60	34⅞	@5 00	@4 90	@14 25
			17 35		4 50	4 40	13 00
9	4.7563	47⅛	@17 45	34⅞	@4.75	@4.60	@14 00
			17 30		4.40	4 30	13 00
10	4 7550	47⅛	@17 40	34⅞	@4 50	@4.40	@13 75
			17 30		4.40	4 30	12 00
11	4.7475	47⅛	@17 40	35	@4 50	@4 40	@13.00

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Aug.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts per Lb.
5	22⅜	71⅛	75⅛	87½	18 64	154¼	155¼	23 5/16	5 02	85	18 10
6	22 3/16	71⅛	73⅛	86½	18 43	151⅜	153¼	23 3/16	4 94	75	15 97
7	22 3/16	.	.	.	.	.	.	.	.	.	.
9	22 5/16	69½	70⅛	84½	17 99	150	152¼	22⅞	4.84	70	14.90
10	22⅛	69	70¼	83¼	17 73	151	153	21⅞	4 65	67	14 27
11	22 5/16	68⅛	69⅛	83¼	17 73	152	154¼	20 11/16	4.40	65	13 84

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Gold, Silver and Platinum

Gold—The largest shipment on record reached New York Aug. 10. The total value was $52,000,000, of which $35,000,000 was in gold, the balance in securities. It was brought from Liverpool to Halifax on a warship, and from Halifax to New York on a special train.

Platinum continues quiet, but rather steady. Business is on a moderate scale only. Current quotations are $37@39 per oz. for refined platinum, $41@44 per oz. for hard metal.

Silver—The market has shown more activity and strength this week on London buying for India account, advancing to 22⅞d. Orders for the present being filled the price has reacted to 22⅝d. The New York price has been adversely affected by the fall in sterling exchange, demand bills closing at 4.74¾. The silver market shows no decided tendency.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Aug. 7

The base price paid this week for 60% zinc ore was $100 per ton, down to $95 at end of the week. The base price paid for 80% lead ore was $56 per ton.

SHIPMENTS WEEK ENDED AUG. 7

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Year	111,013,270	4,083,160	16,689,950
Week	3,112,690	.....	773,500

Shipped during week to separating plants, 3,783,890 lb. zinc ore.

JOPLIN, MO.—Aug. 7

Blende, high price, $102; base price per ton of 60% zinc, premium ore, $100, medium, $95@86; lower grades down to $75; calamine, base per ton of 40% zinc, $48@56. Average, all grades of zinc, $93.73. Lead, high price, $60; base, $60@50 per ton of 80% metal content; average, all grades of lead, $58.30 per ton.

SHIPMENTS, WEEK ENDED AUG. 7

	Blende	Calamine	Lead	Values
Totals this week	11,831,050	63,740	2,038,050	$616,870
Totals this year	344,657,710	28,376,510	52,520,930	15,034,890

Blende value, the week, $555,730; 32 weeks, $13,019,810.
Calamine value, the week, $1730; 32 weeks, $616,550.
Lead value, the week, $59,410; 32 weeks, $1,398,530.

Iron Trade Review

NEW YORK—Aug. 11

The demand for finished steel products, both for home use and for export continues heavy. The export calls are rather urgent in some cases.

Pig Iron Production in July again showed an increase. The reports of the furnaces, on Aug. 1, as collected and published by the "Iron Age," show a total of 234 coke and anthracite furnaces in blast, having a total daily production of 86,800 tons; an increase of 6400 tons over July. Making allowance for the charcoal furnaces, the total make of pig iron in the United States in July was 2,593,000 tons; for the seven months ended July 31 it was 14,826,800 tons. Of this 10,840,450 tons, or 73.1% of the total, were made by steel-works furnaces.

The United States Steel Corporation reports its unfilled orders on July 31 at 4,928,540 tons, an increase of 250,344 tons over June 30, and of 1,091,897 tons over Dec. 31, 1914.

PITTSBURGH—Aug. 10

The steel market has been somewhat quieter the past week, as to new commitments, but specifications against contracts are as heavy as ever, and the mills as a rule are piling up shipping orders despite the fact that their production is a shade heavier. Departments recently placed in operation are turning out somewhat more tonnage and when cooler weather arrives still larger tonnages are to be expected. Practically the entire openhearth steel making capacity is active, and the mills have been so active in recent weeks in securing consent to ship bessemer steel in place of openhearth that there is considerably more bessemer capacity in operation and this branch may soon be operating at capacity also.

The scrap and pig-iron markets have become very much excited. Heavy melting steel scrap has sold at $15, delivered Pittsburgh, representing an advance of over $1 a ton in a week and of fully $3 a ton in 30 days, and dealers look for still higher prices. Pig iron has been advancing in nearly all markets, but more sharply in this district than elsewhere, and predictions are freely made that within two or three months pig iron will be several dollars a ton higher than at present.

Steel prices are continually firming up. Bars are likely to advance above 1.30c. very shortly, while plates are firming up to that level. Sheets have continued to advance, and are now 1.85@1.90c. for black, but galvanized have been weakening with the decline in spelter. An advance in wire products, from $1.60 basis for nails, is predicted to occur before September.

Pig Iron It is claimed that basic iron has sold at $14, Valley, and bessemer at $15, Valley, while there are no quotations to be found below these figures. These prices represent advances of over $1 a ton in less than a month. Foundry iron has stiffened steadily, with moderate transactions on the way up. The market is quotable as follows: Bessemer, $15; basic, $14; foundry, $13.50; forge, $13.25; malleable, $13.50, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese Official statistics of imports of ferromanganese in the first quarter of this year, just published, show only 585 tons imported in the three months. There is now no regular contract market, importers having to submit all inquiries to the English producers. The prompt market remains at $100@105, Baltimore, for small lots.

IRON ORE

Shipments of iron ore from the Lake Superior region in July were 7,204,020 tons, being 1,419,506 tons more than in July, 1914, but 1,000,396 tons less than in July, 1913. For the season to Aug. 1 the shipments are reported by the "Iron Trade Review" as below:

Port.	1914	1915	Changes
Escanaba	1,740,741	2,062,700	I. 321,959
Marquette	681,361	1,114,360	I. 432,999
Ashland	1,416,825	1,870,077	I. 453,252
Superior	5,690,413	3,064,002	D. 2,626,411
Duluth	2,949,286	6,710,460	I. 3,761,174
Two Harbors	2,930,004	3,903,704	I. 973,700
Total	15,408,630	18,725,303	I. 3,316,673

The heavy decrease at Superior and the large gain at Duluth result from the cessation of mining on the Hill leases, and the transfer of activity to the old Mesabi mines.

The Toto iron mines now being developed by the Bethlehem-Chile Iron Mines Co. will probably send to the Bethlehem Steel Works in the United States about 200,000 tons of iron ore this year, and it is expected that the quantity next year will approximate 1,000,000 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 377,410 short tons; shipments, 373,182 tons. Production of Greensburg and Upper Connellsville districts was 45,322 tons.

Anthracite Shipments in July were 4,934,205 long tons, being 457,652 tons less than in July, 1914. For the seven months ended July 31 the total shipments were 38,337,646 tons in 1914 and 36,529,509 in 1915; a decrease of 1,808,137 tons, or 4.7%. Of the shipments this year 31,544,935 tons, or 86.4% of the total were buckwheat No. 1 and larger sizes; 4,984,574 tons, or 13.6% being of sizes below buckwheat No. 1, or steam coal.

Chemicals

NEW YORK—Aug. 11

The general market is not especially active, but there is a fair business doing in many lines. In heavy chemicals trading is rather slow.

Arsenic—Demand continues about as usual, on a moderate scale. Prices are unchanged at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady and prices are about the same. Quotations are $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade in this article is good for the season. A moderate business is forward and prices are steady. Quotations are 2.35c. per lb. for all positions this year.

Magnesite—According to information received from the U. S. consul at Athens, dated July 10, 1915, magnesite, crude and calcined, has been added to the embargo list of Greece.

Pyrites—Imports at Baltimore for the past week included 16,442 tons iron pyrites from Spain.

PETROLEUM

The monthly statement of the "Oil City Derrick" shows new oil wells opened in July as follows: Pennsylvania grade, 356; Lima-Indiana, 40; Central Ohio, 45; Kentucky, 10; Illinois, 64; Kansas-Oklahoma, 320; Texas-Louisiana, 147. The total number was 982 wells, the new production amounting to 133,773 bbl. The larger increase was in Louisiana. At the close of July there were 1612 wells under drill and 405 rigs going up.

Assessments

Company	Delinq.	Sale	Amt.
American, Ida	Aug. 7	Sept. 2	$0.001
Belmont, Ida	Aug. 10	Sept. 10	0.003
Bullion, Ida	Aug. 30	Sept. 25	0.005
Carbonate, Ida., (post.)		Aug. 23	0.001
Cedar Creek, Ida	Aug. 28	Sept. 29	0.005
Con. Virginia, Nev	July 19	Aug. 10	0.05
Copper Chief, Ida	Aug. 30	Sept. 25	0.005
East Coeur d'Alene, Ida.	Aug. 9	Sept. 9	0.001
East Hercules Ext., Wash	Aug. 10	Sept. 10	0.0015
Eastern Star, Ida		Aug. 24	0.002
Four Timbers, Ida	July 28	Aug. 28	0.001
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1.00
Hecla, Ida			0.075
Hennessy-Burns, Ida	Aug. 20	Sept. 24	0.005
Honolulu, Ida	Aug. 24	Sept. 13	0.0035
Iron Mask, Ida	July 1	Aug. 10	0.002
Ivanhoe, Ida.	July 12	Aug. 12	0.002
Keweenaw, Mich	Sept. 1		1.00
Lucky-Calumet, Ida	Aug. 27	Sept. 27	0.005
MacNamara, Nev	Aug. 23	Sept. 13	0.02
Nevada Douglas, Nev.	July 21	Aug. 18	0.10
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0.50
New Quincy, Utah	Sept. 2	Sept. 23	0.01
Oom Paul Con, Ida	Aug. 30	Oct. 4	0.01
Oreano, Ida	Aug. 2	Sept. 2	0.0015
Phoenix, Mich	Sept. 1		1.00
Phoenix, Mich	Jan. 1		1.00
Rescue-Eula, Nev	July 14	Aug. 19	0.01
Revelator, Utah	Aug. 17	Sept. 3	0.00½
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Sandstorm Kendall, Nev	Aug. 23	Sept. 27	0.01
Sierra Nevada, Nev.	July 27	Aug. 16	0.05
Smuggler, Utah	Aug. 17	Sept. 10	0.005
Snowshoe, Ida	Aug. 26	Sept. 27	0.005
Sonora, Ida.	July 23	Aug. 31	0.004
Springfield, Ida.	July 30	Aug. 30	0.002
Sunrise, Ida	July 17	Aug. 17	0.002
Sunset Dev., Wash	Aug. 25	Sept. 18	0.002
Tonopah Gypsy Queen, Nev	July 12	Aug. 17	0.00½
Tonopah Midway, Nev	Aug. 18	Sept. 18	0.01
Umatilla Tonopah, Nev	July 12	Aug. 16	0.01
Union Cons., Nev	Aug. 24	Sept. 14	0.05
Virginia, Ida. (post.)	....	Aug. 30	0.02

Stock Quotations

The Guggenheim Exploration Co. sold its holdings, 33,656 shares, of American Smelters' Securities, pfd. A, to E. Meyer, who made a public offering of it at 85 and accrued dividend.

COLO SPRINGS Aug. 10 Name of Comp.	Bid
Acacia	02½
Cripple Cr'k Con.	007
C. K. & N	02
Doctor Jack Pot	10½
Elkton Con.	.30
El Paso.	75
Findlay	03
Gold Dollar	‡ 01
Gold Sovereign.	03¼
Golden Cycle	1.76
Isabella	16
Jack Pot	06½
Jennie Sample	‡ 02
Jerry Johnson	05
Lexington	‡ 004
Mary McKinney.	37½
Pharmacist	008
Portland	1 44
Raven B. H.	02
Vindicator	1 65

SALT LAKE Aug. 10 Name of Comp.	Bid.
Beck Tunnel	05
Black Jack	.10
Colorado Mining.	.10
Crown Point.	.01½
Daly-Judge	7 50
Gold Chain	19
Grand Central	59
Iron Blossom	70
Little Bell	‡ 10
Lower Mammoth	03½
Mason Valley.	2 00
May Day	22½
Opohongo	00½
Prince Con	74
Seven Troughs	01¼
Silver King Coal'n	3 70
Silver King Con	2 12½
Sioux Con.	01¼
Uncle Sam	05½
Yankee	21

TORONTO Aug. 10			
Bailey	‡ 02	Dome Exten.	20
Conlagas.	3 75	Foley O'Brien.	26
Peterson Lake	18	Hollinger	24 25
Right of Way	03	Imperial	06
Seneca Superior	75	Jupiter	11
Silver Queen	01	McIntyre	46
T. & Hudson Bay	20 00	Pearl Lake	00½
Timiskaming	.33	Porcu. Crown	70
Wettlaufer-Lor	02	Preston E. D.	04½
Dome Mines	22 50	Rea	19

SAN FRANCISCO Aug. 10 Comstock Stocks		Misc. Nev. & Cal.	
Alta	07	Belmont	3 95
Andes	08	Jim Butler	82
Belcher	27	Lone Star	04
Best & Belcher	07	MacNamara	‡ .01
Caledonia	43	Midway	10
Challenge Con	08	Mont.-Tonopah	.40
Confidence	14	North Star	12
Con. Virginia	14	Rescue Eula	06
Gould & Curry.	04	West End Con	57
Hale & Norcross	04	Atlanta	.10
Julia	03	Booth	14
Mexican	49	C. O. D. Con	03
Occidental	79	Comb. Frac	07
Ophir.	26	Jumbo Extension	1 15
Overman	.10	Pitts.-Silver Peak	06
Potosi	20	Round Mountain	44
Savage	05	Sandstorm Kendall	05
Sierra Nevada	12	Silver Pick.	08
Union Con	22	Central Eureka	17
Yellow Jacket	32	So. Eureka	‡1 50

N. Y. EXCH. Aug. 10 Name of Comp.	Clg.
Am.Sm.&Ref.,com.	83
Am. Sm. & Ref., pf.	108½
Am. Sm. Sec., pf. B.	80
Anaconda	69
Batopilas Min.	1⅞
Bethlehem Steel	292
Bethlehem Steel, pf.	139½
Chino	45¼
Colo. Fuel & Iron.	41¼
Crucible Steel	86
Federal M. & S., pf.	49
Great Nor., ore., ctf.	41⅞
Guggen. Exp.	64¾
Homestake	118
Inspiration Con.	33
Mex. Petroleum	85½
Miami Copper.	25⅞
Nat'l Lead, com.	66¼
National Lead, pf.	109
Nev. Consol.	14¾
Ontario Min	2
Quicksilver, pf.	4
Ray Con.	23
Republic I&S, com.	44⅞
Republic I&S, pf.	98¾
SlossSheffi'd, com.	46⅞
Tennessee Copper.	43
Utah Copper	66⅛
U. S. Steel, com.	75¼
U. S. Steel, pf.	112⅝

N. Y. CURB Aug. 10	
Alaska Juneau.	12¼
Alta Con	.85
Beaver Con	27
Big Four.	.05
Blue Bell	‡ 02
Braden Copper	7⅞
Buffalo Mines	⅞
Can. Cop. Corpn.	‡1⅛
Can. G. & S.	‡.05
Cashboy	‡.04
Chambers Ferland.	.10
Chile Cop.	19
Con. Ariz. Sm.	¾
Con. Coppermines.	1¾
Con. Nev.-Utah.	5/16
Diam'field-Daisy.	‡.03
Dia. Black B.	02
Florence	50
Goldfield Con.	1 5/16
Goldfield Merger.	21½
Greene Cananea.	39⅝
International Nickel	181
Kennecott Cop.	36⅞
Kerr Lake.	3
La Rose	7/16
McKinley-Dar-Sa.	21
Mines of Am.	2⅝
Nevada Hills.	19
New Utah Bingham	2½
Nipissing Mines.	5¼
Ora	07
St. Joseph Lead	12¼
South Utah.	‡.25
Stand'd Oil of N.J.	415
Standard S. L.	1⅝
Stewart	1 1/32
Tonopah	5½
Tonopah Ex.	2 11/16
Tonopah Merger	.37
Tribullion	⅝
Tularosa	‡ 3/16
Yukon Gold	2¼

LONDON July 29	
Alaska Tre'dwell	£7 0s 0d
Burma Corp.	1 14 4½
Cam & Motor.	0 13 0
Camp Bird	0 4 3
El Oro.	0 7 0
Esperanza	0 7 9
Mexico Mines	3 7 6
Nechi, pfd.	0 12 0
Oroville.	0 15 0
Santa Gert'dis	0 7 6
Tomboy	1 0 3
Tough Oakes.	0 6 6

BOSTON EXCH Aug. 10 Name of Comp.	Clg.
Adventure	2
Ahmeek	396
Alaska Gold M.	33¾
Algomah	2½
Allouez	53½
Am. Zinc	53¼
Ariz. Com., ctfs.	7½
Bonanza	.37
Butte-Ballaklava	4
Butte & Superior	65½
Calumet & Ariz	63
Calumet & Hecla.	563
Centennial.	18
Cliff	‡1
Copper Range.	54½
Daly West	2¼
East Butte.	12½
Franklin	9¼
Granby	83
Hancock	16
Hedley	27½
Helvetia	30
Indiana	4¼
Island Cr'k, com.	46¾
Island Cr'k, pfd.	89
Isle Royale	27
Keweenaw	1¾
Lake	13½
La Salle	6
Mass.	11
Mayflower	3¼
Michigan	2
Mohawk	71
New Arcadian	11¼
North Butte.	30
North Lake	1½
Ojibway	1½
Old Colony	3½
Old Dominion	52
Osceola	80
Quincy	84
Santa Fe	2¼
Shannon	7⅝
Shattuck-Ariz	26
Superior	26
Superior & Bost.	2½
Tamarack	54½
Trinity	4¾
Tuolumne.	.45
U. S. Smelting	41½
U. S. Smelt'g, pf.	46½
Utah Apex.	3¾
Utah Con	12¼
Victoria	2¼
Winona	3½
Wolverine	58½
Wyandot	1¾

BOSTON CURB Aug. 10	
Alvarado	70
Bingham Mines.	8
Boston Ely.	20
Butte & Lon'n Dev	40
Calaveras.	1¼
Calumet-Corbin.	04
Chief Con.	92
Corbin	‡.50
Cortez	.40
Crown Reserve	.40
Davis-Daily	1
Eagle & Blue Bell.	1⅞
First Nat. Cop.	2 15/16
Houghton Copper.	3¼
Iron Cap Cop., pf.	5¼
Majestic.	.59
Mexican Metals.	.26
Nevada-Douglas.	.65
New Baltic	3⅝
Ohio Copper	.10
Oneco	1
Raven Copper	.14
Smokey Dev.	15
So. Lake	‡6½
Tonopah Victor.	.30
Trethewey.	09
United Verde Ext	5⅞

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	..	27.335	25.979	
September	60.640	53.290	......	27.986	24.260	
October	60.793	50.654	......	28.083	23.199	
November	58.995	49.082	......	27.263	22.703	
December	57.760	49.375	......	26.720	22.900	
Year	59.791	54.811		27.576	25.314	

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

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*		‡		‡	..
September	*		‡	.	‡	..
October	*		‡		‡	..
November	11.739		53.227			..
December	12.801		56.841		*	..
Year	..				......	....

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*		‡	......
September	32.675		‡	....
October	30.284		‡	....
November	33.304	......	139.391	......
December	33.601	......	147.102	....
Av. year	34.301	.	......	..

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	......	3.715	....	‡	......
September	3.828	......	3.658	......	‡	......
October	3.528	......	3.384	......	‡	......
November	3.683	......	3.585	....	18.500	......
December	3.800	......	3.662	......	19.097	......
Year	3.862	....	3.737	....	......	....

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	109.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	......	5.418		‡	......
September	5.380	......	5.230	..	‡	......
October	4.909	......	4.750	...	‡	......
November	5.112	......	4.962	...	25.016	......
December	5.592	......	5.430	...	27.369	......
Year	5.213	......	5.061	....	....	..

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	.....	13.90	.....	14.08	.....
September	14.90	......	13.90	......	14.03	.....
October	14.84	.....	13.75	......	13.97	.....
November	14.59	......	13.43	......	13.83	.
December	14.70	......	13.45	......	13.83	..
Year	$14.88	.....	$13.78	.....	$14.01	..

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The Wisconsin Zinc District—I

By H. C. George*

SYNOPSIS—The zinc district, usually called after Wisconsin, in which state it principally occurs, includes also parts of Illinois and Iowa. It was opened as a lead producer in 1822. The production of both lead and zinc is shown. Geology of the district is described, together with the origin of the ores.

The Wisconsin zinc district, or the Upper Mississippi lead and zinc district, as it is often called, lies in the southwestern corner of Wisconsin, in Grant, Iowa and Lafayette Counties, and it includes adjoining parts of Illinois and Iowa.

The district is about 70 miles long from north to south and about 40 miles wide. It lies wholly within what is geologically known as the nonglaciated area of the upper Mississippi Valley.

History of the District

The district was first opened as a lead producer in 1822. From this time until 1860 about 205,000 tons of cog lead (galena) and washed lead (galena) was produced from shallow crevices and openings. From 1860 to 1900 about 74,500 tons was produced, and since that time from 5000 to 7000 tons has been produced annually. Since 1900 most of the lead concentrates produced have been as a byproduct of the zinc mines.

The first zinc was mined about 1862, and was from the carbonate ores locally known as "drybone." Very little blende was mined in the district previous to 1875 and that mined from 1875 to 1900 was mostly of the high-grade, hand-cobbed, sheet-ore class, which usually contained from 45 to 60% metallic zinc. Such mines as the Sallie Waters, Quinlin, Lead Mine, Benton Blende and Ida Blende, all near Benton, Wis., were mines which produced ores of this period. The mines located at Highland, the Coker Mine at Livingston, Wis., and the Opencut Mine at Shullsburg, Wis., were heavy zinc-carbonate producers previous to 1900.

The production of zinc ores in the district from 1862 to 1890 was about 283,500 tons, mostly zinc carbonate, with a probable average zinc content of 30%. From 1890 to 1903 the production of the district consisted of about 126,000 tons of hand-cobbed and hand-jigged zinc carbonate and blende.

FOX MINE, MILL AND TAILING HEAPS, HAZEL GREEN, WIS.

During the last few years of the nineteenth century there was a decline in the production of both lead and zinc ores in the district. Since 1903 the revival of the district as a producer of blende, and incidentally zinc carbonate and lead, has taken place as a result of the advance in the price of lead and zinc ores. Beginning with that date modern methods of mining and milling

TABLE OF LEAD PRODUCTION FROM MINES

Year	Tons of Lead Concentrates
1822 to 1860	205,000
1861 to 1900	74,500
1901 to 1914	74,000

*Chief engineer, Wisconsin Zinc Co., Platteville, Wis.

lead and zinc ores with power machinery have placed the industry on a stable basis. Nearly all of the district production consists of concentrates containing mixed zinc and iron sulphides with an average zinc content of about 35%. The magnetic separation of low-grade roasted blende concentrates has greatly broadened the field of operations. Zinc concentrates ranging in metal-

TABLE OF ZINC PRODUCTION FROM MINES

Year	Tons of Zinc Concentrate	Year	Tons of Zinc Concentrate
1862 to 1890*	283,500	1909‡	75,528
1891 to 1903†	126,000	1910‡	102,070
1904‡	19,300	1911‡	107,253
1905‡	33,000	1912‡	119,280
1906‡	39,363	1913‡	105,877
1907‡	53,011	1914‡	130,398
1908‡	58,135		

*Carbonate and blende. †Blende and carbonate. ‡Mostly blende.

lie zinc content from 20 to 40% are roasted, the iron sulphides magnetized and removed magnetically and a finished blende is produced which will assay from 58 to 61% metallic zinc.

FIG. 1. MAP OF THE WISCONSIN ZINC DISTRICT

General Geology

The strata of the district consist of a series of Silurian and Ordovician limestones, shales and sandstones, underlain by Cambrian sandstones and pre-Cambrian crystalline rocks. A typical section would be:

		Feet
Silurian	Niagara limestone	50
Ordovician	Maquoketa shale	160
	Galena limestone	230
	Platteville limestone	55
	St. Peter sandstone	70
	Lower Magnesian limestone	200

Erosion has exposed all of these formations in some parts of the district. Nearly all of the Niagara and Mequoketa formations have been eroded away. The Platteville, Belmont and Sinsinawa Mounds in Wisconsin and the numerous mounds in northwestern Illinois are all that remain of this formation in the district.

There is an east-west unbroken ridge in the northern part of the district known as Military Ridge. A north-south ridge extends from it through the middle of the district for a distance of about 30 miles. It is along these two ridges that the local branch of the Chicago & Northwestern R.R. is built. The formations exposed on them are the upper part of the Galena limestone and the lower part of the Mequoketa shale. The ground slopes north and south from the east-west ridge and east and west from the north-south ridge to drainage basins. The streams located in these drainage basins have cut down through the formations, so that at various points along their courses the Platteville limestone, the St. Peters sandstone and the lower Magnesian limestone formations are exposed.

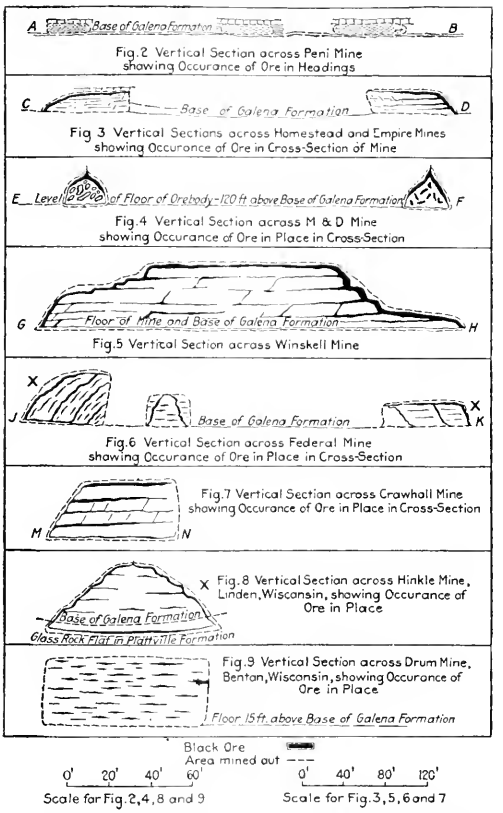
The rock formations of the district dip to the south-southwest, descending about 20 ft. per mile. The strata have been compressed and folded slightly, producing a series of synclines and anticlines and structural basins. The main axis of most of the basins is east and west, produced by lateral pressure from the north and south. The secondary axis of the basins is north and south, produced by an east and west lateral pressure. Frequently one leg of the synclines or one side of the basins will dip more steeply or show changes in slope. At these points the orebodies usually occur, in either the lower part of the Galena or the upper part of the Platteville formations, or in both.

The Galena formation consists of heavily bedded dolomites, interbedded with chert beds, nodules and thin-bedded clay shales. The base of the formation consists of thin-bedded brown carbonaceous shales from one to 15 ft. in thickness. These shales are known as the "oil rock." The bottom of this shale marks the base of the Galena limestone formation. A blue clay shale usually occurs immediately below the oil rock. This shale varies from a few inches to 6 or 7 ft. in thickness and is known as the "clay bed." Immediately below the clay bed is the "glass rock," a fine, compact limestone, usually gray or brown in color, which breaks with a conchoidal fracture, from which characteristic it derives its name. At some places there are shale beds resembling the oil rock between the clay bed and the glass rock. At other places there is practically no oil rock, and at still others there is no clay bed. The base of the glass rock marks the base of the ore-bearing formations as worked up to the present time; but recent discoveries made at the Winskell mine, east of New Diggings, Wis., indicate that ore in paying quantities occurs in the Platteville limestone nearly down to the top of the St. Peter sandstone. The

lower part of the Platteville limestone formation consists of thick-bedded dolomites similar to those of the Galena limestone formation.

The general supposition is that the ore has been dissolved out of the Galena limestone and the overlying Mequoketa shale, in which it is found, and deposited in the crevices and openings existing in the lower part of the Galena limestone and the upper part of the Platteville limestone in the structural basins.

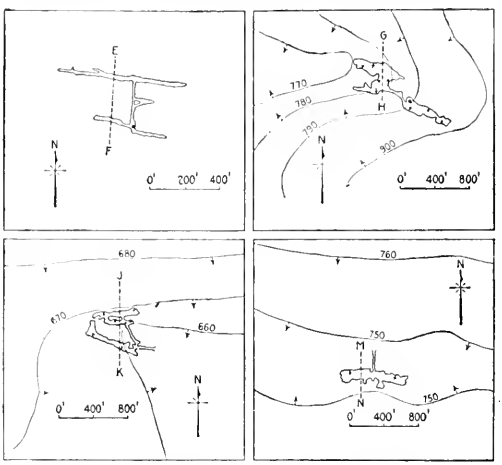
The crevices and openings in which the ore occurs may have been produced in several ways. The lateral pressure and the resulting folding may have produced them, or the dolomite beds for several feet immediately



FIGS. 2 TO 9. SECTIONS OF VARIOUS WISCONSIN MINES

above the impervious oil rock may have been dissolved out along channels in the structural basins, producing a slump in the overlying strata. Or as suggested by H. Foster Bain, the oil-rock layer, containing much organic matter, being much thicker in certain parts of the structural basins, has decreased in thickness to a considerable degree during the changes it has undergone, in the same manner that coal beds have decreased in thickness, producing slumps in the overlying formations at points where the oil rock is the thickest.

Erosion, ground-water level and the physical and chemical differences of the formations in which the orebodies occur have produced different types of ore deposits. Fig. 16 shows a vertical cross-section from the Mequoketa shale to the base of the glass-rock formation. All of the known orebodies of the district occur at some horizon in this vertical section. If the orebody occurs at points marked *A*, *B* or *C*, it will be of the types shown in Figs. 4 and 10. If the orebody is above ground-water level, the ore will consist of galena as "cog lead," zinc carbonate or blende, or all of these minerals occurring together. This type of orebody is known locally as a "crevice" or an "opening." Practically all of the lead mined in the district previous to 1900 was secured from orebodies of this type. Recently such mines have been worked below ground-water level. Such mines are the



FIGS. 10 TO 13. TYPICAL WISCONSIN OREBODY PLANS

Fig. 10 (upper left)—M & D Mine, Cuba City, Wis. Fig. 11 (upper right)—Winskell, New Diggings, Wis. Fig. 12 (lower left)—Federal Mine, Hazel Green, Wis. Fig. 13 (lower right)—Crawhall Mine, New Diggings, Wis.

Board of Trade, the Wicklow and the M & D, at Cuba City, Wis.; and the White Rose and Merry Widow, west of Galena, Ill. Orebodies of this type are frequently rich but limited in production. They are supposed to have been formed in the following manner. Certain rock strata at a given horizon are dissolved for a short distance on both sides of a vertical crevice, and the opening is simultaneously, or later, filled with lead and zinc ores chemically deposited.

If the orebody occurs at points marked *D*, *E* and *F*, Fig. 16, and is not the upper part of an orebody which extends to a lower level, it is frequently of the type shown in Fig. 9—a vertical cross-section of the Drum mine, east of Benton, Wis. In this type of orebody there are no distinct sheets of blende. The ore is disseminated, or "sprangled." In other words, the ore exists as small gash veins. Orebodies of this type have never been of much importance or long-lived. They are locally known as "bunches," occurring where a series of crevices cross at right angles.

The important mines of the district are those that occur in the lower part of the Galena limestone, above the oil-rock formation between *E* and *G*, Fig. 16. These are the true "flat-and-pitch" formations usually found below ground-water level. The flats are sheets of ore along the horizontal bedding planes of the strata and the pitches are sheets of ore located in vertical or dip-

ping crevices. Flats are shown at *M*, Fig. 16; pitches are shown at *N*, Fig. 16. Vertical cross-sections of orebodies of this type are shown in Figs. 3, 5, 6, 7 and 8, and plan views in Figs. 11, 12, 13 and 15.

Fig. 3 shows a vertical section across the Homestead and Empire mines at Platteville, Wis. This cross-section is taken on the vertical section line *CD*, shown in Fig. 15, the plan map of the same mines. The orebodies lie in a broad, flat structural basin. The Grant County and the Homestead mines are along the north side of the basin, and the Enterprise, Empire and Royal mines are along its south side. The distance from one group of orebodies to the other across the basin is about 1000 ft. The Acme mine is at the east end of the basin and shows indications of being connected with both series of orebodies, as it has both north and south pitches and has been connected with the orebodies along the north side of the basin by prospect drilling. As shown in Fig. 3, this is the type of orebody in which most of the ore and the thickest sheets of ore are found in the main or outside pitch, and the top flat is the only one that shows any great ore thickness. Differences exist in these orebodies, varying from those in which all, or nearly all, of the ore occurs in the outside pitch to those that show ore in paying quantities in the top flat and the underlying core, down to the base of the formation.

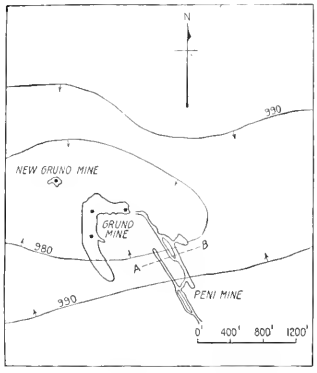


FIG. 14. MIFFLIN MINES

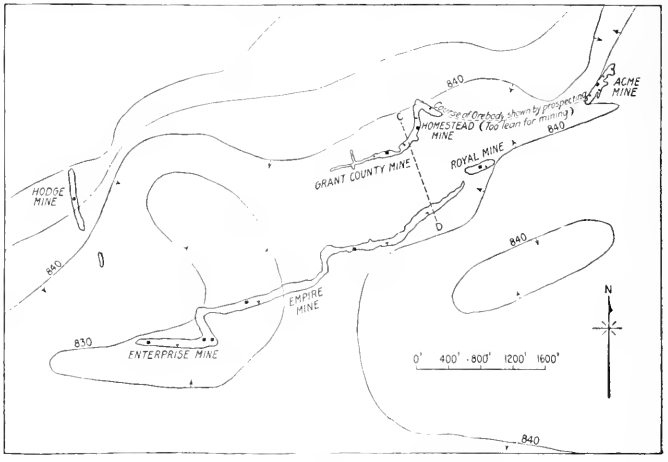


FIG. 15. MINES AT PLATTEVILLE, WIS.

Such mines as the Empire and the Enterprise at Platteville, Wis., illustrate the type where the main or outside pitch and the top flat are strongly developed, and such mines as the Klar-Piquette and the East End at Platteville illustrate the type in which the top flat and several underlying flats are strongly developed, and the outside or main pitch contains little ore, at many places showing nothing more than a crack or crevice.

Fig. 5 shows a vertical section across the Winskell mine, east of New Diggings, Wis. This section is taken on the vertical section line *GH*, Fig. 11, the plan of the same mine. This is the type of orebody located in a narrow, steep, structural basin, and mineralized in the main part of the orebody from one pitch to the other, or from one side of the structural basin to the other. In this type of "flat-and-pitch" formation, the flats and pitches seem to be about equally developed as regards the thickness of ore they carry. The Frontier mine, at Benton, Wis., and the Vinegar Hill Mine, north of Galena, Ill., are also of this type.

Fig. 6 shows a vertical section across the Federal mine at Hazel Green, Wis. This is taken on the vertical section line *JK*, Fig. 12, the plan of the same mine. This type of orebody is in a structural basin similar to the one in which the Winskell mine is located. Nearly all of the ore is in a series of pitches, and flats along the bedding planes show only to a minor extent.

Fig. 7 shows a vertical section across the Crawhall mine at New Diggings, Wis. This is taken on the vertical section line *MN*, Fig. 13. This type of orebody is in the bottom of a broad, flat structural basin. In it nearly all of the ore occurs in the flats along the bedding planes.

Fig. 8 shows a vertical section across the Hinkle mine, at Linden, Wis. This is the type of orebody with both pitches about equally developed, and flats extend from the back into the core of the mine. There is also a flat sheet of blende extending from the foot of one pitch to the foot of the other in the glass-rock formation. Orebodies of this type are in narrow depressions or channels in the structural basins. Nearly all of the orebodies near Linden are of this type, which has been used as an example of the orebodies of the district in the publications of 10 years ago.

Fig. 2 shows a vertical section across the Peni mine at Mifflin, Wis. This is taken on the vertical section line *AB*, Fig. 14. This type of orebody is usually located in the oil rock or the glass rock, and it frequently follows a series of parallel or intersecting crevices extending from the surface to the point of the location of the orebody. The ore is usually disseminated, sprangled or in the form of irregular flat sheets. The Kennedy and the Wallace mines at Highland, Wis., are orebodies of this type. The orebodies of this type frequently produce the highest-grade blende concentrates of the district, often running from 55 to 60% metallic zinc from the mill jigs.

There are numerous variations and modifications of all of these types of orebodies. New features are constantly being found in the orebodies of the district. The

chief production of the district comes from the mines in its southern half and most of these mines are of the types shown in the vertical sections in Figs. 3, 5, 6 and 7.

Prospecting Methods

Prospecting in the district may naturally be divided into drifting, shaft-sinking and churn-drilling. Previous to 1903 nearly all of the lead and zinc mines were found by shaft-sinking and drifting on crevices and outcrops. As most of the operations were conducted without power machinery, the ground-water level marked the limit to which these operations extended. During the latter part of this period the horse whim for hoisting and the horse-operated pump were the only machines used for prospecting and mining operations below ground-water level, and these were used successfully only in connection with the larger ore deposits.

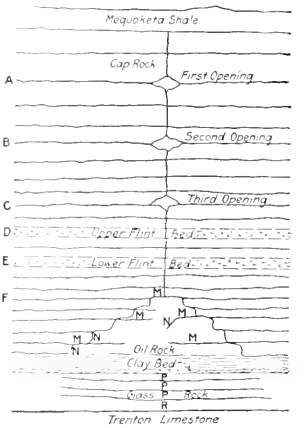
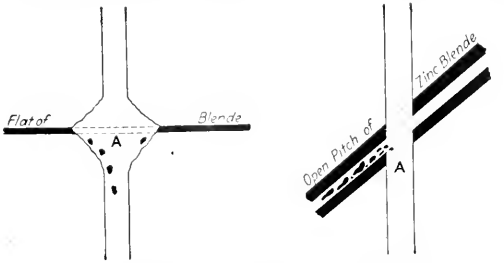


FIG. 16. VERTICAL CROSS-SECTION OF ORE-BEARING FORMATIONS

During the last 10 or 15 years most of the larger orebodies have been found by churn-drilling.

The diamond drill has been tried in the district at several places, but without success. The numerous crevices and openings have interfered with its operation. The churn drill has given the best results of any method of prospecting so far used in the district. When the ore-bearing formations are reached, the hole is sludged



FIGS. 17 AND 18. HOW ERRORS IN CHURN-DRILL SAMPLES ORIGINATE

Fig. 17—Section of drill hole showing ore dropping from flat and salting the hole. Fig. 18—Section of drill hole showing blende cuttings being lost in an open pitch.

out every 2 or 3 ft., and the sludgings that show blende to the naked eye are assayed for zinc and iron. Complete records of these holes are kept, showing the location of the drill hole, the surface elevation at its location, the nature, thickness and position of the formations passed through, and the position and the amount of the ore discovered.

Estimates based on several prospect drill holes are not always reliable, for more ore than actually exists may be shown by ore dropping from an upper to a lower level, especially when the formations are loose, thus "salting" the hole, as shown in Fig. 17. Or less ore may be shown than is actually drilled through because of its being washed into crevices or openings in the rock through which the drill hole passes, as illustrated in Fig. 18. A drill hole should never be "shot" to show the nature of the ore passed through until the hole is completed, because shooting may loosen ore and cause it to salt the sludgings at lower levels.

One of two methods is usually employed for getting the average zinc and iron contents of a drill hole. One

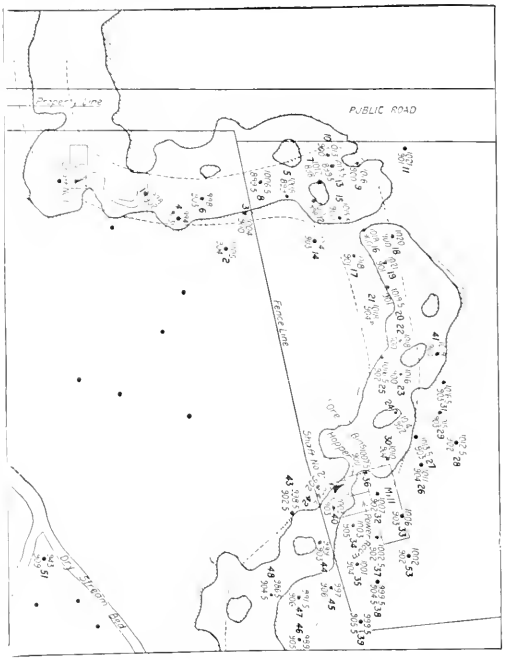


FIG. 19. A TYPICAL DEPOSIT OUTLINED BY DRILLING

method is to assay each sludging and then take a footage average of all of the sludgings from the first one containing ore to the last one containing ore, and including intervening sludgings containing no ore. The other method is to take all of the sludgings included in the former method, mix them thoroughly together and take one assay of the entire sample. The following example of a drill hole in actual practice, assayed by both methods, illustrates the plans and shows how slight errors may occur in both:

DRILL-HOLE RECORDS AND ASSAYS

Depth, Ft.	First Method Zinc Assay	Iron Assay
116-120	14.8	3.0
120-122	20.6	5.8
122-124	10.0	2.2
124-126	12.6	3.8
126-128	11.4	2.0
128-132	2.8	1.4
132-134	9.6	3.4
134-142	2.8	6.4

Total, 26 ft.; average, 8.5% zinc; 4.5% iron.

Second Method	

Total, 26 ft.; average, 7.8% zinc; 4.8% iron.

The difference in the assays in the two methods is due to the fact that equivalent footage of sludgings do not

always produce the same volumes of sludgings, because of the physical conditions existing in the strata drilled through. Each method has its advantages. Both should be used as a check for careful work.

Most of the churn-drill prospecting of the last 10 years, and the resulting discovery of zinc mines, have been at or near the old shallow lead- and zinc-carbonate workings. The old shafts and mine waste dumps have received far more consideration, up to the present time, in determining where prospecting should be done, than outcrops, crevices and geological conditions. But these old, shallow workings, not further developed by churn drill prospecting, are becoming scarce, so that the future developments will have to be made more and more in connection with a knowledge of geological and structural conditions.

After good ore is found in a prospect hole there is no great difficulty in proving up the extent of the orebody, unless it is very narrow or crooked in its course. Fig. 19 shows one of the orebodies of the district blocked out by drill holes. The broken lines represent the walls of the mine as blocked out for estimates of tonnage, based on drill-hole records, before any mining was done; and the full line shows the walls of the mine after it was worked out.

The orebodies of the district vary from 20 to 300 ft. in width, from 5 to 70 ft. in height, and from 500 to 7000 ft. in length. One of the best of the district had a length of 7000 ft., an average height of 20 ft. and an average width of 80 ft. Another had a length of 800 ft., a width of 500 ft. and a mean height of 40 ft.

(To be continued)

Canadian Nickel Production

The following data on nickel production are furnished by Consul Henry P. Starrett, of Fort William, Ont.:

It is said that the world's production of fine nickel in 1913 approximated 34,000 tons, of which the Canadian ore contained 24,838 tons; the ore produced by Le Société de Nickel in New Caledonia and refined in France contained about 8000 tons; and production in Norway amounted to 400 tons, the remainder having been refined in Germany from various metal processes. Practically all of the ore mined in Ontario was reduced to matte and shipped to the United States and Great Britain to be refined, only a small percentage having been refined in Canada.

The production of nickel in the Sudbury district—which region yields 73 per cent. of the world's output of nickel—is closely associated with that of copper, the content of the matte produced from the ore being about 50 per cent. nickel and 25 per cent. copper. The details of this production for 1911, 1912, and 1913 are:

	1911, Tons	1912, Tons	1913, Tons
Ore raised from mines	612,511	737,656	784,697
Ore smelted at mines	610,788	725,065	823,403
Bessemer matte produced	32,607	41,925	47,150
Nickel content of matte	17,049	22,421	24,838
Copper content of matte	8,966	11,116	12,938

The largest producer of this metal is the Canadian Copper Co., of Copper Cliff, Ont., its production of matte in 1913 having contained about 22,000 tons of nickel. Its output of matte was principally shipped to refiners in New Jersey. The Mond Nickel Co., of Coniston, Ont.—controlled by English interests—produced matte containing 2600 tons of fine nickel, this matte being sent to Swansea, Wales, for refining.

Under the metal refining act of 1907, extended in 1912 for a period of five years, a bounty of 6c. per lb. is paid on such metal in cobalt or nickel oxide or metal as is refined in the Province of Ontario. The only company that took advantage of this law during 1913, in respect to nickel, was the Coniagas Reduction Co., Ltd., of St. Catherines, Ont., the production of that company in the year named having been 149,645 lb. of metal.

New South Wales Mineral Production in 1914

The report of the New South Wales Department of Mines for 1914 has just been issued, and gives the figures of production shown in the accompanying table.

NEW SOUTH WALES MINERAL PRODUCTION, 1913 AND 1914

Substance	Unit	1913	1914
Alunite	tons	2,235	3,040
Antimony (metal and ore)	tons	18	36
Bismuth (metal and ore)	tons	9	15
Coal	tons	10,414,165	10,390,622
Coke	tons	298,612	304,800
Copper (ingots, matte and ore)	tons	9,461	6,607
Diamonds	carats	5,573	1,580
Gold	oz.	149,657	124,507
Iron	tons	46,563	75,150
Iron, "oxide"	tons	3,204	3,144
Lead (pig, etc.)	tons	23,554	25,989
Lime	tons	33,272	36,207
Limestone flux	tons	42,663	51,852
Molybdenite	tons	79	61
Platinum	oz.	442	244
Silver (ingots and matte)	oz.	2,194,871	2,871,559
Silver-lead, ore, concentrates, etc.	tons	391,262	337,019
Shale (oil)	tons	16,985	50,049
Scheelite	tons	44	57
Tin (ingots and ore)	tons	3,021	2,317
Wolfram	tons	126	130
Zinc (spelter and concentrates)	tons	506,661	359,319

In addition to the foregoing, marble valued at £2180, opal, £26,534; portland cement, £415,000; building stone, £401, and sundry minerals and ores valued at £5512 were produced in 1914.

The total value of the mineral yield in 1914 was £10,499,720, a decrease of £1,595,364 from that of the previous year. However, considering the disabilities under which the mining industry has labored since the outbreak of war in August, 1914, the production must be regarded as very satisfactory. It has only been exceeded on three occasions, namely, in 1907, 1912 and 1913.

The number of persons employed in mining in 1914 is estimated at 37,470, a decrease of 1410 from figures of the previous year.

Arizona Copper Co.

The Arizona Copper Co., Ltd., Clifton, Ariz., reports for the half year ended Mar. 31, 1915, a profit of £187,899, before payment of debenture interest and dividends, and a balance before payment of dividend on the ordinary shares of £137,303, from which a common dividend of £75,995 was paid.

The production of copper for the half year was 8774 tons, against 9469 tons for the corresponding period of last year and 9909 tons for the half year ended Sept. 30, 1914. The question of the recovery of copper from tailings by means of oil flotation is still under consideration. Agreements have been entered into which will enable the company to introduce oil flotation when experiments that are being carried through at Clifton have demonstrated which particular process is best adapted for treating the company's ores.

The Sampling of Churn-Drill Prospect Holes

By Frederick G. Moses*

SYNOPSIS—Bailing difficulties with dart-valve bailers and results of foreign rock getting into sludge discussed. Splitter designed for cutting down sludge samples automatically. Points to be watched in drying samples and taking and drying a geological sample.

The value of churn drilling, as a means of prospecting for orebodies, depends on the care with which the sampling is done. Of course, in order to get accurate samples in any kind of sampling operations, care and cleanliness are imperative, but this is more especially true in the sampling of churn-drill holes. Many factors enter into this work that make it even more difficult than a superficial glance at the subject would lead one to suppose.

The process of sampling a churn-drill hole, as viewed from a practical standpoint, consists essentially of three operations: (1) The actual bailing of the sludge from the hole, (2) the cutting down of the sludge to the amount required for a sample, and (3) the drying and sacking of the samples.

Bailing

Common practice in the West is to take a sample interval of 5 ft., but this distance may be more or less, depending on the physical character of the formation and the value of the orebody being drilled.

Probably the most fruitful source of unreliable samples and at the same time the hardest operation to carry on in a way to give good results, is bailing.

The two most important factors encountered in bailing which tend to cause poor sampling results are: (1) The drillers can only be made, with the greatest difficulty, to run the bailer enough to clean the hole thoroughly each time, and (2) the mechanical construction of the bailer that is most often used is such that it is impossible to bail the hole absolutely dry.

The bailing operation is a fairly slow one, and when the hole is deep, a great deal of time is taken up in bailing. The drillers are anxious to make good progress and, as a result, hate to spend any more time in bailing than is absolutely necessary to clean the hole enough so that the sludge left in it will not interfere with the drilling. The result is that they leave 10% or more of the sludge in the hole. Of course, this sludge that remains goes into the next sample and if there is any difference in the ore content of the two intervals, it will salt up or down, as the case may be, the sample from the lower interval. The only remedy for this fault is careful supervision of the bailing by some one with the power to enforce careful work.

The second important factor is the mechanical construction of the bailer commonly called the "dart-valve" type, Fig. 1. The bailer is so built that the valve in the bottom of the instrument is opened by the weight of the bailer resting on a lug that projects through the valve opening. When the bailer is lifted the weight of the valve and the sludge above will close the valve. When the bailer is on the bottom of the hole and the lug has opened the valve, the bottom of the bailer proper is still 6 in. from the bottom of the hole. No matter how many times the bailer is run, it is evidently impossible to get the amount of sludge equal to the length of this lug into the bailer. This amount of sludge is so small, however, that unless there is a great difference between the assays of the two adjacent samples, it will not cause an appreciable difference in the assay of the following sample.

A partial remedy for this fault of bailing is a system of progressive dilution that is sometimes used in particular work, or in holes that are in high-grade ore. After all of the sludge that can possibly be taken out with the dart-valve bailer is extracted, two or three bucketfuls of water are thrown into the hole. The bailer is then run into the hole and worked up and down in order to mix the newly added water and the sludge that had been left in the hole by the bailer. The bailer is now pulled from the hole and emptied. Of course, the total amount of material, sludge plus water, is the same as the previous amount

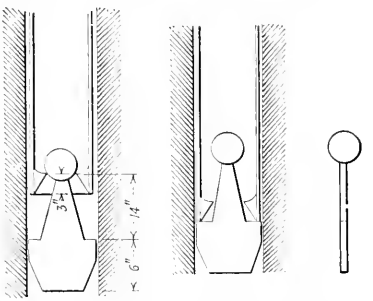


FIG. 1. TYPE OF DART-VALVE BAILER

of sludge, but the total amount of solid matter is less because of the dilution caused by the water that was added to it.

Besides these two difficulties in bailing that have been mentioned, there are several of lesser importance that should also be noticed.

Knocking Foreign Material into the Sludge

One of the greatest of these lesser evils is the dropping of material from the walls of a hole that is caving slightly. A churn-drill hole is very likely to cave, especially the part in a brittle sulphide ore, without being noticed, unless it is watched closely and carefully. Casing a hole is a laborious and often difficult operation, and if the caving is not great enough in extent to interfere with the drilling operations, the driller is likely to say nothing about it. As long as this state of affairs exists the cavings will drop to the bottom of the hole and become mixed with the sludge that is to form the sample from the interval that is being drilled. The result is a sample that is bound to be salted one way or the other, depending on the character of the caved material.

*Churn-drill sampling department, Detroit Copper Mining Co., Morenci, Ariz.

There is also another way in which material can be knocked into the hole, and that is by the drilling tools, when they are being lowered into the hole, after the bailing has been completed and drilling is to be resumed. The string of tools to which the bit is attached is from 30 to 40 ft. or more in length. As this mass of metal is rapidly lowered (as it always is) into the hole, it will vibrate back and forth and, on striking the walls of the hole, knock off pieces of the wall rock. This will continue all of the distance down the hole and, when all of this loosened material has collected on the bottom, will frequently be great enough in amount to cause a noticeable difference in the sample to which it will be added.

Sludges Which Pack

Some sludges, because of a lack of light kaolinized material, will pack in the bottom of a hole as soon as the tools are pulled out of the hole. When material of this sort is being dealt with, the bailing should be done as quickly as possible, and each time the bailer is run down it should be pulled up a small distance and then dropped down again. This is done in order to keep the cuttings mixed as well as possible between the bailer trips.

In extreme cases only, where the sludge is so heavy that it cannot be agitated enough to get it into the bailer, a little clean clay may be added to the hole. This material will mix up with the heavy cuttings and cause them to float, more or less, so the bailer can pick them up. When foreign substance has been added to a sample it must be marked "unreliable" even though the amount added is so small as to make no noticeable difference in the assay results.

Cases have been cited where the driller could not get this sort of sludge into the bailer after the first or second trip. Instead of trying to mix the cuttings and the slimes together and then bail, adding something to make them mix, he would stop running the bailer and commence to drill. This procedure would cause the sludge left in the hole to become mixed with the sludge from the next, and make each sample overlap the next. Conditions like this give an assay result that is worthless, because it is an average of the two adjoining intervals instead of an accurate value of either.

Cutting Down the Sample

The second operation of sampling, that of cutting down the sludge to the amount required for the sample, offers no difficult or unusual problems, but nevertheless, it will always bear the closest supervision.

The amount of sludge obtained from a churn-drill hole in an interval of 5 ft. depends largely on the size of the hole and the amount of water that is necessary for the drilling of the interval. The amount of sludge may vary from, say, three to 10 tubfuls, or even more. This large amount of material must be cut down to a quantity that may be dried and sent to the assay office, and at the same time represent the exact chemical composition of the total amount of sludge taken from the sample interval.

There are two common methods of reducing the total bailing to a convenient sample size. Cutting down the sludge is carried on in order to get this pail of material that will accurately represent the whole amount of material bailed. The first way of cutting down is by hand, and the second method, and probably the best, is by the use of an automatic splitter. The second method has many points in its favor and should be used.

The hand method of cutting down the sludge is simple, and care on the part of the sampler is all that is required to get an accurate sample. The procedure is about as follows: The sludge is dumped from the bailer into a launder of heavy construction, see Fig. 2. At the end of this launder is a Jones sampler—so common in assaying and sampling establishments. This sampler is so placed that all of the sludge that is thrown into the launder will go through it. A tub is then placed under the divider in such a way as to catch half of the sludge, while the other half is allowed to run away as discard. As soon as one tub is filled in this manner it is replaced by another until the bailing has been completed. When this has been done the launder is flushed out with a pail of clean water, in order that the heavy material in the sludge may be washed into the sample. The tubs of sludge are then poured back through the divider as often as required to get the

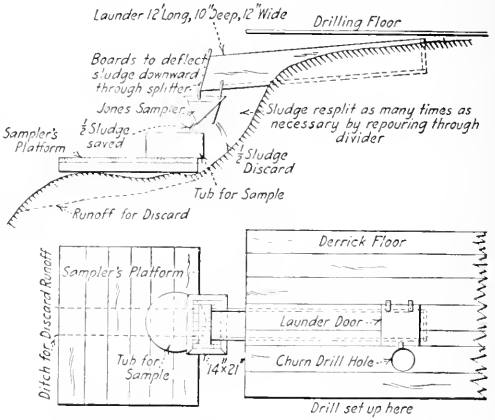


FIG. 2. ARRANGEMENT FOR HAND SAMPLING

sample to the size desired. To accomplish this usually takes five or six more reductions. The sample is now ready for drying.

During the above operation there are several points to be watched. The first is to see that the sludge comes onto the divider as near the center of it as possible. This is to get the most accurate division of the bailing.

The second point is to see that none of the sludge splashes over the sides or ends of the divider and into the tub. It is imperative that all of the material should go through the divider. A remedy for a fault of this kind is to nail a few boards on the end of the launder in such a way that when the sludge strikes these boards it will be deflected downward into the splitter. Usually the rush will be so great when the bailer is dumped that it will be necessary to caulk the cracks between the boards with cloth to keep the material from going between them.

Churn-drill sludge, especially when the hole is traversing a kaolinized or clayey zone, is very heavy and it may be semiliquid. When a sludge of this type carries sulphides they will tend to float. When this material is being resplit, the sampler must use great care in pouring it through the divider or a part of these floating sulphides will flow over the side of the divider and be lost to the sample. These sulphides, in most cases, run the highest in metallic values and to get an accurate assay of the sludge, none of them must be lost.

Often the hole is [illegible] two during the drilling of one sample interval. When this happens, the tubs that are first filled have to stand for a time before the sample can be cut down. With nearly all types of sludge, especially the thick clayey kind before mentioned, difficulties are experienced with the heavy particles and much of the clay by settling to the bottom and sides of the tub where they stick tight. When this happens the sampler must be careful to wash the tubs out over the splitter with a hose, to get this material, which often carries high values.

With the automatic splitter, the sludge is split four or five times, instead of once, before it is caught in the pans or tubs, which means the saving of a great deal of time and also the eliminating to a large extent of the human factor. In sampling this is of great importance. Instead of the sampler having five or six chances to be careless, he can be careless only two or three times. With a small amount of bailed material it will not be necessary to resplit at all, and in the case of a large amount it may have to be cut once or twice more after coming through the automatic divider.

A type of automatic splitter, Fig. 3, that has given satisfactory service for the Detroit Copper Mining Co., at Morenci, Ariz., consists of two 12-in. boards 12 ft. long, placed side by side on end and 2 ft. apart. At regular intervals, between these boards are placed four Jones samplers. The first two of the samplers are 14x21 in. The one next lower down is 11x13 in., and the bottom one is 9x11 in. These samplers are placed one above the other and connected by sloping troughs about 2 ft. long. The splitters are so arranged that the sludge runs out of the launder into the first of the dividers which splits it, throwing half of the sludge, the discard, to the ground and the other half of it into the trough. The half that is to be saved then runs down this trough and into the next lower divider. This operation is repeated by each of the splitters in turn until the product from the last of them is only $\frac{1}{16}$ of the total amount of material bailed. The object of the troughs between the dividers is simply to mix the sludge after it has been cut. As mentioned above, with a medium amount of sludge the sample will need no more cutting, and when large amounts are bailed it will be necessary to resplit it by hand only once or twice, as the case may be.

This divider was designed by G. F. Carr, of the Detroit Copper Mining Co.

The only point to be watched when using this apparatus is to see that it is washed thoroughly with a hose each time after it has been used, in order to get any heavy or sticky material out of the way of the next sample. When it is necessary to resplit the sample once or twice more by hand, the same precautions must be observed as when the whole operation is done by that means.

Drying and Sacking

After the sample has been bailed and cut down, the only operation that remains is the drying and sacking. This work is of the simplest nature, and with a little care should give no trouble. However, there are a few things that must be noticed.

When a hole is deeper than, say, 400 ft., the sludge will often contain gases dissolved in it. These gases are principally CO_2 and H_2S. During the process of drying a sample of this kind, these gases will be expelled. As the gases are driven from the solution by the heat, they will cause foaming to a greater or less extent, and at the same time carry some of the finer of the sulphides to the surface of the liquid with them. If the pan in which the sample is being dried is too full, some of this foam may bubble over the side of it, and cause the loss of some of the fine sulphides, which will cause a low assay. There are two remedies for a sample that acts in this manner: use a pan that is large enough so that the danger of boiling over will be avoided, and dry it over a slow fire.

There is one point that must be watched when sacking any kind of a fire-dried sample. In the drying process the agitation due to boiling will naturally carry the heavier pieces in the sample to the bottom. The foam mentioned before will also be dried on the surface of the cake and a good deal of it will stick around the edges of the pan just at the top of this cake. Great care must be used when sacking a sample to which these two things have happened to see that the pan is scraped thoroughly, both

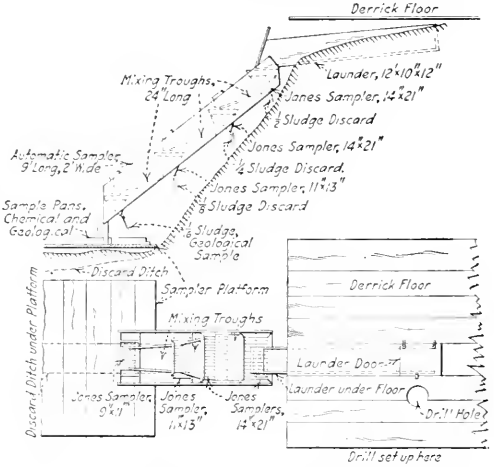


FIG. 3. ARRANGEMENT FOR AUTOMATIC SAMPLING

sides and bottom, to loosen all of this material and get it into the sample. This material will carry the high-grade, if any, which makes it doubly important.

Taking Geological Sample

The above considerations have dealt with samples for chemical analysis only. The large companies that are doing extensive drill prospecting often want a geological sample from the same intervals from which the assay samples are obtained, so that they can, besides learning the value of the ground being drilled, get some idea as to the rock formations in which their ore is being found. When these geological samples are taken they are obtained from the same material as the chemistry samples.

A geological sample is simply a portion of the sludge from which all of the clay and mud has been washed. A convenient way to take this sample is to save and wash the discard from the last splitting of the assay sample. This material is then dried, labeled, sacked and sent to the geologist.

The washing of the geological sample must be [illegible] done. The principle used in treating these [illegible] to get rid of all of the material that will interfere with the mineralogical determination that is made later, and at the same time to have as small a loss of the minerals in

the sample as possible. Special care must be used when washing a sample that is high in kaolinized material, for this, when dry, will make a great deal of dust, causing a dirty sample.

The sludge to be used for the geological sample is diluted until the required amount of cuttings has been thrown down. Everything except these rock cuttings is then carefully poured over the end of the pan and the cuttings that remain are washed as many times as necessary to clean them well.

The sample is next dried. It is best to do this out of direct contact with the fire for the reason that if it is put directly on the fire there is the possibility of its getting so hot that the sulphides present may be roasted to the oxides, and other minerals present be broken up into their component compounds. If this does happen, the value of the sample as an index to the formations that are being penetrated is lost.

The necessity for a careful, intelligent and responsible churn-drill sampling force cannot be emphasized too much. The reliability of the results obtained from the drilling on the property depends directly on this force, and the money that may be saved by a poor, cheap or inefficient sampling organization is earned in the most expensive of ways.

Shannon Copper Co. in 1914

The report of the Shannon Copper Co., Metcalf, Ariz., for 1914 shows a net profit of $95,649 from a production of 9,003,169 lb. of copper, 1295 oz. of gold and 69,603 oz. of silver. The average price received for copper was 13.626c. and for silver 55.78c. Proceeds from all metals amounted to $1,291,539. Operating expenses were $992,527, and freight, refining and eastern expenses, $127,841. Development, interest and taxes amounted to $69,974, and other income, $21,525. There was also a charge of $23,739 for expenses while not operating during the fourth quarter of the year, and $3331 for a net loss on the operation of the Shannon-Arizona Railroad Co.

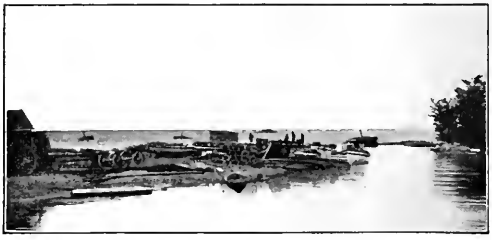
During the nine months of operations the smelter treated 154,300 tons of ore from the Shannon property and 38,997 tons from outside claims. The average copper extraction from the ores of the Shannon mine was 52.76 lb. per ton and 16.68 lb. per ton from the outside properties. The average cost of copper sold in New York was 12.26c. per lb. Net current assets in excess of current liabilities amounted to $349,388, exclusive of $383,000 of Shannon-Arizona railway bonds which the company holds in its treasury. There are now only $198,000 of these bonds in the hands of the public out of an original issue of $600,000. During the year 4462 ft. of drifts and crosscuts were run at a cost of $25,659, about $5.75 per ft. Operations were resumed in full Mar. 1, 1915.

Big Timber Cut in Alaska

A permit to cut 85 million feet of timber in the Chugaeh National Forest for use in constructing the new government railroad from Seward to Fairbanks has been received from the Forest Service. The cutting is to be done so that only mature trees are taken; the young trees being left uninjured and the condition of the forest thus improved. This cut of 85 million feet will be the largest amount of timber ever felled on the Alaskan forests in one operation, and at the average rate per thousand board feet obtained for timber sold from the Chugaeh Forest during the fiscal year 1914, it is worth approximately $145,000 on the stump. It will be nearly twice as much as the total quantity of national forest timber now cut and used annually for local purposes throughout Alaska, but only a little more than one-tenth of the estimated annual growth of the Alaskan forests. The two national forests of Alaska contain about 78 billion feet of merchantable timber, and it is estimated by the Forest Service that more than 800 million feet could be cut every year without lessening the forests' productivity.

Difficult Transportation at the White Pine Mine

The accompanying illustration shows the difficulties which the White Pine mine in Michigan has in getting its output to the smeltery at Hubbell from the mine. The White Pine is a newly developed subsidiary of the Calumet & Hecla, situated 16 mi. from Ontonagon, and is still without rail connection. The copper rock is mined



TRANSPORTATION AT WHITE PINE MINE

and milled at the mine, then hauled in barrels over a rough corduroy road to the point shown in the illustration, then hauled in scows from the mouth of Iron River into Lake Superior and thence to the smelting plant by tug. The tug shown in the background cannot come nearer shore, and the scow loaded with copper has to be towed out to it by a powerful gasoline boat.

Antimony Smelting in the United States

The Chapman Smelting Co. of San Francisco, which smelted antimony a number of years ago, has resumed operations, and in addition a new antimony smeltery has been erected near San Pedro, which is reported as working upon ores from Wild Rose Cañon near Ballarat, Calif. Antimony ores have been sold and shipped from Alaska, California and Nevada, according to the United States Geological Survey.

The *Journal* is advised that the San Pedro smeltery is operated by the Western Metals Co., of which M. Elsasser is president, with offices at 625 Security Bldg., Los Angeles, Calif., and that the Merchants Finance Co., of San Francisco, is erecting a plant at Harbor Industrial City, Calif., of 1000 tons per month capacity, to cost about $75,000.

Metal Loss in Copper Slags—III

By Frank E. Lathe*

SYNOPSIS—*A general consideration of the data presented in the preceding articles and the suggestion that slag losses can be reduced in many instances by careful study of conditions. Serious loss from dissolved cuprous sulphide not considered proved. Loss from suspended matte particles may be reduced by better settling facilities. From one-half to three-quarters of the copper lost in slag is in the oxidized form; various remedies have been suggested by different operators.*

The constitution of mattes and slags is not well enough understood to enable us to formulate definite rules governing their mutual behavior. Recent experiments by Professor Guess and myself at the University of Toronto have shown that artificial mixed sulphides of copper and iron vary greatly in both composition and properties, according to the conditions under which they have been prepared, and that it is not easy, if at all possible, to duplicate in the laboratory the mattes produced in commercial smelting. This fact probably accounts in large measure for the contradictory results obtained by different investigators of the problem.

Complexity of Matte Composition

The main constituents of ordinary mattes are Cu_2S and FeS, mutually soluble in all proportions in the molten condition. They form a eutectic containing about 25% Cu, but the existence of compounds is still a debatable question. If they do exist they seem to have no striking effect upon the general properties of matte. Metallic copper may be seen in many specimens of matte, but is soluble in molten Cu_2S, separating only on solidification. Metallic iron, usually present, varies greatly in quantity, being produced chiefly under the conditions nearest those of the iron blast furnace—high temperature and strong reducing action—the usual requirements for the production of highly siliceous slags in copper blast-furnace operation. It may, however, be mainly due to a dissociation of FeS, in the excess of which it dissolves readily. When zinc, lead, arsenic and antimony are present in the furnace charge they are usually found, in part at least, in the matte; ZnS and BaS in the matte lower its specific gravity. Silver is likely to be in the form of Ag_2S, very soluble in Cu_2S, less so in PbS, and but slightly in FeS, Fe, and ZnS. Gold, chemically very inactive, is probably present as metal, readily soluble in Cu_2S, Cu and Fe, less so in the other constituents. With the exception of Fe_3O_4, which may be present in quantities up to 10% or higher, oxides are practically absent from mattes. The metallography of mattes has been discussed at length by Professor Fulton[3].

The identification of compounds in slags, as carried out by Vogt, is of less value to this discussion than a consideration of the effect of various acids and bases on fluidity and specific gravity, two factors of prime importance, and on the observed copper content. In this connection Waujukoff's curves[4], Figs. 3 to 6, are of interest. In his experiments an increase in the SiO_2 was attended by favorable results, also a replacement of FeO by CaO, Al_2O_3, or MgO, while ZnO in more than small amounts was decidedly detrimental. Both Al_2O_3 and MgO replaced CaO to advantage.

Of these indications the effect of an increase in SiO_2 within reasonable limits is fully borne out in practice, and the data available seem sufficient for a general conclusion. The same is true, though perhaps to a less extent, of the replacement of FeO by CaO. Of course the extent of this replacement is limited by the fluidity of the slag, which almost requires the presence of FeO or its equivalent, MnO, in some quantity. For the same reason the Al_2O_3 or MgO should be kept within bounds, although practical slags show that fair amounts of these oxides do not always increase the viscosity of the slag to such a point that good settling is difficult. ZnO has a particularly bad effect, increasing both the viscosity and the specific gravity of the slag.

Referring to Professor Hofman's list of blast-furnace slags[5]—Table 1—it will be seen that in general the clean slags are high in SiO_2 and CaO, and sometimes Al_2O_3, being thus of low specific gravity, and have been produced with a matte low in copper. At the other end of the list these conditions are generally reversed, although in some cases the reasons for high slag losses are not apparent. The combined effect of low SiO_2, CaO and Al_2O_3, and high ZnO, producing a heavy slag and light matte, is well illustrated in No. 26. BaO does not appear to be detrimental, in spite of its high specific gravity, as two slags, Nos. 6 and 18, containing it in largest proportion are cleaner than one would expect from the other conditions. More light would probably be thrown upon some irregularities if the viscosity of each slag were known. The losses in reverberatory smelting[6]—Table 2—are more uniform than those in blast-furnace practice, and somewhat higher, due to the more nearly uniform composition and high percentage of FeO.

Loss of Copper as Suspended Matte Particles

Considering now an intimate mixture of matte and slag in the molten condition, copper may be lost in several different ways. Suspended matte particles will be first considered. That these particles are usually present, in small amount at least, few metallurgists will probably deny. They may be seen on careful examination in some slags which have no more than 0.20% total copper. If not due to the separation of dissolved sulphides on solidification of the slag, this matte is lost through imperfect settling which may be caused by insufficient difference between the specific gravities of the matte and slag, to the viscosity of the slag or to the very small size of the matte globules. The influence of all these factors is well shown by Sir G. G. Stokes' formula for the law of viscous resistance:

$$v = \frac{2}{9}\frac{g}{\mu}\left(d - d^1\right) r^2$$

*Chief chemist, Granby Consolidated Mining, Smelting & Power Co., Ltd., Grand Forks, B. C., Can.

[3]"Principles of Metallurgy," Chapter IX.

[4]"Engineering and Mining Journal," Aug. 7, 1915.

[5]Ibid.

[6]Ibid.

where v is the terminal velocity of settling particle (sphere), g the acceleration due to gravity, d the density of sphere, d' the density of fluid, n the coefficient of viscosity, and r the radius of sphere. Thus an increase of $d - d'$ may be accompanied by a corresponding reduction in the time of settling, as may also any decrease in viscosity. To illustrate the great effect of variation in r—if a particle of matte of 0.1 in. diam. requires 10 sec. in which to settle, then one of 0.01 in. diam. would require 16⅔ min. Viscosity is perhaps not usually a serious factor, though it is liable to become so with high ZnO or Al_2O_3, or with high SiO_2. Slags of such composition require to be heated considerably above their formation temperature to give sufficient fluidity, while the irony slags, though perhaps formed only at higher temperatures, become very fluid when but slightly superheated. Thus the formation temperature is not nearly as important as might be supposed, the temperature at which the slag will be sufficiently fluid to allow the matte particles to settle within a reasonable time being the minimum permissible.

These losses as suspended matte particles may be reduced by securing greater fluidity in the slag—whether by changing its temperature or composition—by making a slag of lower specific gravity, or by coagulation of the matte particles. As some of these factors work against each other—FeO often increasing both fluidity and specific gravity—it is essential that no condition be changed without its total effect being noted. A compromise will usually be necessary to secure the best results.

Copper Settler Practice

Most metallurgists believe, if one may judge by the common practice, that one large settler, about 15 ft. in diameter, will allow to settle all the matte particles which can be economically separated from the slag. However, this question appears to be worth further investigation. At the Granby's Grand Forks smeltery a large settler was substituted for two small ones, as an experiment, and as long as it was in operation the slag passing through it carried more than the normal amount of copper. The reasons for it are not quite clear, but it is often noticed in analytical chemistry that thorough stirring is followed by a coagulation of precipitates, and the cascading of the slag from one settler to another with a drop of some inches may have a similar effect upon the suspended matte particles. It is certainly unwise to allow a slag to pass to waste without first determining by trial that the amount of copper which might be recovered in a second settler would not pay for the additional expense. To give again the experience of the Granby, up to seven settlers in series have been tried, and some matte has been recovered even in the last of these, while not less than three give the best commercial result. In any particular case the degree to which the slag has been superheated in the furnace will largely determine the length of time during which it may subsequently be economically treated. As already noted, the average temperature of the matte and slag issuing from the Granby furnaces is about 1275° C., though the slag will flow at 1100° C., and its formation temperature may be considerably lower.

If a slag contains a certain percentage volume of suspended matte it is evident that the amount of copper thus lost will vary directly with the grade of matte. While low-grade matte involves additional expense in a subsequent operation, the cost of treating it has materially decreased since the introduction of pyritic smelting and basic converting. It must be remembered also that in its production the amount and specific gravity of the slag decrease and its composition changes, becoming more siliceous, while the specific gravity of the matte also decreases. The first three factors tend to decrease the copper in the slag, and in practice far outweigh the tendency of the last to increase it.

In the curves—Figs. 1, 2 and 8[7]—given to show the result of actual operation at different smelteries, there is a flattening between about 32 and 38% matte. In other words, a variation in the grade of the matte between these limits had no considerable effect on the copper content of the slag. Both above and below these percentages the change in the slag was more marked. This points to 37-38% matte as a desirable grade to produce unless it can be reduced below 32%. No satisfactory reason has been suggested to account for this.

From the small amount of information at hand it may be stated that in some cases at least the loss of copper as suspended matte is not more than 25-50% of the total loss in slag.

Loss by Dissolved Cuprous Sulphide Not Yet Proved

The phrase "solubility of matte" has unfortunately been loosely used by some writers, who often mean by it, in the subject they have under discussion, the total amount of copper retained by the slag, whatever its condition. In this paper it is used in its ordinary chemical sense. The amount of Cu_2S dissolved is a constant under any given set of conditions, but varies with the composition and temperature of the slag, and is probably thrown out of solution when the slag solidifies. It seems altogether likely that such a solubility does exist, though perhaps small, as we learn from chemistry that most "insoluble" substances possess a definite and measurable solubility. That the matte particles found in slag are not due to the separation of dissolved matte, on solidification, seems probable from their appreciable size. If chemical compounds exist in the matte we may expect them to dissolve as such in the slag, while if they do not exist, the various constituents of the matte will have separate solubilities, in the slag and in one another.

It is difficult to conceive of any direct method of determining the actual amount of Cu_2S thus dissolved in any slag, especially if it separates on solidification of the latter. The best we can do perhaps is to estimate it by difference. First, we can calculate the amount of suspended matte from the gold-copper ratios of matte and slag. Then we may determine the amount of copper in the oxidized condition. The difference between the sum of these and the total copper in the slag might be accepted as dissolved Cu_2S, but, as already seen in Mr. Kiddie's experience and at Grand Forks, the only places from which such data are available, there is no appreciable difference of this kind. While the evidence is not such as to enable me to state a general rule I may at least say that the existence of dissolved Cu_2S in slag in determinable quantities has not yet been proved.

It is indeed fortunate that such appears to be the case, for the difficulty of reducing such a loss would be considerable. A possible corrective measure would be

[7] "Engineering and Mining Journal" Aug. 7-14, 1915.

to reduce its solubility in the slag by changing conditions. Of these the temperature—with which solubility might be expected to increase—is already as low as is consistent with thorough settling. A hopeful change would be in the composition of the slag. If the dissolved Cu_2S is dissociated (Hofman states[8] that it is a good conductor of electricity), the addition of pyrite and consequent increase in the number of sulphur ions would tend to precipitate the copper.

Losses of Copper in Oxidized Form

Oxidized copper may be present in slags as cuprous or cupric oxide or as silicate. As the opinion has been freely expressed that none of these really exists in considerable amount in ordinary slags, it may be well to review the evidence. (1) The amount of copper dissolved from some normal slags at moderate temperatures by either dilute HCl or H_2SO_4 is much greater than that dissolved from mattes. If all the copper were present in the same condition in both instances one would expect the opposite to be the case. (2) The copper oxidized, as determined in this way, appears to check the estimated amount too closely to be the result of accident. (3) When copper oxide and silicate are actually introduced into a slag, even though they be intimately mixed with matte, and the whole is fused, the amount of copper remaining in the slag is considerably more than the normal. This shows that the reaction between sulphide and oxide is not complete under such conditions. (4) When a slag is given the treatment necessary to reduce the copper oxide, if it be present, the copper content of the slag is materially reduced. From the foregoing it seems reasonable to conclude, not only that oxidized copper does exist in normal slags, but that its amount may be at least approximately determined.

It does not appear to be of great consequence whether the copper be in the slag as oxide or silicate, the method of reducing it would probably be the same in either case. One would think, however, that no oxide with a considerable affinity for SiO_2 would long remain uncombined, at least in a siliceous slag. Cu_2O, if present as such, would probably color the slag red, while CuO is unstable at the ordinary furnace temperatures.[9] But what is of real importance is the fact, if we may call the conclusion such, that in all the normal furnace slags tested, though they were made under radically different conditions, from a half to three-quarters of the copper lost existed in the slag as oxide or silicate, and not as sulphide.

This being true, particular attention should be directed to possible means of reducing the loss. Mr. Wright—in the article already reviewed—told of passing slag made in two reverberatory furnaces into a third, this one containing matte of low gold and silver content. While he did this only to save the precious metals otherwise lost in the slag from the first two furnaces, it is evident that the treatment might be applied to the reduction of oxidized copper as well. Mr. Kiddie made the definite suggestion of passing a slag containing copper oxide over a bath of low-grade matte in a second settler. The difficulty appears to be to introduce this matte and keep it in the molten condition for a long period of time. If it were produced directly from pyrite in the settler some additional heat would probably have to be provided. Mr. James, in speaking of converter slag, favored the plan of an externally fired settler into which pyrite was dropped to reduce the copper oxide. The most hopeful suggestion, however, was made by E. J. Carlyle. He thought if a wall of refractory material were built across a reverberatory furnace near the skimming end, high enough to keep back the main body of matte, but low enough to allow the slag to flow over it, that pyrite could be charged through the roof between this wall and the skimming door, with a material reduction in the copper content of the slag. A separate tap-hole could be provided for the low-grade matte as well as a side door behind the dam for the removal of floaters. Such a practice would not involve radical changes in construction, and would appear to be of general application in reverberatory smelting. At any rate the experiment is well worth trying, particularly as the loss as oxide in reverberatories is probably much greater than in blast furnaces.

The Cleaning of Converter Slag

This question of oxidized copper is of considerable importance in the treatment of converter slags, at least in those smelteries so situated as not to require it in their blast furnaces. While the custom of pouring molten converter slag into blast-furnace settlers may be commercially, even if not metallurgically, the best practice in some instances, such a course should certainly be adopted only after a thorough investigation of the copper content of the overflowing slag before, during and after the pour. Some sulphide would be settled and some oxidized copper would be reduced by the matte, but the dilution by blast-furnace slag would ordinarily be such as to render the losses actually taking place difficult to determine accurately. Results of the Anaconda company's proposed treatment of converter slag in a special reverberatory furnace will be awaited with interest. .

The similar behavior of the sulphide and oxide (or silicate) of copper under remedial treatment is worthy of note. Thus in the settling experiments not only was the sulphide settled, in part at least, but the oxidized copper in the slag decreased also. This is probably due to the fact that oxidizing agencies (blast and Fe_3O_4) were no longer at work, and the oxidized copper was reduced to its normal amount. Also in the treatment of slag with low-grade matte not only was its particular purpose accomplished, but sulphide also settled. In the case of adding pyrite to a slag to reduce the oxide it would probably carry down with it some of the suspended sulphide, much as the shower of lead in an assay crucible acts as a good collector of the precious metals. It is fortunate that this suggested treatment for slag promises well for a saving of the copper, in whatever form that may be held.

While gold and silver losses may often be considerable, they have not been dealt with at length for the reason that they are not so readily adapted to experimental work and because any method which proves successful in settling a considerable portion of the suspended sulphides in a slag may be expected to reduce these losses also. Suspended matte probably carries its normal proportion of the precious metals, but their actual solubility in slag is small, if not negligible. Silver is oxidized less readily than copper, and gold little if at all. Thus comparing the copper, silver and gold content of slags and their accompanying mattes one would expect silver to occupy an intermediate position. Mr. Wright and Mr. Heberlein found this to be the case in the instances referred to. As mentioned before,

[8] "Metallurgy of Copper," p. 54.
[9] Ibid, p. 13.

silver has not been regularly determined in Granby slags, so that no accurate averages are available, but the assays performed easily place silver between copper and gold in this regard.

In conclusion, it may be said that the question of slag losses, like most others, must be solved separately for each set of conditions. It is my belief, however, that many smelting companies may yet do something to improve their practice in this particular.

Katanga Increasing Its Output

At the annual meeting of Tanganyika Concessions, Ltd., in London on July 23, 1915, Robert Williams presented some interesting data with respect to the progress of the Union Minière du Haut Katanga, the principal mineral interest of the Tanganyika company. The latter showed a debit in its profit-and-loss account of £136,825 owing to the fact that up to the present no income had been received from the Union Minière du Haut Katanga. Following naturally upon the postponement of interest on the first debentures, the payment of interest (£42,250) due on the second-mortgage debentures has likewise been postponed until six months after the conclusion of the war. Mr. Williams, in reviewing the work at Katanga, said:

Active mining work has during the past two years been carried on at Kambove, Luushia and the Star of the Congo mines, and on the Musoshi iron deposits for ironstone flux. The total ore and flux mined in 1914 amounted to 360,000 metric tons, which was more than double the quantity (170,000 metric tons) mined during the previous year.

The cost of ore on trucks at the mines is being gradually reduced. The costs at present average as follows:

Kambove .....about 4s. 5d. ($1.07) per metric ton
Star .....about 6s. 10d. ($1.66) per metric ton
Luushia .....about 7s. 8d. ($1.86) per metric ton

The improvement in mining costs will continue as the exploitation progresses and the low-grade treatment schemes come into operation, and it is estimated that the high-grade ore at Kambove should not cost more than 2s. to 2s. 6d. (48 to 60c.) per ton and the low-grade ore about 1s. 3d. (30c.) per ton on trucks at the mine by the end of 1917.

ESTIMATE OF ORE RESERVES

The ore reserves and stocks already opened up above the present working levels at Kambove, Luushia and the Star mines, as estimated for the end of 1914, amount to a total of 6,026,500 metric tons, while the approximate flux reserve estimated for the Star and Musoshi amounts to about 900,000 metric tons. Of the ore reserves estimated above, about 20% of the total is direct-smelting ore of about 15% copper average, while the remainder is low-grade ore of about 7% average. We call it low-grade; the Americans call it very high grade. About 25% of this remainder will, when subjected to concentration, yield concentrates of about 18% copper, which, added to the direct-smelting ore, will give 1,600,000 metric tons of 15.5% smelting ore and 4,400,000 metric tons of 6% low-grade ore, the average grade being over 8½% copper.

The work of investigating the reserves below the water levels on the Star and Luushia mines is being pushed ahead as the mining progresses. At Kambove also the investigation of the reserves in the next 100 ft. below the adit level—which is about 135 ft. above the bed of the dry Livingstone Creek—is being continued, and it was on this section of the mine that Mr. Gibb, as the result of his preliminary drilling work, estimated that there was about 3,000,000 metric tons of ore similar to that in the superficial part of the deposit.

Arrangements are being made to open up the Likasi and Chituru mines, which are close to the line of railway joining Kambove to the smelters. Mr. Adams in 1903 estimated that about 700,000 metric tons of 13% ore had been exposed in Likasi. Besides the mines already being exploited, there are, as you know, at least 150 copper deposits of importance—without including the mere copper prospects. . . .

SMELTING PROGRESS

The extension of the smelting plant is being continued. Two new furnaces will be erected this year and two further ones next year; these new furnaces are longer than the present type and are estimated to have a smelting capacity one-third greater than the present ones in use, so that the completed 7-furnace plant should have a capacity of 1000 metric tons of high-grade ore daily and an annual output of over 40,000 metric tons of metal and matte. The present ore and flux reserves opened up at the Star, Luushia and Kambove mines estimated for end of 1914 will keep this plant supplied, according to the present program, to about the middle of 1920. The gradual improvement in smelting costs and smelting conditions is very satisfactory, as shown by the following figures:

	1912	1913	1914
Furnace days worked.....	171	443	671
Charge per furnace day, metric tons.....	178	198	212
Total charge smelted, metric tons	30,280	87,800	143,670
Total output, metric tons...	2,510	7,410	10,720
Average cost per ton of fuel	£9 13s. 6d.	£5 17s. 6d.	£4 9s. 6d.
Average cost per ton of flux	15s. 6d.	9s. 2d.	8s. 11d.
Average cost per metric ton of product at smelting works	£47 12s. 0d.	£30 18s. 6d.	£29 12s. 10d.

The successful carrying on of the exploitation of the Katanga copper deposits is largely dependent on the development of the scheme for low-grade ore treatment. The large amount of work being done in various copper districts on the electrolytic-leaching treatment of such ores and the results of our own work in this direction in Katanga promise a very interesting future for our mines. It may be pointed out that the product resulting from this treatment is electrolytic copper, and does away with many of the difficult problems attendant on the smelting of ores, and will also probably considerably reduce the labor requirements compared with smelting. Mr. Wheeler is now out in Katanga for the purpose of working out the details of the low-grade ore treatment. . . .

From the annual reports will be noted the steady increase in the yearly production of copper from 997 tons in 1911 to 10,722 tons for 1914, and 6900 tons for the first six months of 1915. We estimate the total production for this year at something over 14,000 tons, and for 1916, 25,000 tons, and for the following years 40,000 tons per annum.

Forty-three of the staff of Union Minière du Haut Katanga have joined the British or Belgian forces, but notwithstanding this and numerous other difficulties arising out of the war, the company had a fairly good year in 1914, and now has increased smelting facilities and the benefit of greatly improved price for its product.

Strontium in the United States

According to the Geological Survey, no strontium was reported as mined in 1914 in the United States. It is estimated that at present not over 2000 tons of strontium-bearing minerals are needed annually to meet the requirements of the trade. This is because of the fact that, aside from a very limited use in drugs, strontium finds practically its sole use in the manufacture of fireworks and night signals used by railway and steamship companies. The *Journal* has already had an article on the possible use of strontium in the manufacture of beet sugar, but so far the process has not been taken up by any of the Western sugar refiners.

United States Borax Production in 1914

The production of crude borax materials in the United States in 1914 was 62,400 tons, as compared with 58,051 tons in 1913, according to the Geological Survey. All of the crude borax material now used in this country is the mineral colemanite.

The product was obtained from three mines, all in southern and southeastern California. The largest producer is the Pacific Coast Borax Co.; the second largest, the Sterling Borax Co.; and the third, the Stauffer Chemical Co., of San Francisco.

Details of Practical Mining

Clinton Mine Switch

The heavy motors and large cars now common in mining operations will not run safely or satisfactorily over the old switches made by the ordinary mine blacksmith, and where antiquated methods of switch-point construction prevail, all the long-standing troubles and expensive upkeep are present. The Clinton Switch Co. of Clinton, Ind., has developed a latch for a switch point which effectually locks it in position and does away with all the old-time rivets, bolts, spikes, etc., which always cause so much annoyance. This latch is shown in the cut. *A* shows the base plate with slot for web and undercut bottom for rail base; *B* the slide plate, and *C* the base plate in position.

The flat rounded base, or pivot lug on the butt end of the latch, fits into and interlocks with the base plate. The base plate is undercut on the bottom to fit over the

NEW MINE SWITCH POINT AND LATCH

base of standard rail and slotted to receive the web. The base plate has four spiked notches for fastening it to the ties. This method of construction allows all necessary motion of the switch point, but makes imperfect alignment impossible. The slide plate, which is also notched for spikes, furnishes a good bearing for the point end of the latch. In laying these latches, the slide plate is placed inside of and close to the bridle lug of the latch and not at the point. This gives a broader support for the latch precisely where the weight of the car or motor falls. The tire of the wheel, being at least 3 in. in width, is supported by the adjacent rail until well past the bridle lug. This latch, known as the Clinton latch, was developed to meet the requirements of the first Indiana mine to adopt all-electric hauling, and has given results much better than could be obtained from the old-style switch point.

How To Make Blueprints from Opaque Originals*

A method for making blueprints from catalogs or from drawings on thick, heavy, opaque paper is as follows: Lay the drawing, face down, on the glass of the printing frame, soak well with benzine; lay the blueprint paper, back down, on the face of the drawing and soak that with benzine; close the frame and expose to the sun in the usual manner; open the frame and wash the print in water, then hang the drawing and the print until they are dry. The print looks funny until all the benzine has evaporated, but in half an hour nobody would suspect that drawing and print had been in a bath of benzine—they are both opaque and in good condition.

The reason for placing the back of the blueprint paper against the face of the drawing is to lessen the displacement if the frame should not be set square to the sun's rays, as the shadow is "cast" through the thin blueprint paper instead of through the thick drawing.

*F. J. Badge, in "American Machinist."

Elevating Placer Tailings with a Hayward Bucket

By Hubert I. Ellis*

Hydraulicking in the interior of Alaska and the Yukon has been confined largely to the bench gravels. Where the deposits in the present stream channels have been hydraulicked, it has been necessary in most cases to elevate the gravel at some stage of the process. The usual method has been to dispose of the tailings by means of water, using the hydraulic elevator, as is the practice at Nome and elsewhere, or by simply driving the tailing up into piles, as has been done at Circle. The Yukon Gold Co. formerly used an entirely different method at Dawson, elevating the gravel to the sluice boxes instead of sluicing first and then elevating. The material was driven by giants to the desired points and raised by means of a system of steel-bucket elevators to an elevated sluice. Costs were such that when it was found practicable to dredge the ground, this interesting experiment was abandoned.

Where it is so difficult and expensive to develop an adequate water supply as it is in the region under discussion, it would seem preferable to elevate the tailings mechanically. This has been done successfully by means of a Hayward clam-shell bucket at a plant recently installed by Elmer Middlecoff on Highet Creek, in the Stewart River district, Yukon Territory.

The gravel deposit is 20 ft. deep. Water is delivered to a single hydraulic giant under a head equivalent to 150 lb. per sq.in. pressure. All the material is driven by the giant into a bedrock flume and sluice. The drain or flume is made of sheet steel and is 300 ft. long. Flat rocks and plank are used for riffles. Work progresses upstream by stages, the lower end of the flume being taken up and removed to the head as soon as the lower portion of the face has been sluiced.

The novel feature of the plant is found in the method of disposing of the tailings. A 1½-ton Hayward clam-shell bucket, set at the lower end of the sluice is used for this purpose. Power is furnished by a 20-hp. boiler and a 30-hp. engine. The bucket has a capacity of ¾ cu.yd., and the machine can handle an average of 1 cu.yd. of tailings per minute, which is ample for the present capacity of the plant. A sump into which the sluice discharges is first dug by the bucket, and the tailings are removed as fast

*4352 Ninth Ave., N. E., Seattle, Wash.

as they accumulate. The digger has a 75-ft. boom, and when handled properly it can throw the gravel 150 ft. from the sump. The tailings are stacked on one side only.

On the average 8 to 10 men are required to run the entire plant. Last summer 50,000 sq.ft. of bedrock was stripped, corresponding to 37,000 cu.yd. of material handled, so this method of solving the everlasting tailings problem has passed the experimental stage here. No figures relating to costs have been made public, but the operators express themselves as well pleased with the results of last summer's operations.

Aurora's Change House

By William Spence Black*

A new change house has recently been erected at the Aurora Consolidated Mines Co.'s camp at Aurora, Nev. The design and equipment of this house embody a number of new features, and there are several radical omissions. It was the desire of the management so to design and equip the building that it might at all times be kept clean and sanitary. With this in view it was found necessary to make a number of departures from the conventions. While in some cases these changes and omissions will be criticized, they were found to be essential if thorough cleanliness was to be attained.

Accommodations for two shifts of 100 men each are provided. The dimensions and general arrangement of the building are as in the drawings, Fig. 2. The floor

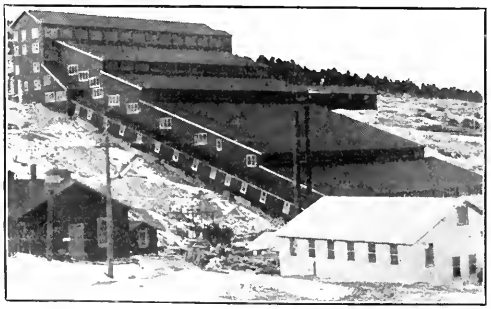


FIG. 1. AURORA CONSOLIDATED'S ASSAY OFFICE, MILL AND CHANGE HOUSE

is of finished concrete and is laid on a slight grade so as to drain to the center from all sides. The walls are boarded both inside and out, the outside walls and also the roof being further covered with corrugated galvanized iron. In the interior the ceiling and walls are lined with flat sheets of galvanized iron, No. 26 gage, 30x96 in. so that with the cement floor it is possible to flush out the interior with a hose. The showers, of which there are six, each with hot- and cold-water connections, are in the center of the building. The hot water is supplied from a 500-gal. tank heated by a steam coil, placed above the ceiling. The showers are inclosed by a partition of corrugated iron which is 6½ ft. high and which stands 1½ ft. from the floor. On one side of this partition is the entrance to the showers, and on the other three sides are wooden sinks with wash basins and hot- and cold-water taps.

*Manager, Mobile mine, Jean, Nev.

No lockers are provided. In their stead open suspended racks are used. There are four of these racks, two on each side of the building, as shown. Each shift has two racks, one on each side; this separates the men and prevents unnecessary crowding. The construction of the racks may be readily understood from the drawings (see Fig. 2). The main frame is a rectangle of ¾-in. wrought-iron pipe, 4 ft. high and 45 ft. long. This is stiffened by six pieces of ½-in. pipe placed in the main frame at regular intervals. All joints are oxyacetylene welded. The wooden frames of the separate compartments are attached to this main frame by means of U-bolts. Small-mesh poultry wire is used to divide the compartments, and is attached

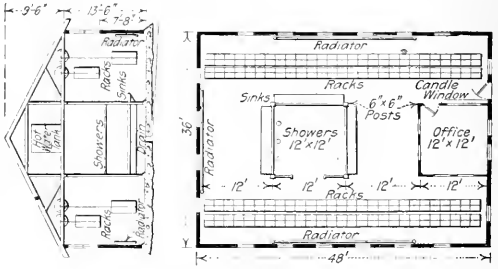


FIG. 2. PLAN AND ELEVATION OF THE AURORA CHANGE HOUSE

by means of staples and wire. Each rack contains 54 compartments, 27 on each side. These compartments are 48 in. high, 20 in. wide and 12 in. deep, and have hooks placed around the top. A bottom is provided by screwing 1½x¾-in. slats along the under side of the frames.

The racks are suspended by ½-in. braided cotton ropes from steel shafts. This shafting is 1½-in. diameter and is mounted above the ceiling. The ropes pass through narrow slots cut in the ceiling and are then attached to the shafting by means of collars and setscrews. At one end of each of the shafts a 3-ft. pulley is mounted, and a 6-in.

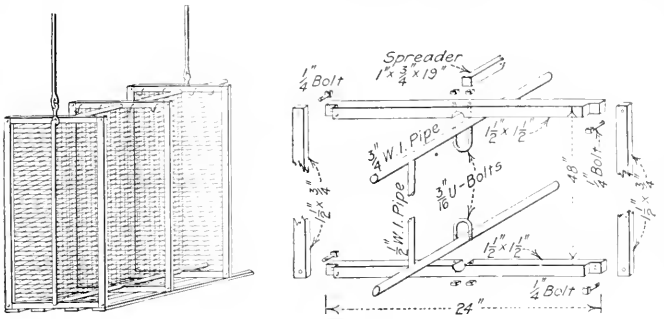
COST OF AURORA CHANGE HOUSE

	Supplies	Labor	Total
Grading	.....	$106.96	$106.96
Foundations and floor	$262.06	64.50	326.56
Construction:			
Lumber	$590.80		
Doors and windows	58.08		
Galvanized iron, interior	295.13		
Galvanized iron, exterior	662.30		
Painting	57.84		
Miscellaneous	11.28		
	1675.43	626.58	2302.01
Racks	165.55	204.66	370.21
Plumbing	119.49	180.72	300.21
Heating	196.40	139.83	336.23
Electrical	33.22	43.64	76.86
Total	$2452.15	$1366.89	$3819.04

pulley, in line, is attached to the wall a few feet above the floor. A manila rope is run belt-wise over both pulleys.[1] To prevent slipping, a continuous row of staggered iron teeth, made from ¼-in. round iron, is placed around the face of each pulley. These teeth slope toward each other, forming a V-shaped groove in which the rope runs. The staggering of the teeth causes a continuous crimping of the rope as it passes over the pulleys, thus greatly increasing its grip. In order that the rope may be kept tight, the lower pulley is mounted in a vertical slot in which it may be moved up or down by means of a

[1]Some style of light sprocket chain would probably be more satisfactory for the hoisting mechanism on the racks, for the strain and wear on a rope are considerable.

threaded rod, thus allowing adjustment of the rope tension. A detachable crank and a ratchet on the lower pulley complete the equipment. By means of this arrangement the rack may be hoisted out of the way and beyond the reach of curious fingers while the shift is on, and be lowered again when the shift comes off.



LOCKER DETAILS, AURORA CONSOLIDATED

As far as cleanliness goes these suspended racks should speak for themselves. They are entirely open and can be readily flushed off if desired. They have no dark corners or shelves on which old clothes and dirt can accumulate, and they are wholly open to both light and air. Furthermore, they take up but little floor space. In fact, on equal floor spaces it is possible to give almost twice the number of accommodations in suspended racks that can be given with the usual style of stationary lockers. Omitting the office, there is an area of 7.92 sq.ft. per man. This figure is lower than the average for change houses, but when one realizes that it is practically all available, its value is considerably increased. No toilets or urinals are provided within the building, an omission which is in line with the policy of thorough cleanliness.

The building is steam-heated. Three radiators are used, one on each side and one across the end. The steam is supplied from the company's boiler house, about 100 ft. away.

A summary of the cost is given herewith. All supplies are brought in from Hudson, on the Nevada Copper Belt R.R., which is 60 mi. from the camp.

New Electric Blasting Caps for Wet Work

When blasting by electricity and there is little water encountered, satisfactory results will be obtained by using the ordinary type of electric blasting caps. When a considerable quantity of water is found in the bore holes, it is more economical to use electric blasting caps that are made for this special condition. The reason for this is that the cotton insulation on the wires of an electric blasting cap only furnishes protection to the wires from abrasion and slight protection from water, the water easily penetrating the cotton insulation, causing short circuits and consequently misfires.

Because of varying water conditions there have been placed on the market two kinds of Du Pont electric blasting caps to meet the demands and also to furnish the consumer with an electric detonator which can be used under the most severe conditions.

The construction of these electric blasting caps is the same so far as concerns the detonating charges, wires, cotton insulation on wires and filling material above the detonating charge. The difference will be found in the length of the copper shells, insulation under cotton insulation, and gutta percha covering the copper shells and extending about 2 in. up the wire.

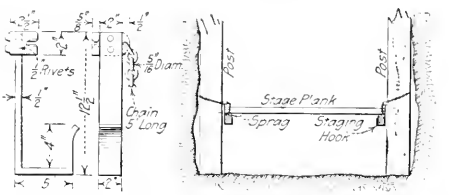
The increasing use of electric blasting emphasizes the importance of watching the condition of all leading and connecting wires and blasting machines to see that all are kept in good condition and that connections are well made.

Avoid kinking wires as this leads to cracks and breaks not easily detected through the insulation. Don't drag wires over the ground as this scrapes off the insulation. Test the blasting machine with the rheostat at regular intervals to see that it is working up to capacity. Test all circuits with the galvanometer before attempting to blast. These are simple precautions.

Safety Staging Hook

By D. E. Charlton*

This hook was designed to take the place of the old-style hook that was driven into the post. The tendency of the old hook was to pull out at times, and it could only sustain a limited weight. Its subsequent removal from a post into which it had been driven required considerable effort.



SAFETY STAGING-HOOK, DETAILS AND IN USE

These staging hooks have been successfully used for some time by the Oliver Iron Mining Co. in its mines on the Mesabi Range. Four constitute a set and are used two on either side in the drifts where timber sets are placed and stagings are required for repairing or drifting ahead or stoping. The chain is wrapped about the post, the hook elevated to the required height and the loose end of the chain placed in the slot on the opposite side of the hook from which the chain is fastened. The slot is so made that the hook will not slip if the chain is placed tightly around the post and the first link, beyond that required to encircle the post, is placed in the slot. Hewn timbers, planks or sprags may then be placed in the hooks and the staging planks on top of them. Protruding ends of rivets will dig into the post when weight is applied and tend to steady hook and staging. The accompanying sketch shows the detail of the hook and the method of application.

*Mining engineer, Virginia, Minn.

Details of Milling and Smelting

Dwight-Lloyd Sintering Practice at Salida, Colo.

The Ohio & Colorado Smelting Works at Salida, Colo., was one of the first to adopt the Dwight-Lloyd sintering machine, and while the management went through the usual experience that falls to the lot of beginners with a new process, it also had the pleasure of seeing the blast-furnace capacity increase, in the case of the 48x180-in. furnaces, from 180 to 250 tons per day for long periods.

The roasting plant at present consists of three Godfrey furnaces, 26 ft. in diameter, with a capacity of 25 tons per day each; one Wedge furnace, 21 ft. in diameter, with a capacity of 75 tons per day; four Dwight-Lloyd machines, 42x264 in., with a capacity of 80 tons per day each. The Godfreys and Wedge are used for preliminary roasting before sintering on the Dwight-Lloyd machines, the sulphur in high-sulphur ores being reduced to a point where the product can be added to the Dwight-Lloyd charge without raising the sulphur above 15% on the unroasted charge. These furnaces are served by a 468-ft. flue, having a cross-sectional area of 166 sq.ft., and joined to a stack 85 ft. high, 12 ft. in diameter. The volume of gases discharged is approximatly 125,000 cu.ft. per minute.

It must be borne in mind, writes F. D. Weeks[1], that this Dwight-Lloyd sintering plant was built when there were no plants to serve as guides. The original charge measuring and mixing apparatus is still used, although many accessories have been evolved since the construction of the plant. The charge is made up from six bins with belt bottoms discharging onto a belt that delivers the charge to the center of a cast-iron revolving table. The charge is moved to the edge of the table by fixed plows, water being added during the time of plowing; then it is scraped off into ore cars, sent to the top of the building on a platform elevator and dumped into the machine feed bins. The use of a platform elevator instead of a bucket-and-belt elevator was decided on after seeing the segregation that took place when a belt elevator or conveyor was used. This stopped the segregation of coarse charge along the edge of the pallets.

For a long time coarse charge was fed to the pallets by means of an extra hopper behind the regular feed hopper, but it was found that if the back of the regular hopper was removed and the feed regulated to a thin stream, all the coarser particles would roll to the grate and stay there, stopping grate leakage and leaving only fines on top, presenting a proper surface for ignition. Coal ignition is still used because gas is not available and, with a wooden structure, gasoline is feared.

An important improvement has been made in the construction of the machines by placing an adjustable rail by the side of the pallets so that the weight of the loaded pallets is carried on the rollers and not dragged across the top of the windbox causing excessive wear. The height of the rails is adjusted so that, as the top of the windbox wears, the rails take the loads. This arrangement leaves no appreciable space between the bottom of the pallets and the top of the windbox.

The Dwight-Lloyd product falls into side-dump railroad cars and is taken to smelting beds. Local conditions necessitate frequent changes of charge, so the sinter is spread on smelting beds instead of being smelted separately.

[1]Excerpts from a paper entitled "The Salida Smelter," to be presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

Storage of Powdered Coal*

Anthracite offers practically no difficulty in the way of storage, as it is almost unaffected by weather conditions and it will not ignite spontaneously. Bituminous coals, however, when stored, disintegrate and are in great danger of spontaneous ignition.

This is due to an absorption of oxygen from the atmosphere by the coal itself. If the heat resulting from this reaction can be dissipated, no harm results; otherwise the temperature of the coal rises until the temperature of ignition is reached. The area of the surface exposed is a determining factor, and since this surface area is increased as the size of the particles is decreased, we can readily imagine the importance of this when applied to powdered coal.

Dennstedt and Schaper in *Zeit. f. angew. Chem.*, 25, 2625-9, show that the greater the percentage of oxygen in the coal, the more liable it is to ignite spontaneously.

Porter and Taylor in *Journ. Ind. Eng. Chem.*, 5, 292, state that "the development of heat on moistening dry coal . . . may contribute appreciably to the spontaneous heating of some coals in storage."

These opinions indicate two factors in the spontaneous ignition of powdered coal—the presence of oxygen and other occluded gases and the presence of moisture. Other causes of self-ignition are: 1. Pressure on the coal. 2. Presence of iron pyrites. 3. Volatile matter in the coal itself. 4. Temperature.

The effect of pressure is to increase the temperature of the pile of coal, and it varies as the height of the pile. It is suggested that the pile should never exceed a height of 12 ft.

The effect of iron pyrites is rather doubtful, as coals containing negligible quantities of this compound have been known to ignite spontaneously.

Coals which are fairly high in volatile matter are more subject to self-ignition. This has been fully borne out by the findings of Messrs. Tessenden and Wharton (*Bull. Univ. of Mo. Eng. Series*, Vol. 1, 1908).

The effect of temperature is considered by many authorities to be one of the important factors in spontaneous combustion, because the oxidation proceeds more rapidly

*Abstract from article in "Coal Age" of July 31, 1915, by Edward J. Kelly.

as the temperature of the coal increases. Heat from the sun's rays may even be dangerous, an instance of this kind having occurred in the surface works of the Mayback colliery at Friedrichstahl, Germany. Floating coal dust deposited on some of the iron girders in layers of an inch or more, and was burned to a white ash when the girders became heated by the sun.

The following precautions should be observed in storing powdered coal: 1. Limit the height of the coal pile to 10 or 12 ft. 2. Isolate the coal from all sources of heat such as steam pipes, flues, reflecting surfaces and direct sunlight.

In regard to the conditions of storage, two different methods may be cited: 1. Storing in piles in the open air. 2. Storing in covered bins.

There seems to be very little to choose between these methods, save that all other things being equal, the covered bin would protect the coal from direct sunlight, which was shown to be a contributing factor in spontaneous ignition. If covered bins are used, added overhead charges will be entailed, while open storage on the other hand gives low costs.

I have been informed of a novel storage bin constructed for a firm in Maine. This bin contained several rows of upright beams. Saw-tooth projections were built on two sides of each upright, thereby forming air-spaces, which led into the main flue, the latter extending from the bottom of the bin to the top. When the bin was filled with coal, the heat generated and the gases given off escaped through the flues to the top of the bin and out into the air. It is perfectly obvious, however, that should the coal in the bin become ignited by any chance, the flues would produce a draft and so increase the rapidity of the combustion.

Bins should be constructed of stone, brick or concrete; if iron work has entered into the construction, it should be covered with concrete.

Radiation Pyrometers

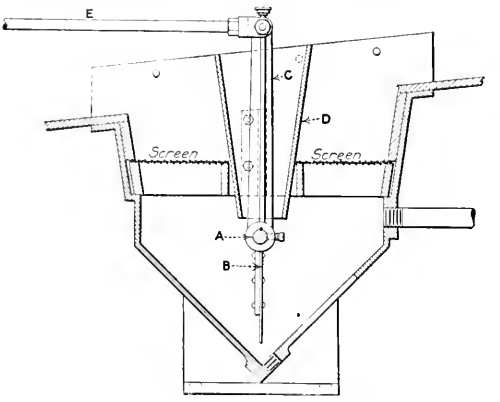
"Characteristics of Radiation Pyrometers" is the title of a paper recently published by the Bureau of Standards of the Department of Commerce, giving the results of careful study of this type of temperature-measuring instrument. Such a study was considered urgent on account of the extensive use of radiation pyrometers in the technical industries. These instruments are widely used in the temperature control of the various processes involved in iron and steel manufacture, alloy foundry work, glass, ceramics and brick manufacture, smelting, gas works, steam generation, etc.

Many of the instruments examined show different temperature readings for different focusing or sighting distances. Errors thus occasioned may amount to several hundred degrees. The effect of dirt upon the lenses and mirrors is of serious importance. The question as to whether the pyrometer absorbs all the heat radiation falling upon it is discussed, and the theory of the instrument and the connection of the behavior of the pyrometer with the theoretical radiation laws are given.

The bureau receives a large number of these instruments for test and standardization from various technical industries located throughout the country. Heretofore this testing required about three days for a single instrument, on account of the difficulty in heating a furnace to an exactly uniform temperature. A new method has now been developed which permits a satisfactory standardization of a radiation pyrometer within one hour. Many suggestions are given for minimizing the errors to which the pyrometer is subject, and it is shown that this type of instrument, suitably designed, adequately calibrated and correctly used, is a trustworthy pyrometer, having many advantages over other types of temperature-measuring devices, both for scientific and technical use.

Neill Jigging Apparatus

James W. Neill, of Pasadena, Calif., has patented (U. S. Pat. 1,141,191) a jig in which the pulsation is supplied by a paddle directly connected to the operating shaft, the object being to provide a more compact mechanism and to save floor space that otherwise would be taken up by



NEILL JIG WITH PADDLE PULSATOR

the rocker arms and link. A sectional view of one form of the apparatus is shown in the accompanying illustration. Mounted on the shaft *A* is a paddle or blade *B*, integrally connected with an upper extension *C* in the casing *D*. To this upper arm *C* is attached a connecting rod *E* in any desired manner to cause the proper oscillation of the paddle.

Prevention of Hot Tops in Blast Furnaces

A novel idea for the prevention of hot tops in blast furnaces is described by William D. Kilbourn, of Tooele, Utah, in U. S. pat. No. 1,148,782. The method consists in coating the fuel with a nonoxidizing fusible coating, which prevents the carbon from catching fire too high in the furnace. Preferably this coating is made of a compound of the metal to be smelted. For instance, in lead blast furnaces the patentee says a very suitable coating is a mixture of lead sulphate, lead oxide and a varying percentage of impurities, the mixture to contain about 60% of lead. It is claimed that the method prevents bad accretions at the tuyere line and helps to make a hot slag and to get a better settlement of the metal because of the added heat.

The Assayer and Chemist

Heusser Multiple Weight Attachment for Chemical Balances

By Wilfrid Heusser*

This balance was designed in response to a general demand for a time- and labor-saving weighing instrument. The tedious task of picking up and placing small weights upon the balance pans and arresting the balance each time for the purpose is eliminated.

With reference to the accompanying illustrations, the pan hanger on the right side carries a perforated plate or grid. Back of this pan hanger a short column is solidly mounted upon the base-plate, carrying nine movable levers. The front end of each of these levers

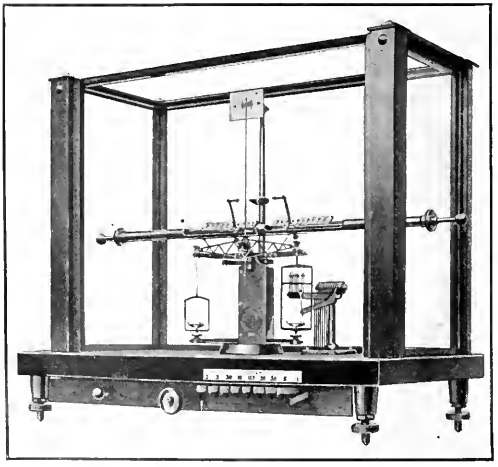


FIG. 1. GENERAL VIEW OF HEUSSER BALANCE

has an upright conically tipped staff, which moves centrally and vertically through the perforations of the grid.

The levers are operated from the outside by means of depressible push keys arranged similarly to a typewriter keyboard and located in front of the balance.

The illustration, Fig. 1, shows eight levers in their uppermost position with the weights at rest, and one lever depressed with its weight deposited upon the grid.

The weights are in the form of disks, each disk having a central perforation. At rest they are supported by means of the conically tipped staffs, which extend partly into the perforations. When in use they are deposited in countersunk holes in the grid. These weights may be deposited and again picked up independently of each other, and the balance-beam is free to swing, by simply pushing the depressible keys up and down.

*Balance manufacturer, Board of Trade Building, Salt Lake City, Utah.

The value of each weight is plainly marked upon an index plate placed above the keyboard, and the possibility of making mistakes is positively excluded.

The capacity of the weights for assay balances is 221 mg. and is divided into 1, 2, 3, 5, 10, 20, 30, 50 and 100 mg. For extremely delicate weighings where the ½-mg. rider is used, the capacity is only 110 mg.

Since the majority of assay buttons will come within this range, the handling of weights with tweezers is

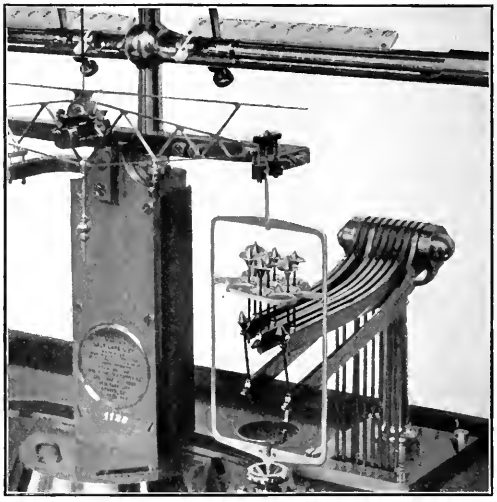


FIG. 2. DETAILS OF WEIGHT-HANDLING ATTACHMENT, HEUSSER BALANCE

almost entirely eliminated. These balances will save 50% of the time consumed in weighing with an ordinary balance, and for assay offices where considerable weighing must be done, this may amount to a great deal.

For analytical balances the weights are 10 times heavier, or 2210 mg. in all. This balance is sold by the Mine & Smelter Supply Co., of Salt Lake City, Denver and El Paso.

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Assaying Lead Bullion at the Salida Smelting Works

A plan to eliminate the personal equation in bullion assaying has been carried out with good results for some years at the Ohio & Colorado Smelting Works, Salida, Colo., according to E. D. Weeks[1]. The "gum-drop" samples, weighing about ½ assay ton each, are weighed without trimming, cupelled and parted; the weights of the gum-drops in decimals of an assay ton of the gold

[1]Excerpt from a paper entitled "The Sallda Smelter," to be presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

and silver together and of the gold alone, in milligrams, are reported by the assayer. The calculations are then made in the office on a machine. In this way the assayer is not tempted to make his results check, because until they are figured he does not know whether they will check or not. The excellent results obtained are sufficient reason for following the plan.

Platinum in Litharge*

The news of platinum finds going through the papers not long ago owe their origin probably to a surveyor by the name of Schreiber who died about one and one-half years ago. He pretended to have discovered a new method of determining platinum in rocks by which occurrences of platinum heretofore not provable—chiefly in colloidal form in the rocks—became determinable. Without going further into the value of this Schreiber method I desire to mention that investigations of ores were undertaken by other parties by which also a trifling amount of platinum was found in rocks that actually contained no platinum.

The Schreiber platinum finds were thus apparently confirmed and great expectations were based upon them in lay circles, creating something like a platinum rush. The incorrect results of these investigations may be in part accounted for by the use of not altogether unobjectionable reagents in the platinum determinations, particularly the use of platiniferous litharge.

Basis of the Westphalian Platinum Excitement

The examination of litharges for their contents of precious metals carried out by the author 10 or more years ago unfortunately did not include the determination of any platinum that might have been present then. It is, however, doubtful whether it could have been proved in those days. At any rate during the last 10 or 15 years the possibility of finding platinum in litharge has become greater through the introduction of jewelers' sweeps for the recovery of their precious metals into custom works producing litharge.

The content of platinum (or of any other precious metal) in the litharge will, of course, vary according to the time the sample is taken, whether in the beginning or at the end of cupellation, or whether it is from lead rich or poor in precious metals. The investigation of the various samples of litharges was made as follows: Separate weighings of 62.5 grams of litharge were each mixed with 15 grams of flour and a flux consisting of 3 parts c.p. sodium carbonate, 3 parts of c.p. potash, 1.5 parts c.p. borax and 1.5 parts c.p. table salt, and reduced to metal in a Hessian crucible. The lead buttons of the same class were concentrated in a scorifier, the result of 8 weighings (equivalent to $\frac{1}{2}$ kg. of sample) being obtained in one single lead button which was run down in a cupel of pure bone-ash. In the resulting bead, platinum, gold and silver were determined in the customary way.

The Freiberg litharge showed the largest differences in precious metals as it consisted of the well-known large scales which even by the most careful mixing do not yield a uniform result. The two other samples of litharge were ground fine and showed hardly any differences. There were contained on an average in 1 kg. of litharge:

	Platinum Mg.	Gold Mg.	Silver Mg.
(1) Litharge from Freiberg.....	0.417	0.916	25.33
(2) Litharge from Frankfurt a/M..	0.350	1.350	11.22
(3) Litharge from Muilheim.....	0.111	0.666	10.00

The results thus obtained were not the totals of precious metals of the samples of litharge examined. On further test the litharges obtained in the scorifiers still gave notable amounts of platinum, gold and silver. Thus 1 kg. of this litharge showed:

	Platinum Mg.	Gold Mg.	Silver Mg.
In (1)	0.123	0.200	5.988
In (2)	0.060	0.362	2.666
In (3)	0.034	0.142	2.446

A further investigation of the litharge obtained in this last scorification was not made, but it would surely have yielded still more precious metals.

*From an article by F. Michel of the Grand Ducal Assay Office at Pforsheim, Baden, in "Chemiker Zeitung," Jan. 2, 1915.

To Cut Glassware Easily

By E. J. Hall*

Of the many methods proposed for cutting bottles there is but one which is satisfactory in the average laboratory worker's hands, namely, the electrically heated wire. A description of this method was published several years ago, but since it does not seem to be generally known, it will stand repeating.

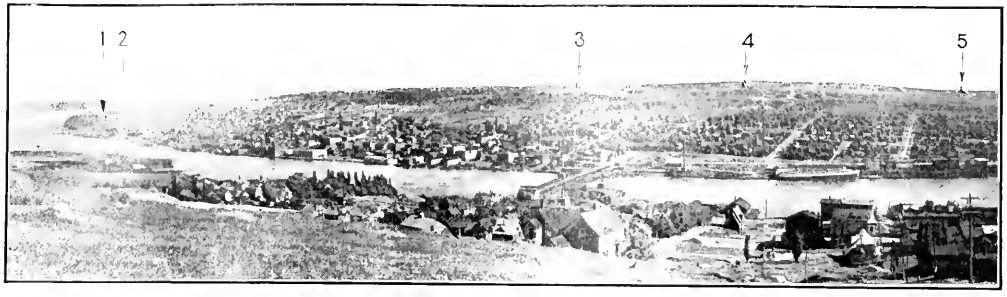
To cut the bottom from a bottle, make a file mark at the desired point; wrap a strip of paper around bottle just below mark, to act as a guide, and encircle bottle with a piece of resistance wire, being sure that the wire passes over the file scratch. Iron wire may be used, but B. & S. 22-gage nichrome wire is preferable. Where the wire passes itself it may be insulated with asbestos paper or simply held slightly apart. The ends of wire are fastened to suitable holders, mounted or held in the hand. In the latter case, the holders must be insulated. A resistance must be placed in the line, and if none is at hand, the following will answer perfectly: Make a 5 to 15% solution of almost any salt—sodium carbonate is satisfactory—and connect to the two ends of a break in the line metal, or to carbon rounds. By inserting these in the salt solution to different depths, or varying the distances apart, the current may readily be controlled. With everything in shape, turn the current on and increase it until the wire, which should be held taut and in close contact with the bottle, shows red—10 to 12 amp. is usually sufficient. The free ends of wire will glow brightly; in about 30 sec. there will be a sharp snap, when the bottom may be lifted off. On rare occasions it is necessary to give the glass a tap with a light instrument.

This is one method which works as well as it reads. Five-gallon water bottles are cut as readily as a test tube, and watch glasses or other glassware, where the wire can be held in contact with the surface, are split with equal facility, the break following true to the contact of the wire.

A Piece of Thin Sheet Rubber Fastened over the Top of a Büchner Funnel by means of a rubber band will prevent the formation of cracks in the precipitate and greatly facilitate the removal of the mother liquor when filtering by suction, according to R. A. Gortner ("Journ. Am. Chem. Society"). The suction draws the rubber down into close contact with the precipitate, and a vacuum of 15 mm. can easily be obtained within the flask.

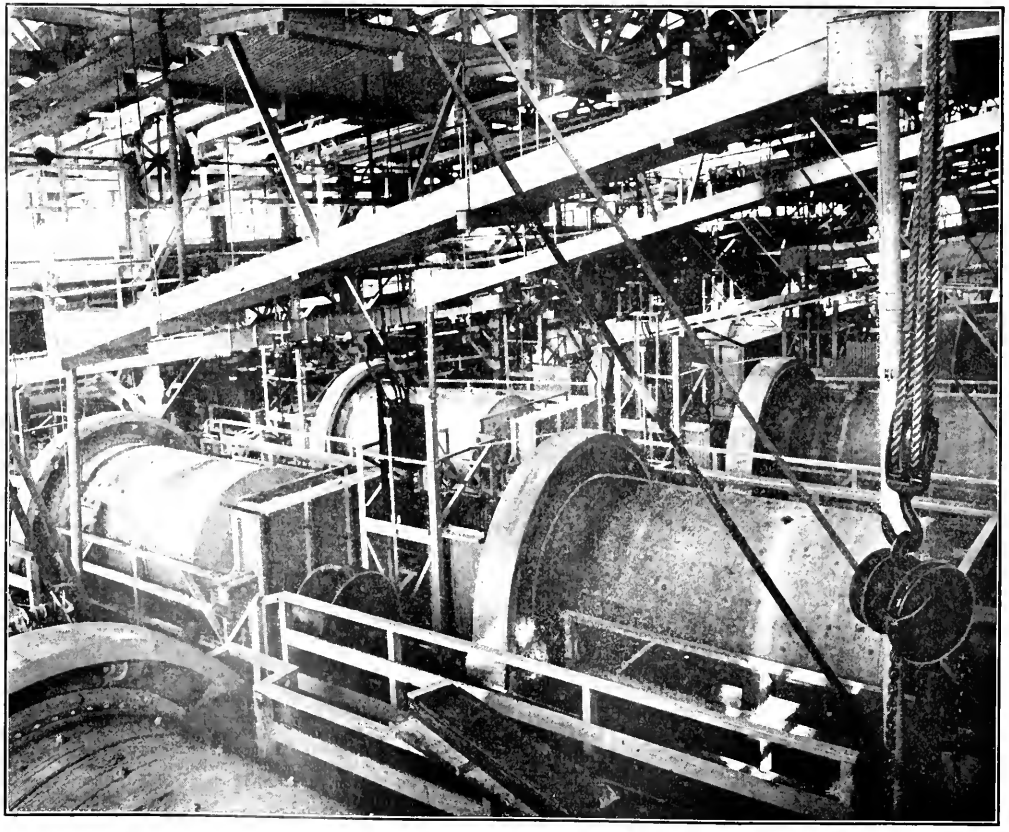
*Department of metallurgy, Columbia University, New York City

Photographs from the Field



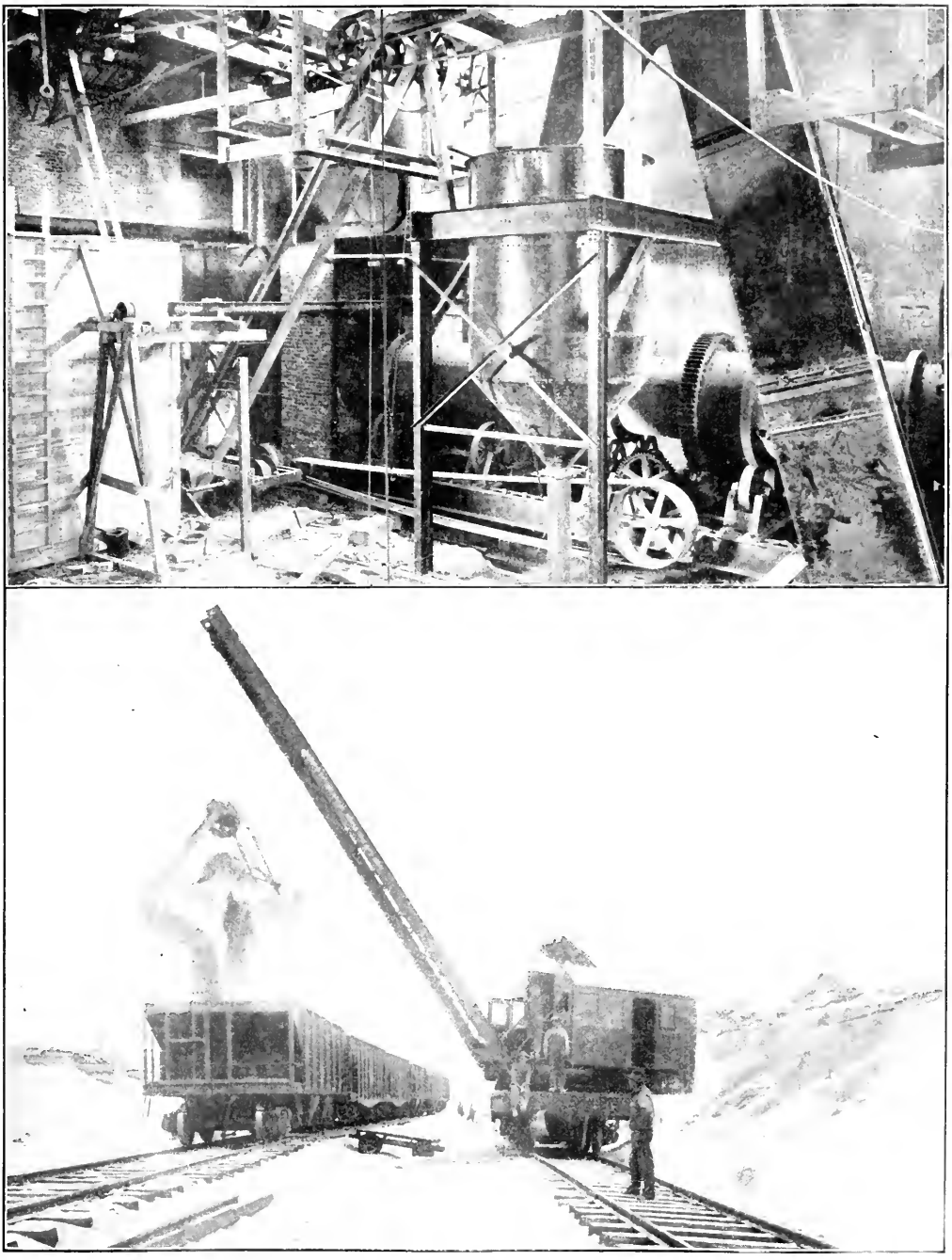
A VIEW OF HOUGHTON, MICH., AND ITS ENVIRONS

1. Michigan College of Mines. 2. Quincy smelting works. 3, 4, 5. Various Isle Royale shaft houses. Part of the town of Hancock shows in the foreground



REGRINDING DEPARTMENT OF WASHOE CONCENTRATOR

Short tube mills installed in No. 1 section of the concentrator of the Anaconda Copper Mining Co.



ANACONDA COPPER MINING CO.'S OPERATIONS

Upper view shows the feed end of the furnace in the first unit of the arsenic plant. Lower view shows a locomotive crane and bucket loading tailings for the leaching plant

Correspondence and Discussion

Recovery of Zinc from Cyanide Precipitates

Owing to the present high price of zinc we, in the cyanide business, are wondering whether some scheme could not be worked out to recover the excess zinc from the press or zinc-box precipitates.

About a year ago Dr. G. H. Clevenger proposed a scheme of retorting which did not look good to me, from a commercial standpoint, considering the then low price of zinc.

In several plants they subject the precipitate to a sulphuric-acid treatment to dissolve the excess zinc before smelting. This gives zinc sulphate in solution. Would it be possible to precipitate the zinc from the sulphate, and by what methods? Several methods have been tried, but I understand they have been unprofitable when zinc is selling around 4c. per pound.

As zinc in the shape of dust or shavings is selling at a high figure at present, some of the older schemes of zinc recovery from solution or by retorting may now prove profitable. If zinc recovery could be effected from cyanide precipitate, it would mean a great saving to cyanide operators throughout the world.

CARL J. TRAUERMAN.

Landusky, Mont., Aug. 4, 1915.

[We think that Doctor Clevenger's paper on the distillation of zinc from cyanide precipitate is the best contribution upon this subject in existence. Zinc may be recovered from the sulphate solution by evaporating the solution and calcining the sulphate, or by mixing the sulphate with a proper proportion of zinc sulphide and calcining. As a precipitant, calcined magnesite would probably be the cheapest of the common agents that are available. The precipitate would be zinc oxide. In any of these cases, the zinc oxide would have to be distilled in order to obtain metallic zinc. We doubt if such a process would be profitable in connection with a gold-extraction works. The distillation of excess metallic zinc from the precipitate ought to be feasible, however. We hope that our readers will join in a discussion of this subject.—Editor.]

Fineness of Crushing for Assaying

The primary cause of differences in assays, noted by A. A. Nason in the *Journal* for Aug. 7, resulting from differences in the mesh to which the ore is crushed, lies in the fact that modern assaying has fallen under the domination of the "rule o' thumb." Fundamentally this condition rests upon the overwhelming tendency of modern education to store the mind instead of training it. In rating United States Civil Service examination papers it is common to find the same flux, often a stock mixture, used for quartz and for limestone and even for roasted pyrite. Incidentally the condition is in part due to the present insane speed mania. Speed has its uses, but it is full of dangers.

Under the "rule o' thumb" it is perfectly logical to find a maximum-extraction degree of fineness for crushing ore. Lower extractions from either coarser or finer mesh are both due to the same cause which results from opposite conditions in the two cases. It is fundamental in crucible fusions that the reduced lead should remain in contact with the fusing ore particles a sufficient length of time to absorb thoroughly the precious metals of the ore. With too coarse a mesh the fusion is slow and the lead sinks to the bottom before fusion is complete. With too fine a mesh the fusion is too rapid and the reduced lead sinks through the liquid charge before it has had sufficient time to extract the precious metals.

Because the attempt to oxidize sulphides in the crucible by means of niter so often leads to boiling over the charge, objection is sometimes raised to it, and the fact is lost sight of that a certain amount of boiling is essential to the success of the fusion. Consequently the conditions favoring the boiling of the charge are often unwisely reduced to the minimum, and the fusion may be completed without a sufficient amount of boiling. Under-boiling is really more objectionable than over-boiling, because the latter shows itself and we know the fusion is ruined and must be rejected; but we have no evidence in the charge itself when it is under-boiled, and such a faulty fusion may easily be accepted.

There is widespread neglect of the physical effect of bicarbonate in the fusion. My old and beloved instructor in assaying, the late Prof. O. D. Allen, used to speak of the bicarbonate as a "rod." Just as wet work required a rod to mix properly the contents of a beaker, so a proper fusion required the mixing of the charge when melting down and this must be secured by the proper evolution of the CO_2 from the bicarbonate. In my own practice I use made-up fluxes sparingly, and as a rule intentionally leave some of the bicarbonate in small lumps for the purpose of prolonging and equalizing the evolution of CO_2.

Finally, if one is obliged to assay very finely ground ore I would repeat the suggestion I gave in the Oct. 19, 1912 issue, to use a retarder of fusion, such for instance as 100-mesh bone-ash.

FREDERIC P. DEWEY, Assayer,
Bureau of the Mint.

Washington, D. C., Aug. 11, 1915.

Platinum in California

I have read with much interest the article on "Platinum in California" in the *Journal* of June 12, 1915, p. 1045.

The tests made on the Long Tom ore as described and the results obtained are identical with an experience I had testing a sample of iron pyrites for platinum by the same qualitative tests outlined by Lodge in his "Notes on Assaying."

I made two tests, one on the ore and the other on a piece of platinum wire, and obtained a strong cherry-

red color in both tests which I supposed was caused by platinum iodide. Later I proved by quantitative methods that the ore contained no platinum and decided my first test was faulty.

The encouragement the first test gave me was responsible for a considerable amount of work and expense in proving the ore and locating a mining claim.

As the *Journal* suggests that ferric chloride will give the red color to the iodide solution, it seems to me this test for the detection of platinum would be useless for ores containing iron, and nearly all ores have some iron in them.

I would like to learn of a simple and reliable qualitative test for the detection of platinum in ores containing sulphides. A discussion of platinum analysis in the *Journal* would, I believe, be of great interest to many readers.

A. L. Hawkins.

Lewistown, Mont., July 19, 1915.

[The *Journal* foresaw almost two years ago the coming need of knowledge of the chemistry of platinum and printed articles on that subject as follows: Dec. 20, 1913, p. 1175; Jan. 24, 1914, p. 229; May 16, p. 1007; June 20, p. 1249; Sept. 19, p. 530; Apr. 17, 1915, pp. 700 and 701. The fact unfortunately remains, however, that the platinum metals, more than other elements, seem to require working experience, and assaying directions do not suffice.—Editor.]

New Sampling Plant at Hamburg

It may perhaps be of interest to call attention to a statement from which erroneous conclusions might be drawn in the article, "New Sampling Plant at Hamburg," published in the *Journal* of July 24, 1915.

Referring to the results obtained by this sampling mill, it is stated in the article, "From careful tests made the results obtained have been extraordinarily accurate, with only a minute difference in the analyses from different bottles filled at the same time by this machine and representing the same parcel of ore."

A little reflection will convince one that the agreement in analyses from any two bottles filled at the same time is no more than an indication of the accuracy of the last device in the sampling plant—that is, the bottle filler. It gives no line whatever on the accuracy of the sample as a whole, which latter point could only be determined by passing the rejected four-fifths of the original lot again through the sampler and checking the bottle sample resulting therefrom with the bottle sample obtained in the first instance.

Furthermore I doubt if the general commendation of this German plant is particularly justified. The pyrites ore there received is homogeneous in character and represents perhaps the simplest known material to be sampled in mining practice. Samples taken with any ordinary degree of care should not be expected to vary materially, because of this homogeneity. There is a much greater probability of variations in the chemical analysis following. The expedient of a three-high train of rolls has been found one of doubtful advantage in this country, for the reason that it makes control, adjustments and repairs difficult. Because of the irregularity of feed, which in spite of the devices mentioned will nevertheless persist, the discharge is irregular, and I doubt if the reciprocating vanes described actually do secure an accurately representative sample.

In short, I doubt very much if this sampling mill would give comparatively good results on complex sulphide ore carrying precious metals such as are treated by many of our Western sampling plants.

Robert K. Painter.

New York City, Aug. 13, 1915.

NEW PATENTS

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

BLAST FURNACE—Francis J. Zippler, Avalon, Penn. (U. S. No. 1,147,475; July 20, 1915.)

CONCENTRATOR (Ore).—Orrin H. King, Wallace, Idaho. (U. S. No. 1,148,591; Aug. 3, 1915.)

COPPER AND NICKEL—A Process of Separating Copper and Nickel in Copper-Nickel Matte and Other Products. N. V Hybinette, Christiania, Norway. (Brit. No. 13,355 of 1914.)

CRUCIBLE POURING DEVICE—Metallurgical Implement. Charles F. Jacobs, Chicago, Ill. (U. S. No. 1,146,573; July 13, 1915.)

CRUSHING—Hammer Attachment for Rotary Mills. Milton E. Williams, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,147,351; July 20, 1915.)

DRILL—Rock Drill. Clarence A. Dawley, Plainfield, N. J., assignor to Ingersoll-Rand Co. (U. S. No. 1,148,760; Aug. 3, 1915.)

DRILLING—Improvements in or Connected with Rock-Drilling Machines. W. C. Stephens, Carn Brea, Cornwall. (Brit. No. 16,034 of 1914.)

DRILLS—Boxing for Drills. John A. Hallander, Ottumwa, Iowa, assignor to American Mining Tool Company, Ottumwa, Iowa, a Corporation of Iowa. (U. S. No. 1,148,313; July 27, 1915.)

DRILLS—Rotation Mechanism for Percussive Drills. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,148,649; Aug. 3, 1915.)

IRON—Process of Smelting Iron Ore. Florentine J. Machalske, Plattsburg, N. Y., assignor to American Ferrolectride Corporation, Plattsburg, N. Y. (U. S. No. 1,148,700; Aug. 3, 1915.)

LEACHING—Process of Precipitating Copper from Solution. George D. Van Arsdale, East Orange, N. J. (U. S. No. 1,147,466; July 20, 1915.)

MAGNETIC SEPARATORS—Improvements in Magnetic Separators. Stephan Bruck, Charlottenberg, Germany. (Brit. No. 20,552 of 1914.)

METAL RECOVERY—Process for the Recovery of Metals from Ores and the Like. Charles S. Vadner, Salt Lake City, Utah. (U. S. No. 1,144,402; June 29, 1915; and No. 1,146,373, July 13, 1915.)

POTASSIUM—Process of Treating Potassium-Bearing Minerals. Saul E. Melkman, Montreal, Quebec, Canada. (U. S. No. 1,148,850; Aug. 3, 1915.)

PULP SETTLER. Harry R. Conklin, Joplin, Mo. (U. S. No. 1,147,786; July 27, 1915.)

PULVERIZED-COAL BURNER. Norman Lew Warford, Anaconda, Mont. (U. S. No. 1,147,833; July 27, 1915.)

REDUCTION—Process for the Reduction of Metals from Their Ores by Carbon from Solid Fuel. William D. Kilbourn, Tooele, Utah. (U. S. No. 1,148,782; Aug. 3, 1915.)

REFINING—Electrolytic Refining or Extracting Process. Francis R. Pyne, Elizabeth, and Henry M. Green, Chrome, N. J. assignors to United States Metals Refining Co., Chrome, N. J. (U. S. No. 1,148,798; Aug. 3, 1915.)

ROASTED ORE—Method and Apparatus for Treating Roasted Ore. A. Ramen, Halsingborg, Sweden. (Brit. Nos. 15,254 and 15,378 of 1914.)

ROASTING—A New or Improved Process for Treating Ores or Other Materials in Roasting and Drying Furnaces. O. Spinzig, and Waldemar Hommel, Clausthal, Germany. (Brit. No. 8766 of 1914.)

ROASTING—Improvements in or Relating to Mechanical Roasting Furnaces. J. Claude, Frankfort-on-Main, Germany. (Brit. No. 10,058 of 1914.)

ROASTING—Improvements in or Relating to the Roasting of Ores Containing Sulphur Existing in the Free State, or as a Metallic Sulphide. A. D. Carmichael and H. S. Montgomery, Norwich, Conn. (Brit. No. 14,295 of 1914.)

SEPARATOR—Centrifugal Apparatus. Wilhelm Meyer, Johannesburg, Transvaal, South Africa. (U. S. No. 1,146,570; July 13, 1915.)

SLAG—Prevention of the Deposition of Slag in Furnaces. Robert Grabowsky, Hanover, Germany. (U. S. No. 1,147,163; July 20, 1915.)

SLAGS—Method of and Apparatus for Recovering the Heat of Slags. Carl Semmler, Wiesbaden, Germany. (U. S. No. 1,146,962; July 20, 1915.)

Mining on the Witwatersrand

JOHANNESBURG CORRESPONDENCE

SYNOPSIS—Decline in grade of ore is the rule on the Rand at the present time. Working costs are being reduced, but profits are also diminishing. The condition and prospects of the principal mines are discussed.

The general tendency on the Rand continues in a normal manner toward a further fall in the average grade of ore milled and a decline in working costs. During 1914 25,701,954 tons were milled of a value of 26s. 6d. per ton, as against 27s. 9d. in 1913, at a cost of 17s. 1d. per ton against 17s. 11d. in 1913.

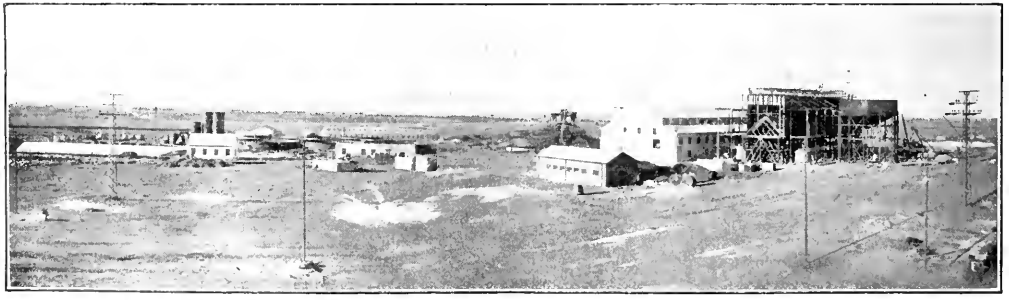
WAR'S EFFECT ON WORKING COST

Working cost has received a setback because of the increased cost of materials, for which the war is responsible. This is estimated at about 5d. per ton. The chief economy in working cost seems to have been due to a reduced white-labor cost per ton milled, and this has been partly on account of increased efficiency and partly because of reduced rates of wages, the average wage-rate paid having been considerably lowered in the last year. The mines will, however, have to pay a special war contribution of £150,000 this year besides the usual profits tax of 10% nominal. Despite this fact, the shares of the newer mines have lately shown large advances because of favorable developments and increased profits.

The native labor outlook has been somewhat more favorable recently, though in some parts of the country, because of the very wet season, malaria has caused great mortality. In the northern Transvaal whole kraals (villages) have been wiped out, and in one district alone from 10,000 to 11,000 natives and many whites have died. The death rate has been reduced from 22.1 to 14.9 per thousand and the accident death rate from 4.5 to 3.5 per thousand. There is talk of opening some of the idle mines to take care of the increased labor supply, but some mines are still short-handed, so that, especially in view of the European situation, the rumors are probably premature. Nevertheless, there is a boom in the stocks of some of these quiescent companies.

The mining industry in other parts of the world does not realize how serious a matter the compensation of phthisis victims has become to the mining houses. No less than £608,000, or 5.6d. per ton milled, was awarded last year. So far there seems to be no great diminution in the number of applicants for relief, and this year the government has issued a mining regulation forbidding miners going back to blast the round after firing the cut. No doubt this was a very great factor in producing the disease, as it is difficult even with the use of water blasts to reduce the fine dust to 10 mg. per liter of air under half an hour.

The native and white miners in development work still produce quite a lot of dust in drilling, though there is a really good water supply at all faces in most of the mines. This is done despite the best efforts of the mine officials and inspectors. I do not think, however, that even this dust is sufficient to cause any great amount of disease, as I know miners who have always fired their cut and round together, thus avoiding the smoke and dust of explosion; and these same miners have been exposed to much dust during drilling, especially in the blast. These men are still alive and working after 10 to 15 years' employment here. There is no doubt that the conditions generally are much better than they were. Nearly all broken rock is well wet down before being shoveled, and tests show that the amount of dust in the mine air is much reduced. There are, of course, portions of nearly all mines where even with fans installed ventilation conditions are bad. This is a matter which it is hard to remedy entirely, and it seems that despite all that has been done men are still contracting phthisis.



PLANT OF THE GOVERNMENT GOLD MINING AREAS (MODDERFONTEIN) CONSOLIDATED, LTD., ON THE WITWATERSRAND

The question of the sale of illicit liquor—mostly cheap wine-brandies from the Cape Province—to the native mine laborers has been attracting a great deal of attention. The well-known mine magnate R. W. Schumacher is leading a campaign in favor of prohibition and the stoppage of all imports of liquor. It seems, however, that experience in America proves that so long as the great bulk of the white population desires liquor, prohibition legislation carries great evils in its train. An article from some impartial authority in the *Journal* on the real

conditions in the prohibition states, especially the states where a mining population prevails, would be welcomed by mining engineers in other parts of the world.

Types of Drills Favored

The use of hammer drills for development work, particularly those of the Leyner type, is gaining ground on the Rand, as where attention is paid to the care of the steel it is found that the great progress made more than pays for the greater maintenance costs. Piston drills will, however, do most of this work and also most of the stoping, but unless improvements are made they may be supplanted by hammer drills which have been developed to suit conditions obtaining here.

The conditions at several of the older mines of the Central Rand are causing anxiety among miners and mine officials. Serious shocks owing to heavy falls of ground are constantly being felt in the town itself, and several of the mines have had their work nearly stopped. Despite much packing and some sand filling, it can be understood that the almost entire removal of two strata dipping 60° to 40° about 80 ft. from each other and about 5 to 10 ft. thick must cause extensive movements through unbearable stresses on shaft pillars and other supports. Some peculiar phenomena have already occured in the lifting of a solid quartzite footwall in a very narrow excavation. Fortunately great loss of life has so far been avoided, and a government commission is to be appointed to remove such danger.

Changes in Ore Value

It is now generally admitted that on the whole there is a marked falling off in the value of the reefs in depths. Nevertheless, some very encouraging instances of excellent developments at between 3000 and 4000 ft. are in evidence. For the last quarter, mainly in drives below 4000 ft. in the Village Deep, 1804 ft. driven on main reef leader assayed 21.6 dwt. over 20 in., while the Coulin Reef, which in the upper part of the mine was mostly unpayable, assayed 9.1 dwt. over 21 in.

On the East Rand at between 3000 and 4000 ft. depth wherever the orebody is well developed—where the pebble bed contains large pebbles—the gold content is high, and any unpayable ground is generally due to the irregular nature of the reef, which sometimes peters out altogether—a condition which of course has nothing to do with depth. In the deeper levels of the Crown mines, the reefs have been poorer. The lower levels of the Witwatersrand Deep have entered poor ore, while those of the neighboring Knight Central are miserably poor. On the other hand, the values met with recently in the Simmer Deep show some improvement and the drives from the deeper levels of the Angelo Deep—which has always been most disappointing in values—at a depth of about 4000 ft. have recently intersected the reef beyond a fault, over 1000 ft. being disclosed by three crosscuts. These assay: (1) Main Reef, 37 in., 19.1 dwt. and M.R.L., 23 in., 18.6 dwt.; (2) M.R., 68 in., 7.4 dwt.; (3) M.R., 35 in., 12.1 dwt.; M.R.L., 48 in., 6 dwt. This seems to be a continuation of a run of rich ore worked by the Witwatersrand Deep.

The main interest for the future of the Rand lies in the Far East Rand Basin. Here very necessary development, if the Rand is to maintain its output, has been hung up, firstly, owing to the unfortunate strikes of January and July, 1914, which undoubtedly prevented a move being made to secure fresh capital; and, secondly, because of the contention of the mining houses that the terms asked by the Government for the lease of several valuable areas belonging to them were excessive. These terms amount to the Government requiring from 30 to 50% of the profits; and in view of the depth at which most of the available reef lies the proportions of unpayable ground and other risks of mining, involving the outlay of at least £1,000,000, the investors contend that the tax on profits should not be more than the usual 10%. I think, however, that a tax of about 25% will be found reasonable by both sides. The area of ground allowed for a mining area will probably be about 2000 claims, of which half may be considered to be unpayable ground and the remainder to contain about 20,000 mill-tons per claim of a value of from 25s. to 30s. per ton.

Mills Starting Crushing

During the year the state mines began crushing. The mill has been supplied from stoped ore, low-grade development, dump rock and current development, so that the real grade of the mine has not been reached. It is expected that this will lie between 26s. and 28s. per ton. The reef attains a width of 10 ft. in places and the mine developments already guarantee at least 50% of the 2600 claims being payable.

The Modder Reef mine also started crushing, its mill being designed to deal with about 100,000 tons per year. The mine is estimated to contain about 1,000,000 tons of ore. The ore developed represents six years' supply, being 2,150,000 tons, valued at 8 dwt. over 69 in. Stoping on this mine is being done with Leyner drills.

The Brakpan mine has not yet developed another orebody like the one which produced phenomenal profits in its early history. Ore reserves are 2,490,000 tons, valued at 6.73 dwt. over 62 in. The unpayable reef amounts to 5,211,000, or about 50% of the tonnage developed to date. Leyner rock drills are used for development and some stoping is being done with hammer drills. Costs are 18s. 6d. per ton. Underground mechanical haulage is largely employed.

Springs mines has incurred a cash expenditure of £808,000 in sinking two shafts to 3000 ft., and in opening the mine 54½% of the footage sampled on the reef has averaged 22.7 dwt. over 26.7 in. Already 533,000 tons, valued at 10.3 dwt. over 52 in., has been developed.

The New Modderfontein mine is to increase its crushing capacity to 1,000,000 tons per year and the new circular shaft is being equipped for production. The Modder B, Van Ryn Deep and Geduld mines have all increased their production and their profits. The New Kleinfontein will shortly reopen the Benoni and Apex mines.

Condition of Milling Plants

All this portion of the field is thus in a flourishing condition. The East Rand Proprietary has again been unable to develop as much ore as has been milled. The tonnage milled was 1,499,089, of a value of £1 7s. 1d. per ton, at a cost of 19s. 4d. per ton, while 1,070,970 payable tons was developed. Payable ore reserves are 5,100,000 tons, averaging 6.6 dwt. over 55 in. Unpayable reef now amounts to 8,928,700 tons, most of which has been encountered on the lower levels of the mine. The

Simmer Deep mine, working down to a depth between 3000 and 5000 ft., despite shortage of laborers and the effect of strikes, made a working profit of £39,000 for 1914. The payment of interest and redemption of debentures—which amount to £835,000—and the profits tax more than absorbed this amount. The mine has worked on a narrow margin of profit, working costs being 15s. 5d. per ton and the value of ore 16s. 7d. recovered. Ore reserves amount to 1,129,000 tons at 4.3 dwt. Better values have recently been encountered, leading to a hope for more profitable returns; 307 claims have been developed, 31 of which contained dikes and 54% of the remainder payable ore; 985 claims remain to be explored.

Yield and Data

The City Deep since starting has produced at the rate of 35s. 11d. per ton milled; costs have been 23s. 9d., with a nominal profit of £1,097,783. Shareholders have, however, received only £600,000 in dividends. The chief reasons for this poor showing have been mentioned before. Ore reserves amount to 2,500,000 tons, valued at 9.7 dwt. per ton.

The Crown mines' yield fell off greatly during 1914, and development at the South Reef showed 36% to be payable. Ore reserves are now estimated at 10,000,000 tons, which are valued at 6 dwt. over 66 in., or a recovery value of 25s. 1d., the original estimate of 35,000,000 tons being 28s. 6d. The mine during the last few years has, however, been crushing ore returning 29s. 10d., so that a fall in grade is now inevitable, apart from poorer development. Costs have been reduced to 15s. 6d., with a monthly tonnage milled of 192,000, whereas the mill could deal with 40,000 tons more, were labor available.

The Consolidated Langlaagte has reduced costs to between 13s. and 24s., and is making large profits. In the Far West the Randfontein Central mines, which work 7½ miles of outcrop, have an ore reserve of 6,826,000 tons valued at 6.6 dwt. During the year, owing to shortness of labor, strikes and other causes, only 883 stamps operated, out of 1000. These crushed 2,493,984 tons, returning 23s. 1.1d. with costs of 16s. 7.4d. and a working profit of £813,774, or 6s. 6.3d. per ton. Of this sum, however, £303,757 was required for capital cost, £258,000 for debentures and redemption, £62,404 for miners' phthisis and £52,877 for profits tax, leaving a real profit of only £157,301.

Nevada Consolidated Second Quarterly Report, 1915

The Nevada Consolidated Copper Co. reports for the second quarter of 1915 a production of 15,106,920 lb., made up as follows: April, 4,710,684 lb.; May, 5,271,756 lb.; June, 5,124,480 lb., an average monthly production of 5,035,640 lb. During the quarter 849,155 dry tons of Nevada Consolidated ore, averaging 1.40 per cent. copper, was milled, as compared with 564,813 dry tons, averaging 1.49 per cent. for the previous quarter. The entire tonnage milled was supplied from the openpits. In addition, 17,541 dry tons of Giroux Consolidated Mining Co. ore was milled during the quarter.

The cost of copper produced, including Steptoe plant depreciation and all charges except ore extinguishment and after crediting all miscellaneous earnings, was 8.93c per lb., as compared with 8.97c. for the previous quarter. The earnings for the quarter are computed on the basis of 17.006c. per lb., and all unsold copper on hand and in transit is inventoried at 13½c. There was a surplus for the quarter of $614,297, after paying the 37½c. per share dividend of June 30. There was set aside $145,764 for depreciation and $84,545 for ore extinguishment, leaving a net credit to earned surplus for the quarter of $383,988. The overburden stripped during the quarter amounted to 754,649 cu.yd.

Zinc Smelting in Great Britain

The following paragraphs are taken from the address of the chairman of the Central Zinc Co. at the recent annual meeting of its stockholders. They are of peculiar interest, disclosing as they do the operations at the most modern zinc smeltery of Great Britain during a year of war, the proprietary company being intimately associated with one of the great zinc-producing companies of Australia. The chairman said, in part:

Within a week of the last annual meeting the great war which still rages began, and in consequence we have had a year full of anxieties and difficulties. I am glad, however, that in spite of them my anticipations of better results for our company have been verified, and that our profit for the past financial year, amounting to £10,413, is the best we have yet made, exceeding by £1267 that of 1912-13. The chief reasons for this improvement are that, owing to our having chosen the right moment to make favorable coal contracts, we have had cheaper coal than in the previous year, and owing to favorable freight contracts made before the war began, have had the advantage of lower ocean freight. We have also had the benefit of higher prices for our product and of the purchase on very favorable terms of a large parcel of calamine, while our technical work and recoveries have shown further improvement. On the other hand, we have had acute labor difficulties to contend with, interruptions of work and increased cost of many of our essential materials.

LABOR SUPPLY SHORT

For the first four months of our financial year—that is to say, for April, May, June and July of last year—our working was on normal lines on a six-distiller basis. On the outbreak of the war, our position at once became extremely difficult on account of the considerable number of reservists employed by us, who were immediately recalled to the colors, and also owing to the quick and patriotic response which many of our men who are not reservists made to the call for recruits. Of the trained hands in our distillery a good many were of German and Austrian nationality, and in view of the national importance of our continuing our output of spelter without interruption we decided, in consultation with the authorities, to retain those men under special conditions, by which they were virtually interned at our works, and so enabled us to assist in the production of a much-needed metal instead of being a charge on the country. By these means, except for about five weeks when one of our furnaces was shut down for repairs, we were able to keep six distillers in operation until Nov. 16, when one had again to be shut down owing to acute general labor shortage, and we continued with five distillers until Dec. 16, when the bombardment of Hartlepool and Seaton Carew by the German cruisers took place. This outrage naturally roused the bitterest feelings of the inhabitants against all enemy aliens in the district, and in deference to these feelings we decided, in spite of the inevitable dislocation of our work which would follow, to apply for the removal and internment of these German and Austrian workers. The result of this was that from Dec. 19 until the close of our financial year, on Mar. 31, our operations were greatly restricted, and were with difficulty maintained even on a three-furnace basis.

RUSSIAN AND BELGIAN WORKERS

We lost no time and spared no effort in endeavoring to recruit Russian and Belgian labor to replace that which we had lost, and although for some time we were not very successful either in the quantity or in the quality of the men we got, we have. I am glad to say, since the financial year closed obtained a much more satisfactory supply of Belgian workmen, many of whom are trained distillery hands formerly employed in Belgian zinc works, with the result that we have now six distillers again in operation, and hope to start a

seventh very soon, while an eighth is being completed as rapidly as possible and will, we hope, be available about the end of the year. A further adverse effect of the outbreak of war was that our very favorable contract for the sale of our silver-lead residues to a German firm came to an end, and in place of it we have had to make another contract on less favorable terms with London buyers, who, moreover, owing to the congestion of their works, are only able to take deliveries very intermittently. Our supply of foreign clays for our retorts was also cut off by the war, and although we at once took steps to obtain the best domestic clays available, these have proved both more costly and less durable than those we had before, so that the cost of our retorts has risen considerably, and their shorter life has made high metal recoveries more difficult. Against these many and grave difficulties caused by the war, the only way in which we have received any compensating benefit has been by the increased value of spelter, our average net sale price of zinc for the financial year having been £27 0s. 8d., against £22 5s. 6d. in the previous year and £26 10s. 11d. in 1912-13. Considering how much our work in the past has been interrupted, it is surprising that our tonnage of ore treated and of spelter and residue concentrates produced should show so small a falling off, the ore tonnage being 825 tons less than in the previous year and the spelter production less by only 269 tons. In the production of blue powder there was an increase of 63 tons, owing to the production of this material in the furnaces having been encouraged in consequence of a rise in its value; and from our distillery residues we produced 3350 tons of silver-lead concentrates, against 3321 tons in the previous year.

WHY ENGLAND IS BACKWARD IN ZINC SMELTING

I have often heard wonder expressed that, in spite of the fact that some of the most important sources of supply of zinc ores are situated within the British Empire, especially at Broken Hill, the industry of spelter making should be so much in German hands, and the Broken Hill mines so dependent on German buyers for the disposal of their material. We, at any rate, have done something to provide a British outlet, and the Broken Hill Proprietary Co. has also established zinc works on a moderate scale in Australia; but the fact is that hitherto British spelter works have not been successful enough to attract large capital to the industry, owing mainly to the difficulty, both in this country and in Australia, of obtaining an adequate supply of skilled labor. We have ourselves experienced our full share of this difficulty, and have found that English workmen are most reluctant to undertake work of this kind, to which they are unaccustomed and which, although it is not dangerous to health, is certainly laborious. In this respect England is at a disadvantage as compared with those continental countries in which spelter making has become almost an hereditary industry with certain classes of workmen, and which are also better situated in respect of the clays which are necessary for the retorts used in zinc distilling, but even on the Continent, so far as I know, the average return on the large capital involved in zinc works is very moderate, and in some cases very heavy losses have been incurred.

I am entirely in favor of England, if possible, making herself more independent of foreign countries in the manufacture of this metal, and the Government, I think, should assist by a duty on foreign spelter, or, failing that, a bounty on domestic spelter, but any attempt suddenly and hurriedly to build enormous new works here, such as I sometimes see advocated by those who know little of the difficulties would, I am sure, lead to disappointing results, and whatever is done in the direction of increasing the domestic output of zinc will have to be done cautiously and gradually. It must be remembered that the spelter works on the Continent, built at the cost of many millions, were at the outbreak of war quite sufficient to produce all the zinc that Europe in normal times can absorb, and if new works on a great scale are now to be built in England the result, unless some of the continental works should be destroyed before the war ends, may be an over-production of the metal and a fall in price, a state of affairs which, although it might be acceptable to galvanizers and brassfounders, would be calamitous both to the owners of spelter works and to the mines which produce zinc ores. Of such ores there is a great abundance in the world, and the limiting factor in the supply of metallic zinc does not lie in any scarcity of mineral deposits, but mainly in the high cost of works to convert these ores into metal and the difficulty of obtaining an adequate supply of skilled labor to make them successful. In our own case our policy is gradually to extend our works until they reach a capacity of 20,000 tons to 25,000 tons a year, which will mean an addition of from six to eight distilling furnaces to the seven we now have and the eighth which is in process of completion. We are also considering schemes for making refined zinc, of which there is considerable scarcity, and for establishing rolling mills for the manufacture of zinc sheets, but we realize that such extensions will require both time and money, and that perhaps they could be better undertaken by our parent company, the Sulphide Corporation, which has larger resources than we have, and which is directly interested in increasing by all possible means the outlet and market for its ores.

The foregoing is rather strange reading in view of the recent prices for spelter in England. However, it is to be remarked that the fiscal year of this company terminated on March 31 and the extravagances in spelter did not begin until April. Yet there was previously a great dearth of spelter in Great Britain. Comparisons may well be made between the statements of the chairman of this company—the Earl of Kintore—and the recent editorials in the *Journal* on zinc smelting in Great Britain and on allied subjects.

State Valuation of Michigan's Iron Mines

SPECIAL CORRESPONDENCE

Valuations have been placed on all Michigan iron mines for 1915, the total now being $89,757,607, which is $1,814,508 less than last year. Valuations by counties are: Gogebic, $34,572,115; Marquette, $28,616,453; Iron, $20,856,919; Dickinson, $5,906,443. The reduction is because several mines have been greatly depleted and because of lower prices for iron ore during last few years. Assessment figures are based on average price for the five years preceding assessment. Republic mine, at Republic, which was valued at $1,110,299 last year is now valued at $520,000, as mine and timber holdings were sold during the year for $600,000. Pewabic at Iron Mountain was reduced from $478,000 to $102,000. Newport still has highest valuation, being placed at $8,074,000.

M. and M. Society To Urge Mining Law Revision

The following announcement from the latest Bulletin of the Mining and Metallurgical Society of America sets forth the progress made by that organization in its effort to secure revision of the present antiquated United States mining law.

On Feb. 19, 1915, H. V. Winchell, chairman of the committee on mining law, presented to the council of the Mining and Metallurgical Society a progress report which was printed in its February Bulletin. In accordance with the suggestion of the committee, and the action of the council at that time, the executive committee of the council entered into correspondence with Washington officials and others interested in securing necessary changes in the mining laws of the United States, with the object of arranging for a meeting of the Mining and Metallurgical Society in Washington during the coming fall or winter, at which meeting, not only the Mining and Metallurgical Society, but all other organizations interested in the changes proposed might present such facts and arguments to the members of Congress and other interested officials as would bring about some positive action by the Government during the next session of Congress.

The result of this correspondence has been most encouraging. All of the officials approached have not only given their hearty approval of the program, but have offered to cooperate to the fullest extent.

After considerable discussion it has been decided to hold the Washington meeting on Thursday, Dec. 16, 1915. By this time the various congressional committees will have been appointed and will be ready to consider proposed legislation. An earlier date seemed inadvisable.

The following organizations have been asked to send representatives to the meeting: The American Institute of Mining Engineers, American Mining Congress, Lake Superior Mining Institute, Colorado Scientific Society, Colorado Metal Mining Association, California Metal Producers' Association, Montana Society of Engineers, Idaho Mining Association, Spokane Mining Men's Club and the Spokane Technical Association. In addition to the foregoing, various chambers of commerce and individuals interested will be invited to attend by representative or in person.

It is the desire of the council to make this meeting thoroughly representative, and members are urged to suggest the names of additional organizations or individuals, not connected with any of the foregoing organizations, who may be interested and who should be invited to attend.

Spelter Production for the First Half of 1915

The production of spelter for the first six months of 1915 has been canvassed by C. E. Siebenthal, of the Geological Survey, with the following results.

The output of spelter was 207,634 short tons made from domestic ores and 8898 tons from foreign ores, a total of 216,532 tons, as compared with 177,991 tons for the preceding six months, and with 175,058 tons for the first six months of 1914. In addition there was produced by distillation from drosses and skimmings 13,546 tons of secondary spelter, as compared with 10,213 tons, half of the 1914 output of distilled secondary spelter. No statistics were obtained of the spelter produced by remelting skimmings, drosses, etc., but it was probably not less than 12,000 tons. The total output of spelter from both ore and skimmings was therefore about 242,000 tons, or at the rate of 484,000 tons per year. The whole number of retorts in operation in June was about 127,000, but many of these retorts had been but recently put in operation. Additional retorts to the number of over 32,000 have since been completed, are under construction, or are planned.

The apparent domestic consumption for the six-month period was 160,906 tons, as against 149,762 tons in the preceding six months, and 149,306 tons in the first six months of 1914. The spelter stock on hand at smelteries were 5884 tons, an average of about 150 tons each for the plants reporting.

Utah Copper Co.'s Quarterly Report

The Utah Copper Co., Bingham Cañon, Utah, reports for the second quarter of 1915 a gross production of total copper contained in concentrates as follows: April, 12,015,148 lb.; May, 14,053,765 lb.; June, 14,330,912 lb.—a total of 40,399,825 as compared with 26,445,995 lb. in the first quarter of 1915. There was treated at both of the company's plants a total of 2,215,159 tons of ore, compared with 1,396,341 tons for the previous quarter. The tonnage handled during the quarter was the largest ever treated in the history of the property, the previous high record having been for the fourth quarter of 1913, when a total of 2,113,080 tons was milled. The average grade of the ore milled was 1.42% Cu as compared with 1.44% Cu for the first quarter of the year, and the average extraction was 64.85%. The extraction was low, partly because the ore at times contained considerable copper in the form of carbonate, but principally on account of the very large tonnage of ore treated. The average cost per pound of net copper produced during the quarter, after allowing the smelter's deduction and without crediting miscellaneous income, was 7.49c., as compared with 8.19c. for the first quarter of 1915. If the net miscellaneous earnings in Utah, including those from the Bingham & Garfield Ry., were applied as a reduction of costs, the net cost per pound for the quarter would be 6.57c. The financial results of the company's operations for the quarter were: Net profits for milling operations, $3,680,249; other income, rents, etc., in Utah, $36,862; income from Nevada Consolidated Copper dividend, $375,187; Bingham & Garfield Ry. dividend, $320,000; total net profit, $4,412,299, from which a dividend of $1,624,490 was paid, leaving a net surplus for the quarter of $2,787,809. The dividend declared June 30 was at the rate of $1 per quarter instead of the 75c. paid previously.

Earnings for the quarter are computed on the basis of 15.98c. per lb. for copper as compared with 14.93c. for the previous quarter. All unsold copper on hand and in transit is carried in the inventory at 13.50c. per lb. During the quarter there was removed a total of 1,548,132 cu.yd. of capping as compared with 1,143,596 cu.yd. for the first quarter of 1915; an average of 16,798 tons of ore per day was moved over the Bingham & Garfield Ry. from the mines to the mill; an average of 2921 tons per day of other freight was transported over the line.

United States Magnesite Output Increased in 1914

The crude magnesite produced and sold or treated in the United States in 1914 amounted to 11,393 tons, as compared with 9632 tons in 1913, according to the Geological Survey figures. Magnesite is used for making soda-water gas, refractory brick, furnace hearths, crucibles, for digesting and whitening wood-pulp paper, in cement making and for various other purposes. The production of the United States is still derived exclusively from California.

The consumption of magnesite in the United States in 1914 was about 122,000 tons of calcined, and 13,000 tons of crude material imported, and the raw production as reported above. The imports were thus equal to 96% of the total consumption, 93% coming from Austria-Hungary, the remainder from Greece.

Gold Production in Georgia in 1914 was 787.06 fine ounces, valued at $16,270. The production in 1913 was valued at $15,108. The yield of placer gold was 534.20 fine ounces in 1914, and the output from quartz or deep mines was 252.86 fine ounces. The output came from 26 placers and 11 deep mines. A total of 1750 short tons of siliceous gold ores, with an average gold and silver recovery of $3 a ton, was treated in Georgia in 1914. The production of gold was contributed by mines in 14 counties, of which Lumpkin County had the largest number of operators and the greatest output.

Editorials

The Prospect for Copper

The hopes for a rally in copper that were recently entertained failed to be realized and the price has declined further. It appears that the buying for ammunition in June, and earlier, was much in excess of the immediate requirement, and although further contracts have probably to be made the buyers are more cautious, slower to act, than they were. In the meanwhile production has increased to about the limit of present refinery capacity. Domestic consumption has failed to increase materially. Although the producers have already contracted to deliver a good deal of the copper that they expect to produce for a long while ahead, even in 1916, there remains a large supply of current production to be sold, and the excess of supply over demand is having the natural effect.

Yet, the position of copper is fundamentally sound. The stocks in the hands of refiners are not increasing to any disconcerting extent. There are not believed to be any speculative accounts in the metal that have to be liquidated. A big operation of that sort that was conducted on the sharp rise in copper, early in the spring, is supposed to have been concluded before copper reached its highest point. There has been no gossip of speculators buying copper at the top and meeting with the fate of some of the adventurers in spelter and lead. Nor has there been any considerable volume of speculation in the shares of the copper stocks. On the contrary, they have been conspicuous by the neglect of them and it is well known that the standard issues have hardly been selling for prices representing their liquidating value on an average of 14½ @ 15c. for copper. Anaconda, for example, has at no time in 1915 sold so high as it did in 1914, before the war. There have therefore been no great bubbles blown in copper that must inevitably explode.

Trying to look into the future certain factors seem reasonably clear. The production of Chuquicamata, Katanga and Inspiration is going to increase. If it appears, however, that the weight of their production added to what is being piled on from other quarters is excessive, the large producers will probably curtail. They learned in 1914 how easy it is to do that, and there is no longer the tendency that there used to be to try to hog the market. On the contrary, there is a better recognition of the wisdom of operating for the common welfare and therefore there is now a spirit of friendliness among competitors.

So long as the war lasts there is going to be a very large quantity of copper used for ammunition, but of course such a consumption is not going to maintain the copper industry of the world. The great uncertain factor at the moment is the consumption for peaceful purposes, which is still below normal, especially in the United States. When is it going to revive? This country is growing rich in money out of the sale of its products and its labor at high prices, and sooner or later that money must be invested in increased means for transportation, in buildings, in improvements, etc., all of which will require copper. The remarkable revival in the iron and steel industry, which can hardly be due wholly to military requirements, is conceived to foreshadow this. Yet we should not be disappointed if a great expansion in domestic peaceful industry does not happen right away. Such expansion must be based upon the financing of bonds and securities, and although we have the means to do that the uncertainty of the times breeds caution. Next there are the questions of men and of plant, both of which are now occupied to a large extent with military business. The two things—war and peace—do not economically dovetail well together. Many months ago the view was expressed in the *Journal* that it would be better for the prospects for increase in domestic business to have copper hold around 15c. than to have it raised to 20c. by military buying. We have seen strikingly how the excessive rise in spelter—far more extravagant than the rise in copper—paralyzed ordinary commercial consumption. Thus a few producers profited hugely, but to a large extent at the expense of peaceful Americans, not warring Europeans.

The only possible deduction from these forecasts is that we shall probably see copper at a lower level than it is now before the end of this year, although there will no doubt be rallies on sporadic buying movements. Yet there is nothing to be pessimistic about. Seventeen cents, or 16c., or even 15c. is a fine price for copper. If the market holds around such levels up to the termination of the war, everybody ought to be satisfied. We find among experts in the trade a unanimous opinion that upon termination of the war there will be a great demand for copper.

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Electrometallurgy of Zinc

The high price for spelter will doubtless develop an electrometallurgy of zinc, if that art is capable of development. It has in fact been an art for many years, having been practiced successfully at the works of Brunner, Mond & Co. at Winnington, England, where spelter guaranteed 99.95% Zn is produced by the Hoepfner process, a metal that is equal to Horsehead and Bertha in so far as zinc content is concerned.

The deterrents to the production of zinc by electrometallurgical methods have been three, namely: (1) Difficulty in obtaining a dense, coherent deposit of zinc on the cathodes; (2) large consumption of energy required for the decomposition of the zinc compounds available for commercial electrolysis, no matter whether it be the sulphate, the chloride or an alkaline zincate; and (3) the difficulty in dissolving a fair proportion of the zinc of the ore.

The first difficulty was mastered years ago, and recent workers in this field have had no trouble in obtaining satisfactory cathode deposits. The second difficulty is a hard hurdle to jump over. Heretofore it has limited the electrometallurgy of zinc to places where the anode reaction may be caused to serve a useful purpose, as at Winnington. The third difficulty is common to all zinc hydrometallurgical processes and refers to the formation of zinc ferrite in the roasting of the ore, zinc ferrite being

insoluble, or difficultly soluble, in most agents that are commercially available. For this reason a roasted zinc ore may give up only 60% of its zinc even to fairly strong sulphuric acid.

The formation of zinc ferrite appears to be governed by the iron content of the ore and the temperature of roasting. Ores low in iron may be roasted at high temperature and yet give up nearly all of their zinc. The great trouble is with blendes that are high in combined iron. In the roasting of such ores the metallurgist has two horns of dilemma. If he roasts at high temperature he produces a great deal of zinc ferrite, while if he roasts at low temperature he leaves much undecomposed zinc sulphide in the ore, which also is insoluble. It is not unlikely that a careful study of conditions will enable him to steer a safe way between the two dangers.

Recent work in zinc electrometallurgy has been done at Trail, B. C., and at Bully Hill, Calif. It is intimated that one or both of these plants is shortly going to offer electrolytic zinc in the market. The Anaconda company has also taken up this problem in an experimental way. Mr. Laist, its chief metallurgist, may be expected to approach the subject unobsessed by preconceived ideas, and it is not unlikely that he will blaze some new trails.

The Independent Powder Manufacturers' Chance

The E. I. du Pont de Nemours Powder Co. writes us, with respect to an editorial in the *Journal* of Aug. 7, 1915, that we were wrong in conveying the idea that "the companies now absorbed in filling their great war contracts for high explosives" are neglecting the mining business. It says that its smokeless-powder plants have no relation whatever to its dynamite plants and that it has ample manufacturing capacity for all the dynamite and blasting-powder business it can possibly get and is seeking such business just as assiduously as at any time in its history. We did not say that this company or any other was neglecting its mining business, but we did say that this looks to us like a very good time for independent powder manufacturers to get more broadly into the business, and our article was a plea for the widening of competition, which we are quite sure would be welcomed by miners.

Some light is thrown upon the effect of the war in the explosive industry, and incidentally the mining industry, by a suit for breach of contract, filed in the United States District Court, Aug. 17, by the Nitro Powder Co., of Kingston, N. Y., against the Butterworth-Judson Co., of New York, and Newark, N. J., a manufacturer of chemicals, which on March 30, 1912, agreed to supply the Nitro Powder Co. with all the acids it needed for the manufacture of explosives for its customers, mainly cement and quarrying concerns. This shows the serious situation which the manufacturers of dynamite for blasting purposes are facing in this country as a result of the heavy shipments of explosives to the belligerent nations of Europe and the consequent scarcity of acids in the domestic market. The Nitro Powder Co. in its suit says that within the last three months it has found it practically impossible to get nitric, sulphuric and other acids used in the manufacture of explosives save at prohibitive prices. As a result, the company says it has been temporarily forced to close its doors.

There are of course many manufacturers of explosives in the United States whose supply of acids has not been affected by the war. This should contribute toward giving them an opportunity to equalize the dynamite business for mining and quarrying purposes and spread out beyond the narrowly circumscribed localities that they supply at present.

Byproduct Coke Ovens

The total production of coke in the United States in 1914 is reported by the Geological Survey at 34,555,914 tons, which is a decrease of 11,743,616 tons, or 25% from 1913. Coke is so closely associated with iron-making, it is to be expected that a dull iron year should show a loss in coke.

The remarkable point in the production of the year, however, is the steady growth in the proportion of byproduct coke. While the beehive product in 1914 decreased 30.5% as compared with the previous year, the falling off in byproduct coke was only 11.8%. In part this difference may have direct connection with the fact that most of the byproduct plants are operated in connection with large iron and steel works and so may be kept at work except in extreme case of depression; while the merchant-coke plants are nearly all equipped with beehive ovens, and are the first to stop when demand falls off. Quite a sufficient explanation can be found in the statement that the value of the byproducts saved was approximately $17,500,000, an average of $1.55 per ton of coke made.

The growth of the byproduct-coke industry is shown by the statement that in 1901 only 5.4% of the coke made came from byproduct ovens, 94.6% being made in beehive ovens. In 1914 the proportion was 32.5% in byproduct and 67.5% in beehive ovens. The proportion is likely to increase, even this year, when improvement in the iron trade is calling for an increased production of coke.

That almost all the increase in coke-making capacity is likely to be in the byproduct line is shown by the statement that at the close of 1914 there were 93,946 beehive ovens existing, and 605, or 0.6% of that number, under construction. There were 5809 byproduct ovens standing at the same time and 644 under construction, the proportion being 11%. It must be remembered that the average output of a byproduct oven is much larger than that of a beehive, and the proportion of coke made to a ton of coal is also somewhat greater.

Fifteen years ago the byproduct oven was having a hard struggle to establish itself against prejudice and the inertia which fights against all changes and improvements. Now it is not only firmly established in its place but is fairly on the way to supersede its ancient rival.

The orgies in spelter and lead are about over. The drunken men are staggering home. The katzenjammer will come later. The copper producers did not have any spree worth mentioning, and therefore probably will not experience any great suffering. The positions of copper and spelter are totally different. Suppose the war should terminate suddenly. The consensus of opinion is that a total collapse in spelter would be very prompt in coming. On the other hand, a boom in copper is looked for in all quarters.

BY THE WAY

This comes from Galena, Kan. The P. C. Millikin livery barn was built several years ago when zinc ore was considered virtually worthless on account of the low price paid for it. The ore was thrown away at that time in large boulders, and some of them were used in the foundation of the barn. Last Easter Sunday the barn burned down. In cleaning up the lot, workmen discovered the ore in the foundation and immediately secured a lease of the lot from Mr. Millikin and proceeded to clean up the ore, from which they realized over $300 for a few days' work from the dirt and rock which years ago was considered worthless.

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How the Comstock Lode acquired its name is thus described by Charles E. Van Loan in the *Saturday Evening Post* in his interesting account of Virginia City's past glories:

The finding of America's richest orebody, second only in production to the gold reefs of the Rand, was an accident due to an insufficient water supply. Even the naming of it was an accident, traceable to the overwhelming assurance and conversational powers of one Henry Thomas Paige Comstock, a skirmisher on the flying wedge of exploration. The lode which will always bear his name might with more fairness be called the O'Riley, the McLaughlin or the Grosch. By some it is claimed that Allen and Hosea Grosch discovered the outcroppings of the lode; the credit is generally accorded to Peter O'Riley and Patrick McLaughlin. . . .

In the spring of 1859 came Peter O'Riley and Patrick McLaughlin, intending to locate somewhere in Six Mile Cañon. There was nothing left for them on the lower ground, and rather than waste the trip they decided to try the mountain. They began work in the bed of a tiny stream fed by a spring in the rocks above. The surface indications were not promising, and in addition to this the stream was not large enough to serve their purpose, so they dug a pit in order to collect sufficient water to operate their rocker.

Noticing a change in the appearance of the soil from the bottom of the pit, they dumped a bucket of it into the rocker and washed it. The gold was there in abundance—a shining film on the riffles of the rocker—and with it a mass of heavy black stuff which O'Riley and McLaughlin believed to be base metal of some sort and worthless. They threw it away.

"About that time," says the Oldest Inhabitant, "along came this fellow, Comstock. He was hunting his horse. The most you can say for him is that he had plenty of nerve and wind. He wasn't what you would call a smart man, but he knew a chance when he saw it. And there was the gold, right in front of him. Well, sir, Comstock started in to run a blazer on those Irishmen. 'This stream of water is mine,' says he. 'I've filed on it and you'll have to go somewhere else.'

"It was the rawest bluff in the world, but it worked. Comstock out-talked 'em. They offered him a share of the claim not to make trouble, and of course that was all he was after. And when that part of it was settled what does Comstock do but make himself a kind of general manager. Work? Not him! He sat down and told the Irishmen what to do.

"They decided to call the claim the Ophir, but when the other miners came up from below to see what they'd found, there was Comstock to do the talking, and it was 'My mine this,' and 'My mine that,' until everybody got to calling the Ophir Comstock's mine. When they went deeper it was Comstock's vein, and after that the Comstock Lode. He just talked himself into it, from start to finish—and that's how the Comstock got its name."

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The New Haven R.R. has sued the Post Office Department for $1472, the damages for being required to carry gold by postal parcel service in manner contrary to law, says the New York *Times*. The packages were not sealed or stamped as required of first-class mail. The weight limit was exceeded, and the packages were not prepared for convenient inspection. The railway alleges that the gold packages were not mail matter of any sort and were not shipped as freight or express. Besides the gold, the company was required to transport seven men as guards, although it has no contract covering such service. Nevertheless the service had to be performed, and it was performed, and the company demands pay for transportation of both gold and men according to fair value received. The case is a mild one. The Pennsylvania R.R. carried $99,000,000 gold for nothing—200 tons of it—and 100 clerks and guards. Gold is not the only thing which is put into the parcels post and carried by the railways for nothing. The only thing which the parcels post has refused to carry is a baby. The postmaster at St. Paul ruled that babies were live stock and not mailable. Seven hundred bushels of oats could not be declined, and five tons of ore in 50-lb. sacks was shipped to the Washoe works, Anaconda, Mont. It was a losing job for Uncle Sam, even worse than for the railways.

A butcher reduced a steer to mailable weights and sent him at a profit, at the expense of the railways, although the Government got the thanks. There are reports of postal contractors who have made business for themselves by means of the parcels post. A West Virginia postmaster, who also was a grocer, received an order for four barrels of flour. So he sold himself stamps and delivered the flour in bags through the parcels post. The Government was bound to supply him with the stamps canceled through his office, and also was bound to deliver his flour. Nobody paid for the transportation of the flour. The railway was bound to carry it under its four-year contract. The Government paid nothing for the additional service.

The transaction was strictly regular in all respects, and yet there is something about it better worth consideration than the oddities of the case. There are six mail-order houses shipping 100,000 packages apiece on which the freight and express charges are avoided. They know their rights, and it is an easy guess that they could tell strange tales of how they put it over the railways and Uncle Sam. The people value the parcels-post service and do not want it crippled: also they do not want it abused. The Government itself sets the worst example in this respect.

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Mogollon Gold & Copper Co. Holdings Sold

At a public sale held in Socorro, N. M., Aug. 5, to satisfy a judgment of $416,626 obtained through court procedure by the Equitable Trust Co., holders of bonds to that amount, the entire property of the Mogollon Gold & Copper Co., at Mogollon, was bid in by the Socorro Mining & Milling Co. for $100,000; this includes 29 claims covering 500 acres, part of them patented, and a 40-acre mill-site and a mill.

This winds up the affairs of the Mogollon Gold & Copper Co., which has had a more or less troubled existence since its organization in 1901. The company paid dividends to the amount of $22,500. The capitalization was for $1,250,000, the par value of shares being $1 each. The R. G. Dun estate, of New York, was at one time heavily interested in the company.

PERSONALS

Roscoe H. Channing was in New York this week.

H. P. Henderson has returned to New York from California.

R. C. Coffee has been appointed superintendent of the Schumacher mill, Porcupine.

Frederick L. Hoffman is making an extended tour through the West, studying sanitary conditions in various mines.

R. H. Stewart, general manager of the Consolidated Mining & Smelting Co. of Canada, visited the Porcupine and Cobalt camps recently.

Hugh McMillan, formerly of the Timiskaming & Hudson Bay Co., Cobalt, is in charge of the work of the Goodfish Lake Mines Co. near Sesikinika.

At the last meeting of the board of directors of the Eden Mining Co. of Philadelphia, a subsidiary of the Tonopah Mining Co., W. W. Charles was elected vice-president.

R. G. McConnell, Canadian Deputy Minister of Mines, is on a trip through western Canada, and before his return will make some explorations in the Rocky Mountain district.

Charles W. Merton, superintendent of the Consolidated Interstate Callahan Mining Co., of Wallace, Idaho, recently spent several days on business for the Butte Ballaklava Copper Co. in Butte.

Simon S. Martin, formerly general superintendent of the Maryland Steel Co., Sparrows Point, Md., has been elected vice-president and director of the Algoma Steel Corporation, Sault Ste. Marie, Ontario.

John A. Rice, mining engineer of El Paso, Tex., has made an examination of the Lustre mine at Magistral in Durango and is now in Ontario where he is in charge of the operations at the Curry mine at South Lorrain, Cobalt district.

Henry E. Wood, of the Henry E. Wood Ore Co., of Denver, Colo., was in Toronto recently making inquiries as to molybdenite ore. Since the outbreak of the war the export of molybdenite outside of the British Empire has been prohibited.

S. R. Guggenheim, chairman of the executive committee of the Guggenheim interests, accompanied by C. W. Whitley, general manager of the American Smelting & Refining Co., inspected the properties in which he is interested in Bingham recently.

H. T. Dickinson, assistant general manager of the De Beers Consolidated Mines, Ltd., Kimberley, So. Africa, is expected in San Francisco about Oct. 1. His address while in the United States will be Columbia University Club, 18 Gramercy Park, New York City.

William Thum, superintendent of the electrolytic lead refinery at East Chicago, Ind., is visiting the western properties of the United States Smelting, Refining & Mining Co. and will spend some time at the Expositions before returning. L. M. Kniffin is acting superintendent.

It may interest those who came in contact with James Ralston Bell during his eighteen years' stay in the United States and Canada, to know that he joined the Sixth Royal Scots on the outbreak of the European War. In May he went to the Dardanelles attached to the Fourth Royal Scots and has been officially reported as seriously wounded in the engagement of June 28 there.

Edward W. Parker, whose resignation as Chief of the Bureau of Statistics of the United States Geological Survey was noted in these columns in May last, is now in charge of the Anthracite Bureau of Information, supported by the anthracite mining operators of the United States, with offices at 1032 Miners Building, Wilkes-Barre, Penn. The work of this bureau has been combined with that of the Bureau of Anthracite Coal Statistics, which was formerly under the direction of the late W. W. Ruley, and since his death in charge of A. A. Armstrong. Mr. Armstrong will remain in charge of that portion of the work.

H. M. Roy, formerly chief field engineer with the American Zinc & Chemical Co. on the construction of its zinc smelting plant, modern town and coal mine at Langeloth, Penn., has accepted a position with the Stone & Webster Engineering Corporation at Keokuk, Iowa, on construction of a zinc plant. He was graduated from the University of Illinois in 1905, and after spending two years in the United States Coast and Geodetic Survey on harbor surveys and precise leveling, entered the engineering department of the Pennsylvania Lines west of Pittsburgh, where he was engaged on various construction and maintenance work until 1912, when he left the railroad to take charge at Langeloth.

SOCIETIES

Santa Clara University is entertaining the geological expedition sent out by the St. Louis University. The purpose of the expedition is to study the geological formations in Arizona and the Canadian Rockies, including a visit to the Panama expositions at San Francisco and San Diego. They visited the Lick Observatory under the direction of Father Selga who resides permanently at the observatory.

Utah Society of Engineers—An address on road-building was given by C. L. Crandall, dean emeritus of the College of Engineering of Cornell University, at a banquet held by this society on the evening of July 19, at the Newhouse Hotel, Salt Lake City. The methods of road-building employed in the state of New York and the results achieved since 1903, when active work began were described. Forty-two members were present. C. J. Ullrichs, secretary of the society, presiding.

American Electrochemical Society—The September meeting of the American Electrochemical Society will be held at San Francisco, from Sept. 16 to 18. Special transportation facilities have been arranged for by a committee of which J. M. Muir, 229 West 39th St., New York, is chairman. Various routings are offered and full particulars can be obtained by addressing Mr. Muir. The regular Society train will leave New York, Sept. 11, and the special engineers' train on Sept. 9. At the time of holding the meetings, the American Institute of Mining Engineers and the American Institute of Electrical Engineers will also be in session, and joint meetings have been arranged with these societies for Sept. 17. During the following week the International Engineering Congress will hold its meetings. A number of papers have been accepted to date and will be presented by members of the Society at the time of the meeting.

Among the papers announced for the meeting are the following of special interest to metallurgists: A. G. Betts, "Electrolytic Antimony Refining"; C. W. Bennett, Rose and Tinkler, "Electrodeposition of Nickel"; W. D. Bancroft, "Electromotive Forces"; Wills and Schuyler, "Heat Losses from an Electric Steel Furnace"; F. T. Snyder, "Electric Steel Costs"; R. S. Wile, "Melting of Ferro-Alloys in the Electric Furnace"; L. Addicks, "The Electrolysis of Copper Sulphate Liquors Using Carbon Anodes"; F. R. Pyne, "Solution Stratification as an Aid to the Purification of Electrolytes"; F. M. Sebast, "Electrical Resistance of Copper-Nickel-Chromium Alloys"; J. W. Beckman, "Electro-chemical Possibilities on the Pacific Coast."

INDUSTRIAL NEWS

The Chas. A. Schieren Co. has received a gold medal at the San Francisco exposition.

At the Foundry & Machine Exhibit at Atlantic City, Sept. 25 to Oct. 1, a Snyder electric furnace will be in commercial operation, melting cold scrap and pouring three times each day, at 11 a.m., 2 p.m. and 5 p.m. The major part of the Snyder Electric Furnace Co.'s booth will be given over to molding and pouring floor.

The Mesta Machine Co., Pittsburgh, Penn., has just received an order for a 1500-hp. mill engine for the Broken Hill Proprietary Co., Ltd., New Castle, N. S. W. The engine is for rolling-mill service and is of the heavy-duty tandem-compound Corliss-valve type. The cylinders are 30 and 54 in. in diameter and the stroke 48 in. This engine, when installed, will make the fourth unit that the Mesta Machine Co. has built for the Broken Hill Proprietary Co.

The Morse Bros. Machinery & Supply Co. has instituted a machinery exchange department. On account of the many changes in treatment, machinery is often displaced by other because it is not suitable to the problem in hand. This machinery at another mine or mill may be just what is needed. Mines are requested to send them lists of anything available with the price asked and it will be listed and advertised without expense. Those wishing machinery should write them their requirements as it is possible at some mine near to them is the very article that they are looking for. A considerable saving is often made in freight as well as in the purchase price. This department will handle goods that on account of distance cannot be purchased and shipped to Denver.

Editorial Correspondence

SAN FRANCISCO—Aug. 11

Forest Fires in California in 1914 were fewer and less disastrous than in 1913. In 1914 there were 152 fires less and the loss was $190,689 less than in 1913. There were 559,370 acres burned over in 1913 as compared to 164,418 acres in 1914. There were 1819 fires in 1914, the losses totaling $320,388. In 1913 there were 1971 fires. The timber land burned in 1914 amounted to 20,835 acres; the brush land amounted to 87,800 acres and the grass land to 55,783 acres. These improved conditions in 1914 are largely due to the activity of government and state foresters aided somewhat by rains extending late in the spring season.

Placer Mining Is to Be Resumed in many of the old time districts in the region of Nevada City. Many of these properties have been idle since the hydraulic law has been in operation. It is expected to conform to the law by building large restraining dams. One such dam is now under construction just north of the Nevada County line at the Omega mine in Sierra County. This dam is of the basket type, designed by J. M. Howells, of San Francisco. It is expected to take care of all the débris that the giants can handle. There is a large amount of gravel exposed in the Omega and other properties in this region. In Trinity and Siskiyou Counties also the present placer mining season has been unusually profitable. Some of the companies are now making final cleanups while the larger mines have sufficient water to continue work probably into August. Late snow and rains extended the regular season. In these counties the legal hydraulic restrictions do not interfere.

You Bet Mining District, situated in the southern edge of Nevada County, just west of Dutch Flat, famous in the early mining days for large productions of placer gold, is to be put on the map again by Chinese drift miners. The You Bet Mining Co. which operated the Goodwin and the Nicholls claims, recently sublet the mining interest to a company of Chinese who it is reported will start work with about 75 Chinese miners. It is believed that the Chinese Six Companies of San Francisco are back of the project. A triple ownership is involved in the claims which have been held under bonds by the You Bet Mining Co. The Goodwin estate and four Nicholls brothers of Dutch Flat own equal interests. The holdings include the Nevada claims formerly owned by the old South Yuba Water Co., and taken over by the Pacific Gas & Electric Co. with the absorption of the South Yuba Water Co. The You Bet Mining Co. is owned principally by George Wight and the Bannings, of Los Angeles. It is reported that the Nicholls interests have received $50,000 in full payment and that three payments are yet to be made to the Goodwin estate by July 1, 1916, a large payment having been made in July, 1915. The total purchase amount is said to be $50,000. The Pacific Gas & Electric Co. will receive $25,000 for its interests, the payments are now being made in quarterly installments at the rate of $1000 per month, the payments to be completed in June, 1916. This makes a total of $125,000 to be paid for the properties by the You Bet Mining Co. The history of the You Bet has never been, and probably never will be, fully written. The early working was by Chinese who are not at all extravagant with information which they give out regarding their own business. The situation of You Bet mine is so close to the Placer County line that in making their records when selling gold to the United States mint, it was an easy matter for the Chinese to report Nevada County gold as having been produced in Placer County. One Chinese who worked a channel under short lease was credited by the mint with having taken out $300,000 about six or seven years ago. It is believed that the amount was actually double that, and that Placer County got credit for the balance. It is known that other Chinese leasers within recent years took out $50,000. And these figures are no part of the early day results of mining at You Bet.

SPOKANE—Aug. 10

Contracts for Ore from Minor Producers of the Coeur d'Alenes are being sought by representatives of the Northport smelter, according to word brought to Spokane by mining men in close touch with the Northport situation. Ore shipments will be begun immediately, it is stated, the Trail smelter handling the tonnage until the Northport plant is rebuilt

BETHEL, ALASKA—June 30

There is a Renewal of Activity in the territory about Bethel now that supplies and provisions are going in. Steamship "Alience" and gasoline schooners "Bender Bros." and "Ruby" are leaving here tomorrow after unloading supplies for the different trading stations on Kuskokwim River. Three Bagleys scrapers were shipped in this spring, one for Bear Creek and two for the Jakutna district on the Upper River. This makes four in all as one is now in operation on the Aralic River below Kwinhagamut. Three dredges will be shipped in here as soon as the legal preliminaries are settled, one for Bear Creek and one large 300-ton dredge for Candle Creek, which produced several thousand ounces of gold last summer. Owing to lack of provisions last winter little work was done on Aniak, Tuluksak and other rivers, Cañon, Windy and Fork Creeks. On Kwisluk River there is a great deal of activity and a good camp is looked forward to. Four men last summer took out $17,000 in Cañon Creek and this summer there are about 30 men working and more are going in, as there are good prospects there. On other creeks it is frequent to find 50c. pans, and 4-in. drill holes to a depth of 5 ft. have prospected as high as 7c. Bethles and McDonald's quartz property is under bond for $200,000 to Iditarod capitalists. The property is located only 7 mi. from Kolmakopsky on Kuskokwim River.

SALT LAKE CITY—Aug. 12

Following the Suit Against the Ohio Copper Co. by the Empire Trust Co., as trustee under the mortgage bond, Henry T. Catrow and Charles T. Lark were appointed receivers by Judge M. L. Ritchie, of the district court, July 30. A $50,000 bond was required, and the affairs of the company have been taken over. The bond holders have been trying to have a receiver appointed until affairs should be settled. This will be done under the supervision and control of the court. The mine and mill are at present under lease to the General Exploration Co., which is operating and treating in the neighborhood of 2000 tons of ore daily. One of the receivers, Mr. Catrow, has long been a stockholder and bondholder in the company.

Utah Mines Paid Dividends amounting to $615,500 during July. The Daly-Judge of Park City, $75,000; Iron Blossom, Tintic, $50,000; Eagle & Blue Bell, Tintic, $90,000; Silver King Coalition, Park City, $187,500; Silver King Consolidated, Park City, $63,000; Utah Consolidated, Bingham, $150,000. In addition there were dividends of $425,530 by the United States Smelting, Refining & Mining Co., which derives part of its income from operations in this state. A new dividend payer has been added to Utah mines by the posting of the initial dividend of the Utah Apex Co. at Bingham. This is for 12½c. a share, payable Oct. 1, and amounts to $63,000. The company has accumulated a large cash reserve, and it is probable that quarterly dividends of a like amount will be paid. Production amounts to more than 30,000,000 lb. a year, at a cost of about 3½c. per lb. A flotation process is now being installed at the mill.

Plants Smelting Ore in Salt Lake Valley and vicinity at the beginning of August are as follows: The United States Co. at Midvale is running five lead furnaces. This company has recently added 250 tons to the capacity of its wet concentrator, and is enlarging the Huff electrostatic plant. The latter will be increased from 60 tons to 100 tons capacity. Both improvements are expected to be completed about Sept. 1. The American Smelting & Refining Co. at Murray, is running five furnaces on lead ore. The Garfield smeltery of the A. S. & R. has five reverberatory and two blast furnaces on copper ores. All of the reverberatories have been equipped to burn powdered coal instead of oil. Around 3600 tons of charge or 2700 tons of ore and concentrates are smelted daily. Utah Copper concentrates at present amount to 1400 or 1500 tons daily. The Garfield smeltery produced 18,000,000 lb. copper in one month recently, as compared with the usual output of 14,000,000 lb. The International smeltery at Tooele is running its lead plant at capacity, having five lead furnaces in blast. There have been two reverberatory furnaces smelting copper ores, until a few weeks ago, when a third reverberatory was blown in.

DENVER—Aug. 12

River Smelting & Refining Co., recent Maine incorporation, has purchased old plant of the Rocky Mountain Smelting Co. at Florence and will immediately reëquip along modern lines and start operations on low-grade, complex ores.

Cresson Gold Mining Co., close corporation, paid dividends for first quarter of 1915 amounting to $1,050,000 on its capital stock of $1,000,000. Dividends distributed during second quarter have not been made public but they were probably large inasmuch as the mine continues to output heavy tonnage of rich ore from an extension of the famous "vug" opened but a short time ago.

New Freight Rates established by the Interstate Commerce Commission prove distinctly advantageous to those Colorado manufacturers having trade on the Pacific coast and in the Orient. Until recently, steel plants in the east could ship to San Francisco via the Canal for 41c. per hundred as against a rate from Denver by rail of 55c. Now the freight from Pueblo, where is located the great steel plant of the Colorado Fuel & Iron Co., to the coast is 40c., while the freight from the Atlantic seaboard is 45c.

Suit Against A. S. & R. Co. by the Government has been dismissed on payment by the smelting company of $112,766, as damages and rent for the use of 3475 acres of southern Colorado lands, valued at $1,000,000. The payment followed the institution by the government of a suit in equity, in which it was charged that the lands in question had been secured fraudulently through the use of "dummy" entrymen. The company was allowed to retain 205 acres, upon which stands the plant of the "model mine" at Cokedale, upon payment for the land. All the land is in the vicinity of Cokedale and Aguilar, Colo. Some of it is under lease to the Victor-American Fuel Co., and the Government will allow the lease to stand, thus becoming a coal mine landlord.

Inspection of the Roosevelt Tunnel and careful measurement of the water now issuing from the heart of the Cripple Creek mining district have been made by Edward P. Arthur, Jr., and John T. Hawkins. A flow of 11,100 gal. per min. is reported, this being the greatest quantity recorded since the first important water course was encountered some years ago. It indicates that the bore is rapidly draining the main basin or crater, the breast of this great adit being now in Raven territory. In the Elkton mine, whenever crevices carrying water are struck, "water galleries" or enlarged openings in the crevices are excavated to permit rapid flows. By this scheme the recession of water level in this mine is at the rate of about 6 in. per day.

Schedule of Fees That May Be Charged under provisions of the new compensation act, by surgeons attending workmen who meet with injuries, has been prepared by the State Industrial Commission. For treating fractures, the fee may be from $5 to $30; for dislocations from $5 to $25; for minor amputations, $10; for amputation of leg at hip, the charge must not exceed $55. The commission announces, also, that it is illegal for an employer to cause employees to stand, directly or indirectly, the payment of premiums on the indemnity insurance. This ruling does not apply to arrangements already in force whereby employees pay a monthly fee for medical and surgical attendance, this being an issue distinct from indemnity insurance.

EAGLE, COLO.—Aug. 12

Strike of Vanadium Ore, of large proportion, has been discovered in the Swarthout Hills within eight miles of Eagle, by Capt. A. H. Swarthout of Denver. The original discovery was made last August, but has been kept very quiet during the opening up of the deposit and securing of other claims in the locality which now cover about 400 acres, on all of which vanadium ores are traceable.

CRIPPLE CREEK, COLO.—Aug. 10

The Recent Rich Discovery on the Ella W on Tenderfoot Hill, has created considerable local excitement. Michael Johnson has opened up, in the course of careful surface prospecting, a veritable quarry of rich ore in an open pit which is now about 20 ft. wide, 30 ft long and 20 ft. deep. The rock seems to be a partly decomposed andesite breccia and does not suggest the presence of rich ore upon casual examination. However, some of the rock shows a little free gold upon careful inspection. So far the lessee has taken out of the open pit about 10 carloads of ore which assays from 1 to 4 oz. of gold a ton. Three partings are noticeable in the pit, two parallel and about 6 ft. apart, and one cutting across, but nothing prominent enough to be called a vein has been exposed. The ore is determined from the waste by panning without roasting, and so far no other method of determining the ore has been developed. The extent of the orebody has not yet been delimited. Preliminary hoisting equipment will soon be installed and a shaft will be sunk in the ore. From the point of discovery the ore seems to be extending easterly and southerly, with an apparent flat dip to the east. The discovery has greatly stimulated prospecting on Tenderfoot Hill, and many new pits and trenches are being dug in the immediate neighborhood. The development of the find will be watched with great interest by all property owners in this locality.

HOUGHTON—Aug. 14

Two Additional Heads are to be built at once at the "little" Tamarack mill, owned now by the Lake Smelting, Milling & Refining Co., the subsidiary of the Calumet & Hecla company that was taken over with the Allouez and Centennial mines when the Fay management retired from those properties. Isle Royale's third head goes into commission soon. Copper Range Consolidated is continuing to run the Champion mill to capacity on the highest-grade copper rock ever produced from this property. It is stated that the record for one shaft, No. 2, in one month showed better than 50 lb. per ton. Baltic mill is handling both Baltic and Trimountain rock which is running close to 20 lb. to the ton at present. The Trimountain mill is handling the rock that comes from the Lake mine and some of the Champion overflow.

HIBBING, MINN.—Aug. 14

Threat to Attach the Ore on stockpile and at the docks has been made by Mayor V. L. Power of Hibbing in the controversy over nonpayment of $750,000 taxes due the city from the mining companies.

The Steam-Shovel Stripping Record for Cuyuna Range was broken on Aug. 9 when 324 cars of 16-yd. capacity were removed in a 10-hr. period. A force of 150 men working. A. Guthrie & Co., contractors.

DOUGLAS, ARIZ.—Aug. 12

Nacozari Having Been Cut Off from communication with Douglas for three months there was great rejoicing when the first train arrived the first of the month, but this train only brought in coal and supplies for the Moctezuma Copper Co., which has had to close its concentrator as there was no coal in camp. Several bridges were cribbed up to allow the train to get in and then the cribbing was taken out and new bridges put in so that on Aug. 9 the first train went to Douglas; and now Nacozari is having regular trains every day. Agua Prieta, which has been the only port in Sonora held by Carranza, and Nacozari which has been held by Maytorena, are each at an end of the railroad so that neither side would allow the trains to run and all the bridges were destroyed. Now the Carranza garrison has been reinforced and has routed the army of Maytorena and has taken all the line of the Nacozari railroad driving Maytorena into Nogales, which town is now under siege. There being no Maytorena soldiers close, it is probable that the operation of the railroad will not be molested for some time. The Moctezuma Copper Co. is shipping about 30 cars of concentrates a day and at this rate it will take them about three weeks to get out the concentrates that they have stored in Nacozari.

TORONTO—Aug. 14

The Zinc and Copper Required for ammunition manufacture will be made in Canada, it is announced by Gen. Bertram, chairman of the Canadian Shell Committee. As the result of several conferences between the Shell Committee and the Canadian Government, agreements have been perfected for the refining at Trail, B. C., of both copper and zinc. The Government has also arranged for the opening of a plant for the smelting of zinc ore at Welland, Ont., by a company which will be incorporated as the Canadian Zinc Co., capitalized at $500,000. This concern is backed by the Weedon Mining Co. of Sherbrooke, Que., which owns large zinc deposits on the north shore of the St. Lawrence. The company has secured a vacant factory on a lease for 2½ years. The ore will be smelted by the electric process for which 4000 hp. will be required and the company is negotiating with the Hydro-Electric Commission for a supply.

VICTORIA, B. C.—Aug. 11

The First Shipment of Copper Ore from the Sooke district on south end of Vancouver Island that has been made for a number of years was sent out to the Tacoma smeltery in July by Mellin & Hincks, operating under lease the Willow Grouse group. The shipment consisted of 130 tons, averaging 11% copper, with small quantities of gold and silver. Ore is being mined from surface workings and a tunnel is being run to strike deposit at shallow depth, after which development will have to be continued by sinking. The ore occurs in shear zones in gabbro and diorite. The leasers expect to ship 100 tons per month.

The Mining News

ALASKA

GRANBY (Hadley)—Infill runners go out on strike for higher wage scale at Mamie and 11 mines in the Ketchikan district. Mines idle for present.

READY BULLION MINE (Ketchikan)—Has just sent out gold brick that weighs close to $2000. Harry Webber, manager, states that work is progressing rapidly and cleanups this size will be regular this summer.

ALASKA GOLD (Juneau)—In July mill treated 118,200 tons of ore compared with 90,792 tons in June; 73,500 in May; 57,000 in April and 40,000 in March. Average heads sent to mill $1.50 per ton. Cost for July, including mining, milling, transportation, and overhead charges, 65c.

DUNTON PROPERTY (Ketchikan)—Shaft on this property near Hollis is now down 200 ft. and drifts are being driven both ways in good ore. More men and supplies have been sent in recently and Superintendent Reece is planning installation of another 50-ton unit to mill.

NASCOT ASSOCIATION (Ruby)—One of biggest cleanups ever made in north was made recently on this property when $100,000 was taken from sluice boxes. A considerable portion of gold was in nuggets ranging from $2.50 up. Dump was taken out last fall and was known to be rich but actual value was unexpected.

STIKINE (Devils Elbow)—J. G. Galvin and Sam Silverman have purchased this property situated about 100 miles up Stikine river from Wrangell. Amount of purchase price is not known but it is claimed to be one of largest mining deals pulled off in this section this year. L. Dixon and J. Boderl of Telegraph were sellers.

SPEEL RIVER POWER PROJECT (Juneau)—Announcement comes that new company has been formed with Dunn the California power magnate as president and Eugene Kennedy, formerly mine superintendent at Alaska Treadwell as vice-president. This proposition involves much litigation with Bradley interests and was cause for entire change in personnel of Alaska Treadwell and Alaska Juneau officials last year.

ARIZONA

Gila County

RAY HERCULES (Kelvin)—Syndicate in which Joseph B. McCall and George A. Huhn, of Philadelphia; J. Guthrie Hopkins, of Virginia, and E. P. Earle, N. F. Brady, August Heckscher and Frank C. Armstrong, of New York, are interested has taken over control of Ray Hercules Copper Co. of Maine, which has acquired properties immediately adjoining Ray Consolidated. Hercules orebody has been developed by drifting under direction of Henry Krumb, consulting engineer for new company. Ray Development Co., owning water-supply of Ray camp, is also controlled by this group. C. E. Addams, formerly mines manager for De Beers Consolidated Mines, Ltd., South Africa, and until July 1 last in charge of mining for Ray Consolidated, has been appointed general manager of company. It is planned to equip mine for an output of 3000 tons per day and to erect mill for ore treatment.

Mohave County

UNITED EASTERN (Oatman)—Reported that a large mill will be built in near future. Hayden, Stone-Jackling crowd said to have invested $200,000 in property.

Pinal County

MAGMA (Superior)—Crosscut on 900-ft. level shows vein first 7 ft. of which assays copper, 17%; silver, 13 oz.; gold, $3 per ton. The next 5 ft. assayed 3% copper; silver and gold not reported. Face of crosscut still in mineralized vein matter carrying some chalcopyrite. This is hanging-wall streak; on 1000-ft. level encountered fairly good copper shoot on foot, but of little lower grade.

Yavapai County

CROWN KING (Crown King)—O. W. Blickenstaff and Henry Braun, who are working ores of old dump, will build 100-ton addition to existing mill on property. Latter will be renovated and brought up to date by addition of concentrating tables, additional tanks and larger engine.

CALIFORNIA

Amador County

DEFENDER (Defender)—Two new oreshoots recently disclosed. One is 3½ ft. wide in old shaft; the other is smaller vein in new shaft. L. C. Dibert Co., engineers of San Francisco, are installing new device for saving gold from mill tailing. Details of installation are not available.

ALTAMONT PASS portion of improved highway between Sacramento, Stockton and San Francisco will be accepted by State Highway Commission, and opened to traffic. Old Patterson Pass used while Altamont was being completed will be abandoned.

Calaveras County

ECONOMIC (Esmeralda)—Electric power to drive 20-stamp mill is now installed and water made available for milling. Mill is equipped with seven Frue vanners. Floor of concentrating room is 40x45 ft. built of concrete. Main building is 100x60 ft. covered with corrugated iron. Cost of mill complete, approximately $60,000.

Fresno County

COPPER KING (Fresno)—New owners are preparing for extraction of large amount of ore which is exposed in old workings. Ore said to average 3% copper.

Kern County

BALTIC (Johannesburg)—First milling of ore since Fraser Bros. took over the property was cleaned up recently, showing a recovery of $600 from 100 tons.

SUNSHINE (Randsburg)—Leasers contemplate sinking another 100 ft. Sulphide ore disclosed in February has proven to be one of most valuable orebodies ever opened in camp. Has produced about $40,000. Ore being crushed in three-stamp mill and concentrated on Wilfley table.

Nevada County

GOLDEN CENTER (Grass Valley)—Installation of new hoist has begun. Headframe will be 93 ft. high. New incline shaft has been connected with old workings and old crooked shaft abandoned. When hoist is ready, sinking will proceed to 1000-ft. point.

SOUTH IDAHO AND GOLD POINT (Grass Valley)—Purchase bond has been secured by Errol MacBoyle of San Francisco. Properties have been worked only superficially but they are situated in good neighborhood in vicinity of the Idaho, Maryland and other prominent producers. Old Idaho vein, which produced several million dollars, is believed to extend into these properties.

Placer County

DYER (Dutch Flat)—Satisfactory progress made in bedrock drift being driven under old river channel from which upraise will be driven. Continued development and operation will depend upon character of gravel tapped by upraise. B. T. Dyer is manager.

Plumas County

SPRING GARDEN (Spring Garden)—Property being worked by shooter and bedrock being cleaned. Coarse gold has been found, some nuggets running $50 and one worth $700. Dutre & Taunt operating on adjoining claims also recovered coarse gold. Frank Woodward and Charles Copelin are operating shooter on another claim adjoining on Squirrel Creek. Shooter is also being installed on Shinn property on Greenhorn Creek below Spring Garden.

San Luis Obispo County

LITTLE BONANZA (Cambria)—E. S. Rigdon has seeured purchase option on this quicksilver mine and also Klau mines near Paso Robles. Both mines have been producers.

Shasta County

A NUGGET weighing 14 oz., 10 dwt. was found in cleanup of an old gravel bar on Squaw Creek, recently, by Charles Boding. It is valued at $246.92. Bar, which is known as Black Pup, was worked about 16 years ago by Frank Cox, an early resident of Kennett.

DELTA CONSOLIDATED (Delta)—Arrangement being made for installation of new reduction plant. Fair tonnage of $10 ore has been developed in upper workings and later development in lower adit is satisfactory.

CONSTRUCTION OF NEW DREDGE will be started at once by L. Gardella, of Oroville, on recently purchased McCormick-Saeltzer ranch of 2700 acres. Pit being dug; dredge to cost $100,000. Other dredges may be used later.

GOLINSKY (Kennett)—This group of 14 claims has been bonded to Mammoth Copper. Work will be done by Mammoth company on large scale. Stated property formerly bonded to Guggenheims for $100,000.

UNCLE SAM (Coram)—Lessees operating 10-stamp mill eight hours per day, will install settling tanks and pump so mill water can be saved and used over, giving sufficient water supply for continuous operation. Compressor will also be installed. Ore is gold-bearing, of good milling grade.

STOWELL (Kennett)—Preliminary surveys being made for aerial tramway for mine, 11 miles west of Kennett, to connect with upper terminal of Balaklala Consolidated Copper Co.'s tramway at Kimberly. Ore can then be sent over this tramway to Coram, and thence by railroad to Mammoth smelting plant at Kennett. Mammoth Copper has an option on Stowell group and is doing considerable development work.

BALAKLALA (Coram)—Edward Newhouse, vice-president of American Smelting & Refining Co., reported to have stated that mine and smeltery will resume operation in 1915 or by first of 1916. Installation of the improved Cottrell system of fume control is contemplated. Should this report prove true, is expected that not only Balaklala but Trinity copper mine will be worked. Balaklala smeltery has been idle since July, 1911, having closed down on account of the opposition of farmers in Shasta County. It is estimated that the cost of repairs to smeltery and installation of Cottrell system will amount to about $350,000.

Tuolumne County

SPRINGFIELD TUNNEL & DEVELOPMENT Co. (Sonora)—Application made to State Corporation Department to sell $1,271 shares, par value $1, proceeds to be used in continuing development.

COLORADO

Boulder County

MARY McKINNEY (Gold Hill)—American Mines Co., James N. Caldwell, manager and secretary, has opened up large outcropping veins of free-milling gold ore and will erect small mill on property.

Chaffee County

HIRSCHBERGER (Salida)—Contract has been let to drive adit 500 ft. further into Cameron Mt. to reach orebodies opened higher up mountain-side.

MADONNA (Monarch)—Because of dangerous conditions in main shaft, mine is closed down pending arrangements for sinking new shaft. E. D. Denison, manager, has gone east.

OHIO & COLORADO SMELTING & REFINING (Salida)—Effective Aug. 11, wages of 285 employees raised approximately 5%. Lowest wage around plant is now $2.10 for eight hours.

Clear Creek County

BIG FIVE (Idaho Springs)—Power plant at portal of big tunnel has been increased by installation of 1700-cu.ft. air compressor motor driven. Haulage department has new 4-ton gasoline locomotive.

Gilpin County

BROCK HOLLOW (Black Hawk)—Has been purchased by C. A. Frost who will reopen old tunnel workings and push development. Has been idle many years.

Lake County

DERRY RANCH DREDGE (Snowden)—New 42x107-ft. hull of boat has been launched.

ROBERT EMMET (Leadville)—Although mine has tremendous reserves of high-grade blende ore, shipments are prevented by lack of contracts whereby it can be marketed. Regular shipments are made of ore averaging about 25 oz. silver and 21% lead.

ARKANSAS VALLEY SMELTERY (Leadville)—American Smelting & Refining Co., taking exception to tax assessment levied by county officials, appealed to district court. Trial occupied about a week. Point of controversy is assessment on capital involved in equipment for manufacturing purposes at the smeltery, the plant for such purposes being valued at $557,600 on which 1914 taxes are approximately $15,000. Several experts have inspected this equipment and their valuations on many items caused much discussion in court. Case is before Judge Cavender.

Ouray County

REVENUE TUNNEL (Ouray)—St. John Mining Co., Ltd., London, Eng., has made second payment and taken possession of this development and mining project. It is understood that earnest work will be undertaken as soon as British government removes its embargo on exploitation of foreign enterprises.

IDAHO

Shoshone County

MAYFLOWER (Wallace)—This company, developing claims lying about four miles up Ninemile Creek from Wallace, is installing electrically-driven compressor.

HECLA (Wallace)—Steps have been taken to have stock of Hecla company, which has not missed monthly dividend for about 12 years, listed on New York curb.

OOM PAUL (Kellogg)—By recent decision of Secretary of Interior, Oom Paul will receive patents to several claims contested by Forestry Department since 1908.

NATIONAL COPPER (Mullan)—Mill will be operating soon after Sept. 1, according to advices received from management.

GERTIE (Wallace)—Seventeen men are employed driving crosscut adit, which is expected to cut vein at 3700 ft. from portal late in October. The portal of the adit is just above Burke schoolhouse; adit is 685 ft. in clear.

TERRIBLE EDITH (Kellogg)—Promising Pine Creek property, has new smelter contract calling for minimum of 50 and maximum of 150 tons of zinc concentrate a month. Work is being pushed on new 1300-ft. adit, which will give depth of 500 ft.

HIGHLAND SURPRISE (Kellogg)—The 100-ton mill is being thoroughly renovated and will be started shortly. This mine has been one of regular shippers from Pine Creek. Smelter contract, following tests on two car-load lot, being negotiated for increased output of concentrate.

HYPOTHEEK (Wallace)—Orebins have been completed and high-grade ore stored on 500-ft. level will be hoisted at once, hauled to railway station at Kingston, and shipped to smeltery. Skip-pocket on 1100 has been cut and crosscut has been started to vein.

CROWN POINT (Kellogg)—Crown Point Leasing Co. resumed work on Silver King about two months ago. Two carloads of concentrate have been shipped and these netted enough to pay operating expenses and to wipe out indebtedness from former work. Twenty-two men are employed. Ore is concentrated at Stewart mill.

BUNKER HILL & SULLIVAN (Kellogg)—Earnings of company are in excess of dividend requirements and a large surplus is accumulating. The new dry-house, constructed of reinforced concrete at cost of $15,000, is nearing completion. There is persistent but unverified rumor that company will take lead in establishing plant in Coeur d'Alenes for production of metallic lead.

MICHIGAN

Copper

SOUTH LAKE (Houghton)—Mill run showed 24 lb. of mineral per ton of rock. Mineral expected to show close to 70% in smeltery.

HANCOCK CONSOLIDATED (Hancock)—Is now shipping 330 tons a day. Quincy is getting No. 7 ready, rebuilding partially dismantled hoist and fixing up skip-way.

FRANKLIN (Houghton)—Mill is handling South Lake rock at rate of two cars a day.

ONONDAGA (Houghton)—Drill core is in sandstone, but whether it is above or below mineralization zone is question. Five of most noted geologists in the district, Pryor, Fesing, Allen, Lane and Seman are going to property to make an examination.

Iron

FORBES (Iron River)—New coal trestle is being erected here. Will have capacity of 2000 tons. Tracks from railroad are now being constructed to it.

RAVENNA (Crystal Falls)—Orders given by M. A. Hanna Co. to resume work here. Mine has been idle a year. Ten new houses will be erected at the Monongahela location near by. All ore at the Ravenna and Carpenter mines will be shipped.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—New mine to be opened at North Lake, Hoose & Person Construction Co., of Iron Mountain, given contract to strip 75,000 cu.yd. overburden from small area near Morris and Lloyd properties of company. Ore lies about 30 ft. below surface. Ore is so close to surface, with sand over it, that it could not be taken out from underground; will be extracted by mill-hole method. Shipping will be started next spring. Deposit contains about 200,000 tons.

MINNESOTA

Cuyuna Range

CUYUNA-MILLE LACS (Ironton)—A 1600-ft. air compressor, largest on Cuyuna Range, will shortly be installed.

KENNEDY (Cuyuna)—Shipments now going to dock via Northern Pacific tracks instead of Soo Line as heretofore.

PENNINGTON (Ironton)—Operations started Aug. 1. It is unofficially stated that 100,000 tons will go forward this season. Pit was idle last season.

ARMOUR NO. 1 (Crosby)—Steam shovel operations started in new pit Aug. 1. Production will come entirely from pit; no work being done underground.

IRON MOUNTAIN (Ironton)—Shipping 2 cars daily, one to Ashland, Wis., and one to Manistique, Mich. Company reports that this ore averages 39.25% manganese, 24% iron and 0.054% phosphorus.

ADAMS (Oreland)—Preparations being made to unwater this South Range property. Operation was suspended about year ago and mine permitted to fill with water. Electric pumping equipment will be installed.

Mesabi Range

CORSICA (Elba)—New timber shaft now being sunk, and main working shaft deepened 75 ft.

ALEXANDRIA (Leonard)—Hill ore interests will shortly start work sinking a shaft at Alexandria property ½ mi. west of Leonard. Ore is non-Bessemer. Hill properties are at present shipping 5000 to 6000 tons.

MISSOURI—KANSAS

BIG JACK MINE (Baxter Springs, Kan.)—Has started up again; is turning out large quantity of lead silicate, and as soon as some repairs are made a double shift will be put on.

SWEENEY (Baxter Springs, Kan.)—Has started pumps on land south of Baxter and as soon as ground is unwatered, production of ore will commence.

KATY MINE (Baxter Springs, Kan.)—South of here on Kansas and Oklahoma line has good body of ore and is making about two cars a week.

LUCKY FIVE (Joplin, Mo.)—On their lease on Colorado land south of Joplin struck ore at 40 ft. in new shaft and are still in ore at 50 ft.; they have started drift and are carrying 10-ft. face of ore.

ST. JOE (Joplin, Mo.)—On Connor land near Chitwood has framework of new mill up and ready for machinery which they expect to install right away. In sinking mill shaft, large quantity of pay dirt was taken out and is piled up ready to be milled when plant is completed.

MONTANA

Park County

WESTERN SMELTING & POWER CO. (Cooke City)—According to Mr. Tanzer, president of company which owns group of mines in Cooke City mining district, company will purchase 10 or more heavy automobile trucks to haul ore from Cooke to Gardiner and thus dispose of hardest question that has confronted district, namely getting transportation to a railroad point at a reasonable price. Trucks will carry coke on their return to camp. Power plant which was constructed last year will be in operation within two weeks and company will operate saw-mill and furnish light for Cooke City. Smeltery will be ready for operation next month.

Silver Bow County

EAST BUTTE (Butte)—At present East Butte is producing at rate of about 20,000,000 lb. of copper a year at a cost said to be about 10c. a pound.

TOULUMNE (Butte)—The $35,000 required to resume operations at the company's mine having been secured, active mining was started beginning with unwatering of shaft. Water is down to 2400 level; there still remains 200 ft. of shaft.

DAVIS-DALY (Butte)—For quarter ending June 30, 16 cars of ore aggregating 1422 tons were shipped. Ore averaged 3.7% copper and 6.4 ounces silver. Management believes that ore shipments will nearly pay operating costs.

NORTH BUTTE (Butte)—From January, when operations were only 50% of normal, North Butte increased output until now it is 90% capacity. This is equivalent to a production of 2,000,000 lb. of copper per month.

BUTTE-BALLAKLAVA (Butte)—Ore is being hoisted at rate of from 300 to 400 tons a day. In July mines were down for half the month on account of trouble with hoist. During 15 running days about 5000 tons of ore were taken out assaying 3% copper and giving an approximate profit of $4 a ton after deducting all charges for mining and extraction. August production will run close to 600,000 lb. of copper. Most of ore is now being taken from 1300- and 1600-ft. levels.

BUTTE & SUPERIOR (Butte)—All previous records in output of ore and concentrates by this company were broken in July. Estimated that about 45,000 tons of ore were taken from Black Rock mine during month; average of about 1500 tons a day. Total amount of zinc produced was between 13,000,000 and 14,000,000 lb. Payroll of company for July was in vicinity of $175,000. According to quarterly report period ending June 30, dry tons of ore milled 124,080; average zinc contents of ore 17.003%. Produced during quarter 17,686,000 lb. of zinc concentrates with an average zinc contents of 52.706%. Operating costs for quarter were $916,972.

NEVADA

Clark County

ANCHOR (Goodsprings)—Crosscut from lower level has intersected orebody in foot-wall of main vein. Now shipping about 500 tons of zinc-carbonate ore per month. Contracts have been let for erection of 50-ton dry concentrating mill for separation of lead and zinc minerals, and some machinery has already arrived.

YELLOW PINE (Goodsprings)—New shaft has reached depth of 900 ft. and crosscut is to be driven at this depth to intersect vein. Special dividend of 5c. per share, amounting to total of $50,000 has been declared payable Aug. 5. Beginning June 1, company has paid bonus of 10% to each employee; this action having been taken on account of increased earnings due to higher prices of metals.

Elko County

BLUSTER CONSOLIDATED (Jarbidge)—Is crushing 50 tons of ore per day and will install 50-ton cyanide plant; construction to be started immediately. Ore averages about $20 per ton.

Esmeralda County

MERGER MINES (Goldfield)—Receiver for Merger Mines discharged by Judge after filing by counsel of stipulation settling case out of court.

JUMBO EXTENSION (Goldfield)—President Sprague is quoted as stating that all possibility of litigation between Jumbo Ex and Merger Mines, growing out of dissatisfaction of minority interests of Merger over sale of Velvet claim to Jumbo, has passed.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 7 amounted to 10,722 tons valued at $218,956 compared with 10,407 tons week previous. Producers were: Tonopah Belmont, 3587; Tonopah Mining, 2900; Tonopah Extension, 1850; West End, 1015; Jim Butler, 1100; North Star, 66; and miscellaneous leasers 204 tons.

TONOPAH EXTENSION (Tonopah)—Receipts from operation in June $110,157; current expenses $73,201; operating profits $36,955.

NEW JERSEY

Sussex County

NEW JERSEY ZINC (Franklin Furnace)—Normal production of this mine is 30,000 tons per month. Owing to demands for high-grade spelter for war munitions, production has been increased to 70,000 tons per month without addition of further equipment or adding to personnel except as to underground miners.

NEW MEXICO

Hernalillo County

CONSOLIDATED MINING & SMELTING CO. (Cerrillos)—Ore concentrator being remodeled and zinc-lead ores will be treated. Custom ores will be accepted.

EL MORO MINING & MILLING CO. (Albuquerque)—Company has filed articles of incorporation. Capitalization $50,000 with $2000 paid in. A. P. Gibson, L. E. Carson and J. McNutt are incorporators.

Grant County

EIGHTY-FIVE MINING (Lordsburg)—New electric hoist being installed in main adit. Company will ship over new A. & N. M. spur from Shakespeare. New location for ore hauling road being sought by caterpillar tractors.

SAVANNAH COPPER (Silver City)—Reports from company's Duluth office state offer of $700,000 has been refused for holdings at Pinos Altos and Burro mountains. Lessees working company's ground.

BIDS FOR BRIDGE ACROSS GILA RIVER are being called for by county commissioners of Grant county. If contracts are let, it will mean the overcoming of an obstacle in transportation to Mogollon. Rivers being forded to disadvantage or loads are transferred over cable-way. Specifications call for three 112-ft. steel spans on concrete foundations and two 20-ft. wooden approaches. Bids will be opened Aug. 28.

SOUTH DAKOTA

Lawrence County

ORO HONDO (Deadwood)—Shaft is nearly 1700 ft. deep. Cross cutting is going forward both easterly and westerly on 1500 level.

MOGUL (Terry)—De LaVergne 100-hp. oil engine being installed, which, with one now in use, will allow cyanide mill to almost double capacity.

WASP NO. 2 (Flatiron)—Forty tons of wolframite ore, hand sorted, contained 56% tungstic oxide and brought net returns of over $16,000. Lower grade material is on dump; it runs about 10%. Wolframite is found on top of quartzite. It is removed first, and then quartzite goes to cyanide mill.

TROJAN (Trojan)—Test is being made of the practicability of dispensing with rolls, which have previously been used between crusher and chilean mills. From data so far gathered in 30-days test it appears that perfectly good results can be obtained without rolls.

WISCONSIN

Zinc-Lead District

FRONTIER (Benton)—At Hird mine has finished shaft to 125 level after severe troubles and heavy expense due to flow of 2200 gal. of water per min. which had to be handled.

WILKINSON (Benton)—Largest shipper of pyrites in district, lost its plant by fire. Will be rebuilt at once.

WISCONSIN ZINC (Galena)—Cleveland Separator at Galena, first in district, has been leased to treat some of its low-grade ores.

HARRIS-MURPHY (Platteville)—Rich strike of zinc and lead ore at 105 to 119 ft. was made by churn drill on Felix Murphy farm six miles south of Platteville.

QUINCY (Platteville)—A. L. Utt and others have secured lease on this tract three miles southwest of Platteville and will assemble complete mining and milling equipment.

CAPITOLA (Platteville)—Adam Miller and others have put up small milling plant and are operating this old mine which has been idle for 10 years.

SPINK (Platteville)—Local company has made valuable discovery of zinc ore on August Spink farm four mines south of Platteville.

UTAH

Juab County

EMERALD (Mammoth)—Rock mineralized with manganese, and carrying some lead, silver and gold has been cut recently in winze below 700 level.

RIDGE & VALLEY (Eureka)—Ore running high in lead, with some silver is being mined from 1650 level. This is being hoisted through main Gemini shaft.

EAGLE & BLUE BELL (Eureka)—No attempt will be made to connect the newly acquired Victoria ground with the Eagle & Blue Bell workings until new equipment at latter property has been installed. This will include hoist, capable of sinking 2000 ft.

Salt Lake County

UTAH COPPER (Bingham)—Present output is about 28,500 tons of ore daily.

UTAH METAL & TUNNEL (Bingham)—Ore valued at approximately $60,000 was shipped in July. The output will be increased up to 150 tons daily. Present shipments amount to 120 tons.

UTAH ORE SAMPLING (Salt Lake)—Declared its regular quarterly dividend of 6c. a share, Aug. 9. On this date one car from Idaho, three from Nevada, two from California, one from Colorado, and eight cars of ore from Utah were sampled.

SOUTH HECLA (Alta)—Ore a foot thick has been cut on the 500 level. Wedge fissure was cut sooner than expected, though ore may be stringer from this fissure. New lease on Quiney level, 1000 ft. east of Wedge workings, is showing improvement. About one car of ore daily is being shipped from main stopes on 250 level.

Summit County

PARK CITY ORE SHIPMENTS for month of July were among heaviest this year amounting to 217 cars, total 10,051 tons. Shippers were: Silver King Coalition, 4440 tons; Daly-Judge, 2265; Silver King Consolidated, 1725; Daly West, 368; Ontario Silver, 983; E. J. Beggs, 47; G. A. Keep, 46; Big Four Exploration, 1041; Daly, 76.

SNAKE CREEK TUNNEL (Park City)—During July face was advanced 368 ft. Tunnel is now in 12,000 ft. of the 14,000 ft. to be driven. About 16 ft. progress a day is being made.

DALY-JUDGE (Park City)—Callow pneumatic flotation plant of daily capacity of 75 tons will be installed in mill to treat fines. New electric hoist for the Anchor shaft and other machinery has been ordered.

SILVER KING CONSOLIDATED (Park City)—During July shipments of between 60 and 70 tons a day were made. It is probable that tunnel may be driven from some point near railroad to avoid wagon-haul from mine to loading station.

Washington County

HAYES-MONETTE (Modena)—This leasing company has taken over Dora Jane group of six claims at Goldstrike, and will start work at once. Shaft is to be sunk.

CANADA

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for month of July were: From Cobalt proper—Beaver, 32 tons; Chambers Ferland, 28 tons; Cobalt Comet, 76 tons; Coniagas, 86 tons; Crown Reserve, 118 tons; Kerr Lake, 68 tons; La Rose, 136 tons; McKinley-Darragh, 116 tons; Mining Corporation of Canada, Ltd., Cobalt Lake Mine, 107 tons, Townsite City Mine, 56 tons; Nipissing, 47 tons; Penn Canadian, 70 tons; Peterson Lake, 63 tons; Right of Way, 44 tons; from New Liskeard—Casey Cobalt, 29 tons, making total silver-ore shipments, 1107 tons; from Schumacher—gold, McIntyre, 5 tons; Porcupine Vipond, 1 ton; from Porquis Jct.—Alexo Mine, nickel, 1070 tons.

MEXICO

Sonora

NORTH TIGRE (Ysabel)—Mill is again in operation and shipment of concentrates on road to smelter.

MINNEAPOLIS COPPER (Cumpas)—After being closed down for about a year this property is again being opened up and force of men are at work cleaning up mine in preparation for actual mining which will start within week. It is expected to ship three or four cars of ore a month to Douglas smelters.

MONTECRISTO SONORA (Moctezuma)—An El Paso company has bought this property from heirs of C. C. Soto and it is now being operated under management of R. A. Meyer who has already located vein which was faulted on 5th level and ore is again being taken from vein at this place. Ore has also been located in other parts of the mine and one car of ore has been shipped and one awaiting shipment at Nacozari and another at mine. New plant of machinery is at mine and will be installed as soon as conditions settle a little.

AFRICA

Transvaal

GOLD PRODUCTION IN JULY is reported by cable at 770,000 oz., being 14,720 oz. more than in June and 45,000 oz. more than in July, 1914. For the seven months ended July 31 the total production was 4,818,247 oz. in 1914, and 5,178,048 oz in 1915; an increase of 359,801 oz., or 7.5%, this year.

The Market Report

Metal Markets

NEW YORK—Aug. 18

Tin and lead declined slightly, while copper and spelter became practically demoralized during last week, copper declining more than 1c. a lb. and spelter about 2c. a lb.

Copper, Tin, Lead and Zinc

Copper—The alleged news published in the Wall Street papers on Saturday and Monday that large buying of copper had taken place was all "moonshine." Not even any inquiries were addressed to some of the largest producers, to whom prospective buyers would naturally go. The principal producers, whose salesbooks are still fat with orders entered two to three months ago, have a nominal asking price, but do not get any new business, as to which they are temporarily more or less indifferent. On the other hand, some of the smaller agencies and producers are eager for business, and make sharp concessions to get it. The business transacted during the last week was relatively small in the aggregate, but included several 500,000-lb. and 1,000,000-lb. transactions, upon which there was sharp competition. An order for export to England was taken at £80, which at the present rate of exchange was figured as netting 16.10c., net, New York.

Stocks at refineries are reported as not increasing to any great extent as yet, owing to the large deliveries still being made on old orders. However, production is proceeding at a high rate; one estimate in the trade is 160,000,000 lb. per month. There is some gossip among the producers about taking steps to curtail the output.

Copper Sheets are quoted at 24c. base, with the usual advance for cold rolled. Wire is 20c. per lb. at mill.

Tin—After an early decline the market became steady. Spot tin is closely held and its owners were not disposed to sell lower than 34½c. per lb. A pretty fair business was done. There was a good demand for contracts for future delivery and sales were made covering deliveries far ahead. The uncertainty respecting the future rate of sterling exchange is, however, a perplexing feature.

Lead—The week was characterized by renewed interest on the part of buyers, who took considerable quantities, nearly all the producers making sales. The terms were rather variable, being governed to a large extent by the conditions and time of delivery. On the ordinary shipment business prices ranged from 4.35@4.50c., New York, but during the latter part of the week some large contracts for delivery in the last quarter of the year were taken at 4.25@4.30c. In the St. Louis market rather a large tonnage of lead was offered at relatively low prices.

Spelter—The business actually transacted was relatively light, but prices went off sharply on offerings from many quarters. Anybody who needed spelter had ample opportunity to do shopping. There were plenty of sellers and but few buyers. A large differential between spot and contracts for future delivery is maintained nominally, but it would probably contract if important business came in sight. Stocks of metal available for prompt delivery are beginning to increase. Rather than sell such metal at the present market, some producers are anticipating deliveries on their later contracts. Reselling by consumers does not appear to have ended. At the close of the week there were bids of 9c. for round lots for September-October delivery, producers asking 9¾c. There are thought to be some signs that galvanizers may become buyers again at around 9c.

Zinc Sheets are in active demand. The base price for carload lots is $17 per 100 lb. f.o.b. Peru, Ill., less 8% discount. Usual extras are charged.

Other Metals

Aluminum—There was not much activity in this metal, but No. 1 ingots were quoted at 33@35c. per lb., New York.

Antimony—There has been but little spot demand, but some small orders have been filled at 32@33c. for outside brands; Cookson's remains nominal at 48@50c., with few sales.

Quicksilver—The market was quiet at the beginning of the week but is asuming a firmer tone. New York quotations for large orders are $91@92 per flask of 75 lb., and for smaller lots $92@95. San Francisco market began quietly at $85, rising to $87.50 and finally to $95. London quotes £18 per flask.

Minor Metals—Current sales of **Bismuth** are at $2.75@3 per lb., New York. The London price is quoted at 10s., or $2.49 per lb. there.—**Cadmium** is quoted at 6s., or $1.44 per lb. in London, $1.50 per lb., New York.—**Tellurium** is reported sold at 80s., or $19.20 per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50@5 for retail lots.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Spot, Cts. per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis, Cts. per Lb.	Zinc: St. Louis, Cts. per Lb.
12	4 71½	48⅛	16½ @17½	34¼	4 35 @4 40	4 25 @4 35	11 @12
13	4 71½	47⅞	16½ @17	34¼	4 35 @4 40	4 25 @4 30	10½ @11½
14	4 70	47⅝	16½ @16½	34¼	4 35 @4 50	4 25 @4 30	10½ @11½
16	4 65	47	16½ @16½	34¼	4 35 @4 50	4 15 @4 20	9¾ @11
17	4 64	46½	16 @16½	34¼	4 25 @4 50	4 15 @4 20	9¾ @11
18	4 65	46½	16 @16½	34¼	4 25 @4 50	4 15 @4 20	9¾ @10½

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Aug.	Silver	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic £ per Ton	Copper: Electrolytic Cts per Lb.	Tin: Spot	Tin: 3 Mos	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts per Lb.
12	23⅛	67¼	68½	81½	17 35	150¼	152¼	20⅝	4 32	65	13 84
13	23	67	68¼	81½	17 27	149½	151¾	20¼	4 36	63	13 22
14	22⅞										
16	22⅞	67¼	69¼	80½	16 90	151	153	20⅜	4 33	63	13 14
17	22⅛	67¼	68½	80	16 67	150	152	20¼	4 34	59½	12 34
18	22¼	66¾	68	80	16 68	148¾	150	20⅜	4 35	58	12 07

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Gold, Silver and Platinum

Gold in the United States, Aug. 2 is estimated by the Treasury Department as follows: In Treasury against gold certificates outstanding, $1,177,131,169; in Treasury current balances, $226,076,821; in banks and circulation, $603,191,549; total, $2,006,399,539. This is an increase of $12,850,524 during July.

Silver—The market jumped to 23⅛d. on Aug. 12 on London buying for Indian account, but buyers being satisfied London price has reacted to 22⅞d. and closes fairly steady. The New York price has been seriously lowered on account of the phenomenal drop in sterling exchange from 4.75 to 4.64 in one week.

Coined silver in the United States, Aug. 2 is estimated by the Treasury Department as follows: Standard dollars, $568,272,478; subsidiary coins, $185,476,523; total, $753,749,001. Of the silver dollars $485,669,000 are held in the Treasury against silver certificates outstanding.

Platinum was stronger this week with an upward tendency, $39.50@41 per oz. being quoted for refined platinum and $47 per oz. for hard metal.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Aug. 14

The base price paid this week for 60% zinc ore was $85 per ton, down to $60 at end of the week. The base price offered for 80% lead ore was $50 per ton. No sales of lead ore were reported.

SHIPMENTS WEEK ENDED AUG. 14

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Year	117,452,340	4,083,160	17,392,770
Week	3,313,120	.....	702,820

Shipped during week to separating plants, 4,814,530 lb. zinc ore.

JOPLIN, MO.—Aug. 14

Blende, high price, $88; base price per ton of 60% zinc, premium ore, $85, medium $80@70, lower grades down to $60; Calamine, base per ton of 40% zinc, $70@50; average, all grades of zinc, $83.78 per ton, many settlements being made on previous week's buying.

Lead, high price $58.30, base price $56@50 per ton of 80% metal content; average, all grades of lead, $52.86 per ton.

SHIPMENTS WEEK ENDED AUG. 14

	Blende	Calamine	Lead	Values
Totals this week..	10,077,660	600,750	1,776,610	$494,300
Totals this year..	354,735,370	28,977,260	54,297,540	15,529,190

Blende value, the week, $431,370; 33 weeks, $13,451,180.

Calamine value, the week, $15,980; 33 weeks, $632,530.

Lead value, the week, $46,950; 33 weeks, $1,445,480.

The demand for zinc with less than one-half of 1% of lead continues very strong, with iron content up to 6%, but ore carrying over that low-lead marking finds slow sale and heavy penalty. One recleaning plant has been constructed and other large producing companies are figuring on making such an addition. The Church Mines at Miami have raised their zinc product from an unsalable commodity to one in active demand. The recleaning is estimated to net $10 per ton.

Iron Trade Review

NEW YORK—Aug. 18

The steel mills are now running at practically their capacity, but of course are not producing as large tonnages as they could in more moderate weather. In few if any of the finishing departments is capacity fully engaged except in the case of the merchant-bar mills, and the steel trade finds it was not so difficult as was expected to engage the steel-industry's capacity. Rails have been in as poor demand this year as last, the sheet mills are operating at only 75 to 80% of capacity, the pipe mills are operating at only about 75%, demand for oil-country goods being exceptionally light, while bookings of the fabricators in July, although heavier than in June or May, are reported at only 86% of capacity. Exports are easily at record rate and seem to be increasing, but are only absorbing about 25% of the current steel output.

PITTSBURGH—Aug. 17

Specifications on finished-steel contracts are good, but new buying is light. Prices continue to show an upward trend. The Carnegie Steel Co. yesterday began quoting bars, plates and shapes at 1.35c., and other mills are expected to advance to this basis. Blue annealed sheets are firm at 1.35c., with sales for forward shipment at 1.40c., and prompt material is expected to advance to that level within a week. Galvanized sheets are lower, with the decline in spelter, at 3.75c. to 4c., and demand is quiet but prices light. The National Tube Co. has issued a new pipe list dated Aug. 16, showing no change in black, but reductions of six points in galvanized pipe 6-in. and under and four points on 7- to 12-in. On base sizes the spread between black and galvanized is now 15½ points, against 8½ points before the rise in spelter started. A point is equivalent to about $1.90 per net ton.

Pig Iron—Bessemer and basic continue to show an advancing tendency. Fair-sized tonnages of bessemer have sold at $15.25, Valley, and small lots at $15.50, representing advances of 25 to 50c. during the week. Basic is reported to have sold at $14.25 and $14.50, Valley, but these reports are not fully authenticated. Foundry iron is strong. The advances in pig iron, now totaling $1 to $1.50 since early in July, appear to be genuine, but have occurred upon a smaller turnover than has usually characterized such movements. Apparently the furnaces were well filled before the advances started. Few additional furnaces are blowing in. Shenango No. 4 is to go in this week, on basic. We quote: Bessemer, $15.25@15.50; basic, $14@14.50; No. 2 foundry and malleable, $13.50@13.75; gray forge, $13.25@13.50 at Valley furnaces, 95c. higher delivered Pittsburgh. Cleveland furnaces are reported to have advanced No. 2 foundry 50c. to $14.50, delivered Cleveland.

Ferromanganese—The prompt market remains at $100@105 for small lots. There is no contract price. English producers would probably quote $100, Baltimore, but are uncertain whether they can ship, on account of the restrictions lately placed by the English Government.

Steel—There is no regular market on billets and sheet bars, mills being well sold up for prompt and being unwilling to make commitments for late delivery, while middlemen, who probably control considerable steel, are nursing their resources. Roundly the market can be quoted at about $23 for billets and $24 for sheet bars, Youngstown, prices delivered Pittsburgh being about $1 higher. Rods are firm at $27, Pittsburgh.

Exports of those articles of iron and steel which are reported by tonnage were as follows for June and the fiscal year ended June 30, in long tons:

	1914	1915	Changes
June	143,953	355,829	I. 211,876
Year	2,076,364	2,003,798	D. 72,566

The large increase in exports now reported did not begin until April or May of this year. Imports given by tonnages were as follows:

	1914	1915	Changes
June	23,075	31,610	I. 8,535
Year	293,774	251,251	D. 42,523

Imports fell off quite steadily through the fiscal year, some loss being shown almost every month.

The sensation of the market just now is the sudden demand for pig iron and the rapid advance in prices. In the past two weeks bessemer and basic pig have gone up $1.25 per ton; Northern No. 2 foundry from $1 to $1.50, while Southern No. 2 has advanced $1.50 at Birmingham, with some furnaces withdrawn from the market altogether.

FERROALLOYS

Late London quotations are: Ferrochrome, $153.60 per ton for 4-6% carbon down to $120 for 8-10% carbon. Ferrotungsten, 75 to 85% tungsten and not over 1% carbon, $1.20 per lb. Ferromolybdenum, 70 to 80%, $4.32 per lb. Ferrosilicon, 45%, $69.60; 25%, $50.40 per ton.

Late quotations for American ferrosilicon are $71@73 per ton at furnace, according to size of order.

COKE

Coke production of the Connellsville region for the past week is reported by the "Courier" at 366,840 short tons; shipments, 369,725 tons. Production of Greensburg and Upper Connellsville districts, 42,664 tons.

Chemicals

NEW YORK—Aug. 18

Nitrate of Soda—The outlook is improving and nitrate is now quoted at 2.40c. per lb. for all positions.

Arsenic—The demand is improving slightly, in part due to the substitution of arsenic for antimony in the glass industry. Large lots are quoted at 3¼c. and smaller orders at 4c. per lb.

Copper Sulphate—Trade is steady but prices remain unchanged at $7.25 per 100 lb. for carload lots and $7.50 for small parcels.

Assessments

Company	Delinq	Sale	Amt.
American, Ida	Aug. 7	Sept. 2	$0 001
Belmont, Ida	Aug 10	Sept 10	0 003
Buffalo, Mont.	July 22	Sept. 10	0 003
Bullion, Ida	Aug. 30	Sept 25	0 005
Carbonate, Ida., (post.)		Aug 25	0 001
Cedar Creek, Ida	Aug 25	Sept. 20	0 005
Copper Chief, Ida	Aug 30	Sept 25	0 005
East Couer d'Alene, Ida	Aug 10	Sept 9	0 001
East Hercules Ext., Wash	Aug 10	Sept 10	0 0015
Eastern Star, Ida		Aug 24	0 002
Four Timbers, Ida	July 28	Aug. 28	0 001
Hancock Cons., Mich	Sept		1 00
Hancock Cons., Mich	Jan. 3		1 00
Happy Day, Ida	Aug 26	Sept 30	0..0025
Hennessy-Burns, Ida	Aug 20	Sept. 24	0 005
Honolulu, Ida	Aug 24	Sept. 13	0 0035
Idaho Los Angeles, Ida	Sept	3 Sept 25	0 005
Idaho Montana, Ida	Sept	3 Sept. 25	0 001
Idaho Nevada, Ida	Sept.	7 Oct. 1	0 002
Imperial, Ida	Aug 31	Oct. 1	0 005
Keweenaw, Mich	Sept	1	1.00
Laclede, Ida	Sept	3 Sept 27	0 003
Liquidator, Ida	Aug. 28	Sept. 28	0 003
Lucky-Calumet, Ida	Aug. 27	Sept. 27	0..005
MacNamara, Nev	Aug 23	Sept. 13	0 02
New Arcadian, Mich	Dec	1	0..50
New Baltic, Mich	Jan. 15		0 50
New Quincy, Utah	Sept.	2 Sept. 23	0..01
Old Veteran, Ida	Sept.	2 Sept. 30	0 002
Oom Paul, Ida	Aug. 28	Sept 28	0 01
Oom Paul Con, Ida	Aug. 30	Oct. 4	0..01
Oreano, Ida	Aug.	2 Sept. 2	0 0015
Phoenix, Mich	Sept.	1	1 00
Phoenix, Mich	Jan.	1	1 00
Revelator, Utah	Aug 17	Sept. 3	0..004
Revelator, Utah	Oct.	4 Oct 25	0..004
Royal, Ida	Sept	1 Oct. 1	0..001
Sandstorm Kendall, Nev	Aug. 23	Sept. 27	0 01
Smuggler, Utah	Aug 17	Sept. 10	0 0015
Snowshoe, Ida	Aug. 26	Sept 27	0 005
Sonora, Ida	July 23	Aug. 31	0 004
Springfield, Ida	July 30	Aug. 30	0 002
Sunset Dev., Wash	Aug. 25	Sept. 18	0 002
Syndicate, Utah	Sept 11	Oct. 2	0 001
Tonopah Midway, Nev	Aug 18	Sept. 18	0 01
Union Cons., Nev	Aug. 24	Sept. 14	0 05
Virginia, Ida. (post.)		Aug. 30	0 02
White Caps, Nev	Aug. 14	Sept 18	0 015

Stock Quotations

Among sales at auction during the last week was one of Batopilas Mining first-mort 6% bonds, $1700 par value, sold for $1026.

COLO. SPRINGS	Aug. 16
Name of Comp.	Bid.
Acacia	02
Cripple Crk Con.	007
C K & N	03
Doctor Jack Pot.	10
Elkton Con	27
El Paso	75
Findlay	03
Gold Dollar	02
Gold Sovereign	03
Golden Cycle	1 76
Isabella	15
Jack Pot	06
Jennie Sample	02
Jerry Johnson	04
Lexington	006
Mary McKinney	37
Pharmacist	008
Portland	1 44
Raven B. H	02
Vindicator	1 65

SALT LAKE	Aug 16
Name of Comp	Bid.
Beck Tunnel	05
Black Jack	10
Colorado Mining	10
Crown Point	01
Daly-Judge	7 50
Gold Chain	16
Grand Central	35
Iron Blossom	69
Little Bell	10
Lower Mammoth	03
Ontario	12 00
May Day	17
Opohonco	00
Prince Con	70
Seven Troughs	01
Silver King Coal'n	3 25
Silver King Con.	2 07
Sioux Con	00
Uncle Sam	07
Yankee	24

TORONTO	Aug 16
Banfe	02
Conlagas	75
Peterson Lake	18
Right of Way	02
Seneca Superior	80
Silver Queen	01
T & Hudson Bay	20 00
Timiskamine	52
Wettlaufer-Lor	03
Dome Mines	21 50

Dome Extn	19
Dobie O'Brien	25
Hollinger	23 00
Imperial	06
Jupiter	11
McIntyre	46
Pearl Lake	00
Porcu Crown	70
Preston E. D	06
Rea	1 10

SAN FRANCISCO	Aug 16
Comstock Stocks	The New & Call
Alta	07
Andes	07
Best & Belcher	06
Caledonia	42
Challenge Con	16
Chollar	02
Confidence	10
Con. Virginia	12
Gould & Curry	03
Hale & Norcross	04
Julia	03
Mexican	43
Occidental	79
Ophir	24
Overman	08
Potosi	01
Savage	06
Sierra Nevada	12
Union Con	22
Yellow Jacket	15

N. Y. EXCH.	Aug 16
Name of Comp.	Clg.
Am Sm.& Ref.,com.	80
Am. Sm. & Ref., pf.	106
Am. Sm. Sec., pf. B.	80
Anaconda	68
Batopilas Min	1
Bethlehem Steel	29
Bethlehem Steel, pf.	154
Chino	45
Colo. Fuel & Iron	44
Crucible Steel	74
Federal M. & S., pf.	40
Great Nor., ore., ctf.	42
Guggen. Exp.	63
Homestake	118
Inspiration Con.	33
Mex. Petroleum	81
Miami Copper	24
Nat'l Lead, com.	65
National Lead, pf.	109
Nev. Consol.	14
Ontario Min	2
Quicksilver, pf	4
Ray Con.	22
Republic I.&S, com.	45
Republic I.&S, pf.	98
Sloss-Sheffield, com.	55
Tennessee Copper	47
Utah Copper	66
U. S. Steel, com	76
U. S. Steel, pf.	113

N. Y. CURB	Aug. 16
Alaska Juneau	1
Alta Con	8
Beaver Con	26
Big Four	05
Blue Bell	02
Braden Copper	7
Buffalo Mines	.43
Can Cop. Corpn.	1
Can. G. & S	1.05
Cashboy	.03
Chambers Ferland	.13
Chile Cop	1.19
Con. Ariz. Sm	.75
Con. Coppermines	1
Con. New-Utah	5/16
Diam'tfield-Daisy	1.03
Dia Black B	02
Florence	46
Goldfield Con.	1
Goldfield Merger	22
Greene Cananea	39
International Nickel	175
Kennecott Cop	41
Kerr Lake	7
La Rose	.43
McKinley-Dar-Sa	23
Mines of Am	2
Nevada Hills	20
New Utah Bingham	2
Nipissing Mines	5
Ore	07
St. Joseph Lead	11
South Utah	1.25
Standard oil of N J.	416
Standard S. L.	1
Stewart	1 3/8
Tonopah	5
Tonopah Ex.	2
Tonopah Merger	.38
Tribullion	7/16
Tuscarora	7/16
Yukon Gold	2

LONDON	Aug 2
Alaska Treadwell	£7 0 0d
Burma Corp	1 14 4
Cam & Motor	0 13 0
Camp Bird	0 4 3
El Oro	0 7 0
Esperanza	0 7 9
Mexico Mines	3 7 6
Nechi, pfd	0 12 0
Oroville	0 15 0
Santa Gert'dis	0 7 6
Tomboy	1 0 3
Tough Oakes	0 6 6

BOSTON EXCH	Aug 16
Name of Comp	Clg.
Adventure	2
Ahmeek	395
Alaska Gold M	33
Algomah	2
Allouez	52
Am. Zinc	52
Ariz. Com., ctfs.	8
Bonanza	35
Butte-Balaklava	4
Butte & Superior	64
Calumet & Ariz	62
Calumet & Hecla	562
Centennial	17
Cliff	60
Copper Range	54
Daly West	2
East Butte	12
Franklin	9
Granby	82
Hancock	16
Hedley	27
Helvetia	70
Indiana	4
Island Cr'k, com	50
Island Cr'k, pfd.	90
Isle Royale	26
Keweenaw	1
Lake	13
La Salle	6
Mass	10
Mayflower	3
Michigan	2
Mohawk	72
New Arcadian	11
North Butte	23
North Lake	1
Ojibway	1
Old Colony	2
Old Dominion	51
Osceola	80
Quincy	85
Santa Fe	2
Shannon	7
Shattuck-Ariz.	24
Superior	26
Superior & Bost.	2
Tamarack	54
Trinity	4
Tuolumne	47
U. S. Smelting	70
U. S. Smelt'g, pf.	46
Utah Apex	3
Utah Con	12
Victoria	2
Winona	3
Wolverine	59
Wyandot	1

BOSTON CURB	Aug. 16
Alvarado	70
Bingham Mines	7
Boston Ely	20
Butte & Lon'n Dev	35
Calico Extras	1
Calumet-Corbin	04
Chief Con	90
Corbin	1.50
Cortez	50
Crown Reserve	29
Davis-Daly	98
Eagle & Blue Bell	1
First Nat. Cop	2
Houghton Copper	3
Iron Cap Cop., pf	5
Majestic	59
Mexican Metals	25
Nevada-Douglas	68
New Baltic	3
Ohio Copper	12
Oneco	1
Raven Copper	09
Smokey Dev.	20
Sup. Lake	16
Tonopah Victor	29
Trethewey	10
United Verde Ext	5

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57 572	48 563	28 083	26 553	22 731
February	61 640	57 500	48 377	27 552	26 573	22 753
March	57 870	58 067	50 241	26 669	26 788	23 708
April	59 430	58 519	50 250	27 416	26 958	23 709
May	60 361	58 175	49 915	27 825	26 704	23 570
June	58 990	56 471	49 034	27 199	25 948	23 267
July	58 721	54 678	47 519	27 074	25 219	22 597
August	59 293	54 344	.....	27 335	25 079	.....
September	60 640	53 200	.....	27 996	24 260	.....
October	60 793	50 654	.....	28 083	23 199	.....
November	58 995	49 082	.....	27 263	22 703	.....
December	57 760	49 375	.....	26 720	22 900	.....
Year	59 791	54 811	.....	27 576	25 314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14 223	13 641	64 304	60 756	69 488	65 719
February	14 49	14 394	65 259	63 494	70 188	*
March	14 131	14 787	64 276	66 152	69 170	*
April	14 211	16 811	64 747	75 069	69 313	*
May	13 996	18 506	63 182	77 600	67 786	*
June	13 603	19 477	61 336	82 574	66 274	95 333
July	13 223	18 796	60 540	76 011	64 955	91 409
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11 739		53 227		‡	
December	12 801		56 841		*	
Year	.....		.....		.....	

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 770	34 260	171 905	156 550
February	39 800	37 415	181 556	176 925
March	38 038	48 426	173 619	180 141
April	36 154	47 884	163 963	166 225
May	33 360	38 790	150 702	162 675
June	30 577	40 288	138 321	167 636
July	31 707	37 423	142 517	167 080
August	*		‡	
September	32 675		‡	
October	30 284		‡	
November	33 304		149 391	
December	33 601		147 102	
Av. year	34 301		.....	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4 111	3 729	4 011	3 548	19 665	18 606
February	4 048	3 827	3 937	3 718	19 606	19 122
March	3 970	4 053	3 850	3 997	19 651	21 883
April	3 810	4 221	3 688	4 142	18 225	21 094
May	3 900	4 274	3 808	4 182	18 503	20 347
June	3 900	5 932	3 810	5 836	19 411	25 170
July	3 891	5 659	3 738	5 531	19 051	24 611
August	3 877		3 715		‡	
September	3 828		3 658		‡	
October	3 528		3 384		‡	
November	3 683		3 585		18 500	
December	3 800		3 662		19 097	
Year	3 862		3 737		.....	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6 386	5 112	6 211	21 533	30 844
February	5 377	8 436	5 228	8 255	21 413	39 819
March	5 250	8 541	5 100	8 366	21 460	44 141
April	5 113	10 012	4 963	9 837	21 569	49 888
May	5 074	14 781	4 924	14 610	21 393	68 100
June	5 000	21 208	4 850	21 038	21 345	100 614
July	4 920	19 026	4 770	18 856	21 568	97 250
August	5 568		5 418		‡	
September	5 380		5 230		‡	
October	4 909		4 750		‡	
November	5 112		4 962		25 016	
December	5 592		5 430		27 369	
Year	5 213		5 061		.....	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14 59	$13 23	$13 45	$13 99	$13 90
February	15 06	14 55	14 12	13 45	14 08	13 90
March	15 07	14 55	13 94	13 45	14 10	13 95
April	14 90	14 55	13 90	13 45	14 13	13 95
May	14 90	14 61	13 90	13 60	14 27	13 83
June	14 90	14 70	13 90	13 67	13 96	13 77
July	14 90	14 94	13 90	13 91	13 90	13 68
August	14 90		13 90		14 08	
September	14 90		13 90		14 03	
October	14 84		13 75		13 97	
November	14 59		13 43		13 83	
December	14 70		13 45		13 83	
Year	$14 88		$13 78		$14 01	

The Engineering and Mining Journal

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New Developments in the Coeur d'Alenes, Idaho

By Hubert I. Ellis*

SYNOPSIS—The Coeur d'Alene district has benefited through the high prices ruling for lead and zinc. While these prices will undoubtedly be reduced under normal conditions, the development induced by the present high prices will be of lasting benefit. A review of present activity is given.

The Coeur d'Alene country is in the midst of a mild boom owing to the high prices prevailing for the base metals, especially lead and zinc. With the exception of the Snowstorm, Hercules, and National all the regular producers are working at normal capacity, or in excess of normal. The orebodies of the Snowstorm, for years the only important producer of copper in the district, were exhausted about Sept. 1, 1914. Further prospecting was barren of results and the mine was finally shut down in June, 1915. The management hopes by purchasing a new mine, however, to continue the life of the company. In a circular letter recently sent to the stockholders by Manager Greenough, it is stated that the company has on hand $160,000, and also has a complete mill, as well as surface and underground mining equipment. Options have been taken on several properties, including the Missoula copper mine, which lies in the same belt as the Snowstorm. This option, originally calling for 50c. a share for the Missoula stock, is said to have been renewed at 25c. Some definite decision in regard to the options held will probably be taken at the meeting scheduled to be held at Larsen on July 27.[1]

STANDARD MINE AT MACE, IDAHO. THE GREENHILL-CLEVELAND IS WORKING THROUGH THE OLD STANDARD TUNNEL

The National copper mine, in Deadman Gulch, about three miles northeast of Mullan, and supposed to be the same deposit as the Snowstorm, is making no production at present but is pushing development work under the

*Kellogg, Idaho.

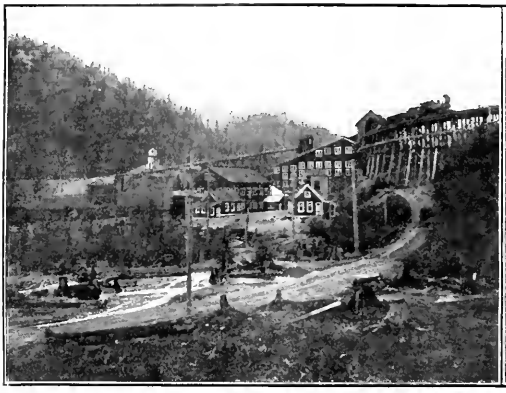
[1]This article was written before this date.—EDITOR.

direction of R. R. Catching. A two-compartment winze, 6x11 ft. in the clear, is being sunk from the level of the adit, which is 5000 ft. long. Three shifts are working and sinking is at the rate of 5 ft. per day. It is hoped to have the station at the 200-ft. level finished by Sept. 1, and to have the mill running by the middle of that month. Hoisting is by air compressed with current from the lines of the Washington Water Power Co. The mill is situated at the railway near Mullan and is reached from the mine by a three-mile tram road, equipped for electric haulage. The mill has a capacity of 500 tons a day; concentration is chiefly by flotation methods.

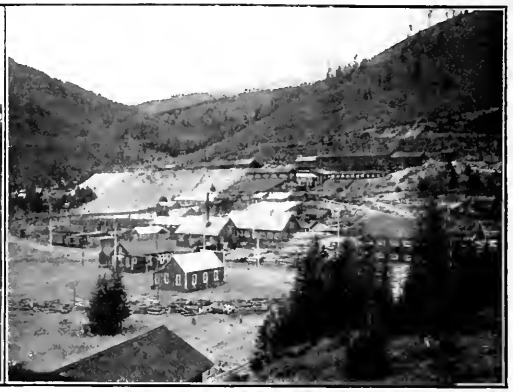
The Hercules mine, on Cañon Creek near the town of Burke, is closed down pending the negotiations of a satisfactory smelting contract. Current report is that the company formerly had a more favorable rate than other obtained for the concentrates. A new building, 42x230 ft., is under construction at the mine. This will house the machine shop, the blacksmith shop, the carpenter shop, and the electrical shop. A new section has also been added to the mill orebin, giving it a capacity of 25 cars of mill feed. Buffalo track scales have been installed.

The Gold Hunter mine, just above Mullan, is sending 340 tons of ore daily to the mill. The ore is hard to treat, about 50% of the concentrates being obtained by flotation. The total recovery is 85%. The Hecla mine, another old producer, is at Burke and the mill is three miles down Cañon Creek. The mill is treating 380 tons of ore per day by jigging, table concentration, and flotation.

The Marsh mine is also at Burke, but the ore is shipped by rail to the old Black Cloud mill on Ninemile Creek



SWEENEY MILL, TWO MILES FROM KELLOGG



MORNING MILL, JUST BELOW MULLAN

Coeur d'Alene mines which have now demanded the same treatment as that accorded the Hercules. The smelters unwilling to lower other rates to agree with that of the Hercules, refused to renew the Hercules contract at the old figure. The Hercules objected to the increased rate and the management is considering the construction of a smelting plant of its own or the purchase of the Northport smeltery. Meanwhile advantage is being taken of the shutdown to make some repairs and to put mine and mill in shape for continued production as soon as an outlet is and treated there. The mine, which was closed down for some time, was started up this spring and is producing 200 tons of ore a day. The mill has been remodeled after a series of careful tests and is making a saving of nearly 90%. A controlling interest in the Success, a Ninemile Creek mine, was recently sold by H. F. Samuels, to a Duluth capitalist for a price reported to be more than $1,000,000. The mine is producing 250 tons of lead-zinc ore per day and is shipping 2000 tons monthly of zinc concentrate and 200 tons of lead concentrate. Concentration is by jigs, Wilfley tables, flotation, and magnetic separation.

The Interstate-Callahan, situated near the head of Ninemile, at an elevation of 4500 ft., is the sensation of the district. This company, which was almost unknown a year

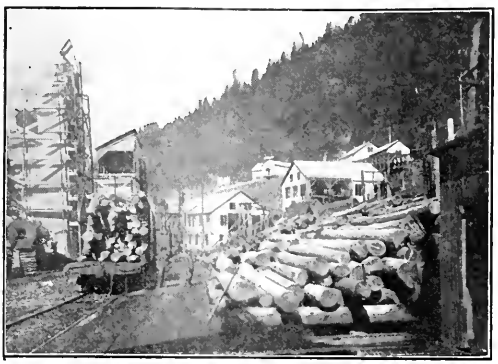
DATA ON PRINCIPAL COEUR D'ALENE MINES FOR 1914

	Tons Extracted	Gross Value	Extraction Cost	Freight and Treatment	Betterments and Repairs	Net Profit	Net Loss
Caledonia	22,336	$560,958.27	$64,987.69	$173,113.57	.....	$322,857.01	.....
Bunker Hill & Sullivan	440,819	3,374,387.73	1,060,149.90	1,352,362.26	$159,316.16	802,559.41	.....
Hecla	123,857	925,868.81	382,949.21	300,775.33	46,067.70	196,136.57	.....
Federal (Mullan)	202,400	1,257,191.81	560,882.05	549,694.71	47,492.89	99,122.16	.....
Federal (Wardner)	219,200	942,108.16	550,655.24	316,651.54	1,858.61	72,942.77	.....
Green Hill-Cleveland	190,965	2,324,961.38	650,786.73	591,663.56	35,754.01	1,046,757.08	.....
Snowstorm	69,958	371,125.45	202,955.60	48,783.96	141,780.13	.....	$22,394.24
Tamarack & Custer	20,685	957,358.92	412,782.97	348,778.68	13,541.50	182,255.77	.....
Interstate-Callahan	88,664	828,963.31	313,002.76	318,143.08	10,754.14	187,063.33	.....
Hercules	60,559	4,147,609.99	827,120.72	1,156,461.35	295,266.11	1,868,761.81	.....
Success	82,664	232,520.65	256,466.81	.....	.....	.....	23,946.16
Gold Hunter	10,543	421,318.18	293,304.06	136,924.00	37,016.27	.....	45,926.15
Ontario	88,857	712,666.06	237,513.96	228,991.62	6,984.71	239,175.79	.....
Stewart	189,615	2,140,363.40	614,792.01	669,818.80	3,317.03	854,433.56	.....
Yankee Boy (lease)	358	38,646.31	22,057.00	4,191.56	950.00	4,556.80	.....
D. Blake (Yankee Boy royalty)	.....	.....	.....	.....	.....	6,890.95	.....
Sierra Nevada	77,270	566,825.00	204,860.42	202,725.03	.....	159,239.55	.....
Totals	1,879,750	$19,802,873.43	$6,655,267.13	$6,399,079.05	$800,039.26	$6,042,752.56	$92,266.55

	Per Ton
Average value of ore	$10 50
Average extraction cost	3 54
Average freight and treatment cost	3 40
Average improvemeots and repairs	42½
Average net profit	3 16

or two ago, paid a dividend of $115,000 on Apr. 1 and another of $575,000 on July 1. It is reported from Duluth that at a meeting of the board of directors held July 17, an extra dividend of $2 a share was declared, payable Aug. 10. This aggregates $920,000, bringing the total for the year to $1,620,000, or $3.50 per share. Provision has also been made for regular disbursements of 25c. on Oct. 1 and Jan. 1, making a total of $1,840,000 for 1915. If the present high price of zinc is maintained there is every reason to believe that other special dividends will be declared and that the total for the year will be nearly $3,000,000.

The ore occurs in the Prichard slate and is remarkably rich. At the mill, which is situated half a mile below the mine and which is served by an aërial tram, waste,



HERCULES MINE

crude lead ore and crude zinc ore are sorted out. Twenty per cent. of the shipping product is obtained in the sorting plant, yet the ore going to the mill proper still carries 28% zinc and about 5% lead. The mill, originally designed to treat 250 tons of lead ore, has been remodeled to treat 360 tons of zinc-lead ore. Concentrates are hauled two miles to the railway terminal by wagon, as many as 16 to 18 four- and six-horse teams being required for this work. An aërial tram two miles long is under construction to a loading station on the railway and this is expected to reduce the shipping cost by about a dollar a ton. At the mine it is planned to build a number of cottages, a new dryhouse and a new bunkhouse, all of which will have every modern convenience. Although the remarkable strides made by this mine in the last half-year are due in no small measure to the high price of zinc, it is evident from the richness of the orebodies that its continued prosperity is not dependent on abnormal conditions. The management is in excellent hands and there is no reason to doubt that the Interstate-Callahan will maintain its position for years as one of the leading mines of the Coeur d'Alene district.

The group of mines near Kellogg under the management of Stanly A. Easton, including the famous Bunker Hill & Sullivan, the Caledonia, the Sierra Nevada, the Stewart, and the Ontario, are in a prosperous condition. The three mills of the Bunker Hill & Sullivan Mining & Concentrating Co. are treating 2000 tons of ore a day. The ore is of about the same grade as that sent to the mill during the last 30 years, carrying 10% lead, less than 1% zinc, and 4 oz. of silver per ton. Production of lead is at the rate of more than 100,000,000 lb. a year. The West mill is treating the bulk of the ore from the main workings of the company by the usual process of jigging, table concentration and flotation. The South mill is treating ore from the Caledonia and Sierra Nevada mines and from the leases in the old workings. The North mill, originally laid out to treat accumulated tailings from the other mills, is now used as an experimental plant. The Bunker Hill is working in coöperation with the United States Bureau of Mines on an electrochemical process for producing metallic lead, zinc and silver directly from their ores without recourse to smelting. Some metal is actually being produced from ordinary mill feed and the results are considered by the management to be very encouraging. The Ontario mine is under lease to Mr. Easton and associates. Ore from the Stewart is milled at the Cañon Creek mill, just out of Wallace. The Stewart, according to persistent rumor, will soon be placed on a dividend basis of 10c. per share per month. The disbursements of the company to date, including a dividend payable July 29, total 150% on the par value of the stock, which is $1. In 1913 dividends aggregated 32½%; in 1914, 62½%, and so far in 1915, 55%. The net profit in June, due to increased metal prices, was over $120,000 as against $83,000 in May and $73,000 in April. The company is also accumulating a surplus for the development of its copper property at Quatsino Sound, B. C. Production has been increased from 3,000,000 lb. of lead a month to 4,000,000 lb.

Progress of the Federal Group of Properties

Little information is available concerning the activities of the mines under the control of the Federal Mining & Smelting Co., including the Morning near Mullan, the

WINTER IN KELLOGG, IDAHO

Frisco and the Cleveland-Greenhill on Cañon Creek, the Tamarack-Custer on Ninemile, and the Last Chance at Wardner. The Tamarack-Custer is said to be in very good shape. The Frisco mill, with a capacity of 250 tons, is treating about 125 tons—concentrating by jigs, tables, flotation and magnetic separation. The Greenhill-Cleveland uses selective flotation for keeping zinc and lead concentrate separate. The ore runs 3 to 4% zinc and 6 to 9% lead. A small amount of pine oil is added and the zinc is floated off. More oil is then added to the tailings from the zinc cell and the lead is thus removed.

Besides the larger and older mines, several new properties are coming to the front and there is a large amount of prospecting and development work being carried on throughout the district. At a meeting of the board of di-

rectors held a short time ago at Wallace it was stated that a fund of $200,000 was available for further development of the Ray-Jefferson, which adjoins the Interstate-Callahan. An oreshoot exposed for 340 ft. in the present tunnel is thought to be in the extension of the Interstate-Callahan lode. The company has a good millsite at the junction of Beaver and Carbon Creeks and plans to start construction work on a 250-ton mill about Apr. 1, 1916. The Rex, another promising property tributary to Ninemile, has been bonded to capitalists who plan to unwater the shaft and start production as soon as possible. Included in the equipment of the company is a 15-drill compressor, electric driven, and the mill now used under lease by the Tamarack & Custer.

There is considerable activity in the copper belt near Mullan. The Reindeer-Queen has obtained money for further development work by the sale of 100,000 shares of stock to J. P. Gearon. Carbonate Hill, Carney Copper, and Idaho Giant are working small crews.

Of the outlying districts, Pine Creek, where more than 30 prospects are in various stages of development, is attracting the most attention. A promising strike of zinc-lead ore was recently made at the Little Pittsburg, which is situated between the Surprise and the Nabob. The 800-ft. crosscut adit tapped the vein at a depth of 380 ft., and it is reported on good authority that the vein at the intersection consists of 6 ft. assaying 8% lead, 18 in. of lead-zinc ore of milling grade, and 14 in. of high-grade zinc ore. It is planned to increase the force of 15 men employed at the Constitution, which is being operated by Thwaite & Hamilton, lessees. The output will be increased at once to 300 tons per month and a small mill will probably be built later in the season. A promising body of high-grade galena was recently found by workmen engaged in grading for a wagon road. It is announced that the Amy will soon call for bids for the construction of a concentrator on Pine Creek. Active development work has been under way for more than a year and some good orebodies are said to have been opened up.

Work on the North Fork Properties

Several properties on the North Fork of Coeur d'Alene River are showing up well. Jerome Day has been given an option on the claims of the Lead Crystal Mining Co., located on Cottonwood Creek near Union. High-grade galena has been found in the upper adit which is 500 ft. long. A tunnel at a lower elevation also shows some good ore. The Paragon has two carloads of ore ready for shipment. It is planned to work a crew of 20 men and to make an output of 500 tons a month. The five-year smelting contract of the company with Beer-Sondheimer expires next May, and as much concentrate as possible will be shipped before that time. W. H. and Charles Conn, lessees on the Terrible Edith, will ship two carloads of concentrates soon. A rockhouse has been built and a new crusher installed; three jigs have also been added to the mill equipment. The H. E. M. Mining Co., after making a series of careful tests under the direction of W. D. Buckby, is building a 100-ton concentrator. Four tunnels have been driven on the property, the lowest of which will give a depth of 1000 ft. A total of 8000 ft. of development work has been done at a cost of $75,000, all of which was obtained from the sale of treasury stock. Work done in 1914 aggregated 2979 feet.

In general it is safe to assume that although the present activity in prospecting in the Coeur d'Alenes is partly due to the high metal prices, there are a good many orebodies that will be worked with profit when prices recede to normal. The smaller operators, as in other zinc-lead districts, complain of the difficulty of disposing of their small lots of concentrate at a figure that they consider fair in view of the high quotations for the metals, particularly zinc, and this undoubtedly has a slight tendency to discourage the prospector.

Ray Consolidated Copper Co.

The Ray Consolidated Copper Co. reports a production for the second quarter of 1915 of 14,524,380 lb., made up as follows: April, 5,303,213; May, 5,016,048; June, 4,205,119; giving an average monthly production of 4,841,460 lb., as compared with a monthly average of 4,821,071 lb. in the previous quarter. In addition to this production of copper in concentrates, there was a total of 277,851 lb. of copper contained in ore shipped direct to smelters.

The total amount of ore milled for the period was 679,004 dry tons averaging 1.677% of copper, as compared with 656,652 dry tons averaging 1.667% for the previous quarter. The tonnage corresponded to a daily average of 7462 tons, as compared with 7296 tons for the previous quarter. Milling costs were 44.53c. per ton. The average mining and coarse crushing cost of ores milled was 60.959c. per ton, of which 3.256c. was the cost of coarse crushing, leaving a net mining cost of 57.703c. per ton. The underground development for the quarter was 10,769 ft., making a total development to date of 469,842 ft. The average cost per pound of net copper produced from milling ores for the quarter, after allowing for smelter losses and applying dividends of the Ray & Gila Valley R.R., with no other miscellaneous income as a credit to costs, was 9.122c. The combined cost per pound of net copper produced from milling ore and direct-shipping ore for the quarter was 9.123c. These costs include all operating and general charges, as well as 12½c. per ton of ore milled, which is applied to the extinguishment of mine-development cost. If all miscellaneous income were credited to the reduction of costs the per pound cost of net copper produced for April was 8.665c., for May 8.891c., for June 9.735c. Net operating income for the quarter was $1,361,737; miscellaneous income, $9399; total, $1,377,136. Bond interest amounted to $2250, and dividends to $517,035, leaving a net surplus over bond-interest and dividend requirements of $793,851. The earnings for the second quarter are based upon a price of 18.635c. per lb. for copper, compared with 14.324c. for the first quarter. All unsold copper on hand and in transit is carried at 14c. per lb.

Mining in Venezuela, according to recent consular report, was affected last year by the general unfavorable business conditions. Nevertheless, considerable attention was given during the year to the development of gold mining in the Guiana section, and some of the new mines have yielded satisfactorily. There have been rumors for many years of the finding of diamonds in that part of Venezuela or in the Orinoco Valley. These rumors have been verified by the exhibition of specimens found. So far as known, no examination of that section has been made by experts familiar with diamond mining.

The Wisconsin Zinc District—II

By H. C. George*

SYNOPSIS—Continuing the discussion of the Wisconsin zinc fields, an estimate of a typical orebody is made up. Mining methods are explained, with descriptive details of drilling, blasting, timbering, etc. The use of the various types of hoisting machines is described.

A plan map of a hypothetical orebody blocked out for a total length of 1000 ft. by drill holes is shown in Fig. 20. The west 600 ft. of this orebody shows an average width of 80 ft. The east 400 ft. of the orebody shows an average width of 120 ft., with a higher zinc content and a lower iron content for the average assay of the drill holes than the west 600 ft. The west 600 ft. of mine had 12 drill holes in ore and the east 400 ft. had eight drill holes in ore. On the basis of the assays of these holes, and the thickness, width and length of the orebody, I will make an estimate of tonnages, grades and values, using the same costs as the State Tax Commission has used as the average of the district:

WEST 600 FT. OF OREBODY

Hole No.	Footage	Zinc Assay	Iron Assay
1	40	7.8	6.2
2	29	4.2	8.8
3	39	3.0	5.5
4	22	1.3	10.4
5	36	7.0	4.1
6	6	2.1	6.7
7	26	10.7	7.0
8	42	12.6	5.4
9	32	8.6	6.0
10	33	5.8	7.9
11	31	7.2	7.0
12	18	4.1	12.0
Average	28.7	6.73	6.42

EAST 400 FT. OF OREBODY

Hole No.	Footage	Zinc Assay	Iron Assay
13	33	11.1	5.4
14	62	6.5	6.4
15	29	8.0	2.0
16	4	13.8	7.6
17	7	8.3	12.6
18	69	8.2	7.7
19	83	4.0	5.8
20	45	9.7	2.6
Average	41.6	7.37	5.66

*Chief engineer, Wisconsin Zinc Co., Platteville, Wis.

Concentrating (milling) operations in the district have shown that about 70% of the zinc content and about 50% of the iron content of the ore, as shown from the drill-hole record, are recovered in the concentrates. I will use these factors to show recovery from drill-hole assays.

WEST 600 FT. OF OREBODY

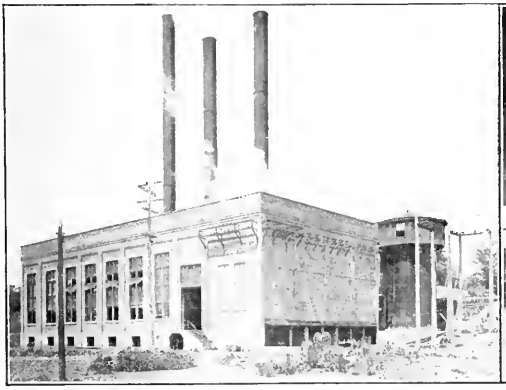
$6.73 \times 0.7 = 4.711\%$ recov. zinc; $4.711 \times 1.5 = 7.07\%$ recov. ZnS
$6.42 \times 0.5 = 3.21\%$ recov. iron; $3.21 \times 2.2 = 7.06\%$ recov. FeS_2
$7.07 + 7.06 = 14.13\%$ recov. mineral as concentrates.
$4.711 = 33.3\%$ zinc in concentrates
14.13

$28.7 \times 80 \times 600 = 1{,}377{,}600$ cu.ft. (12 cu.ft. = 1 ton)
$= 114{,}800$ tons of ore in place

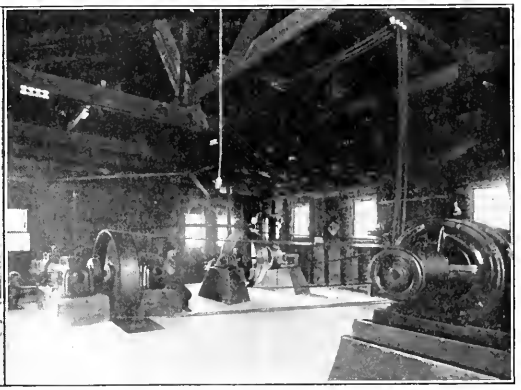
Based on 5c. spelter, $40 per ton for 60% Zn concentrates, 33.3% zinc concentrates will be worth $17 per ton.
$114{,}800 \times 0.1413 = 16{,}221.2$ tons of 33.3 % Zn concentrates
$16{,}221.2 \times \$17 = \$275{,}760.40$, gross value concentrates

EAST 400 FT. OF OREBODY

$7.37 \times 0.7 = 5.159$ recov. zinc; $5.159 \times 1.5 = 7.74\%$ recov. ZnS
$5.66 \times 0.5 = 2.83$ recov. iron; $2.83 \times 2.2 = 6.23\%$ recov. FeS_2
$7.74 + 6.23 = 13.97\%$ recov. mineral as concentrates
$5.159 = 36.9\%$ zinc in concentrates
13.97



INTERSTATE LIGHT & POWER CO.'S PLANT, GALENA, ILL.



POWER ROOM OF THE CLEVELAND MINE, HAZEL GREEN, WIS.

$41.6 \times 120 \times 400 = 1{,}996{,}800$ cu.ft. (12 cu.ft. = 1 ton) = 166,400 tons of ore in place.

On same basis as above, 36.9% Zn concentrates will be worth $20 per ton; $166{,}400 \times 0.1397 = 23{,}246.1$ tons of 36.9% Zn concentrates; $23{,}246.1 \times \$20 = \$464{,}922$ gross value of concentrates in east 400 ft. of mine.

Gross value of concentrates in west 600 ft. of mine, $275,760.
Total value of zinc concentrates of mine, $740,682.

Tons of ore in place, west 600 ft.	114,800
Tons of ore in place, east 400 ft.	166,400
Total	281,200
50% added for ground broken outside of drill holes (see Fig. 21)	140,600
Total tonnage to be mined	421,800

The average operating cost, as shown by the report of the Wisconsin Tax Commission, is about $1.25 per ton mined. I will use this figure for the estimates.

Operating cost, 421,800 tons at $1.25	$527,250
Cost of 150-ton mill and mining equipment	30,000
Total	$557,250

Gross value of concentrates	$740,682
Less 10% royalty to landowner	665,614
Operating cost, mill and equipment	557,250
Net operating profit	$109,364

A concentrating plant such as planned for the above-mentioned property, running two shifts per day and "culling" the "boulders" before the mine ore, or "dirt," goes

to the crusher, will handle about 100,000 tons of mine ore per year, so that the life of the mine would be about 4.2 years.

Some of the mining companies of the district own the property on which they mine, but most operations are conducted on leased land. The owner generally receives 10% of the gross receipts of the sales of ores. Technically this 10% is part of the profit, but from the standpoint of the mining company it is an operating expense.

Mining Methods

The mines vary in depth from 75 to 200 ft. The shafts are usually vertical and vary in size, depending on the tonnage to be handled, the depth of orebody and the amount of water to be taken care of. Common sizes for shafts are 5x7 ft., 5x9 ft., 6x10 ft., 7x12 ft., and 7x14 ft.

Shafts seldom have to be cribbed to a greater depth than 30 ft., but there are cases where it has been necessary to a depth of 75 ft. The different kinds of cribbing used are 4x10-in. plank or 6x6-in. timber in soft ground, or, in small mines, 2x10-in. plank. Several shafts in the district have been cribbed with reinforced concrete. A recent state law limits the size of the hoisting compartment to a minimum of 5½x5½ ft. in the clear when power machinery is used for hoisting. Most of the shafts are sunk from 5 to 10 ft. deeper than the deepest mine level. The last 5 or 10 ft. is floored over and is used as a sump from which all of the mine water is pumped. Nearly all mine shafts are equipped with ladders, usually of the vertical continuous type, without landings. They are made with uprights of 2x4-in. pine, and the rungs are usually hardwood or pipe. In most cases these ladders are used only for emergency, the men being hoisted in the cage or tub used for hoisting ore. The cost of shaft-sinking in the district varies from $7 to $20 per ft., depending on the size and depth.

The amount of water to be pumped from the mine workings varies from a small amount to 3000 gal. per min. Several of the largest mines of the district have pumped so little water that a supply for jigging the ore in the concentrating process has had to be secured from other sources. Others have had so much that they run their mine water direct to the concentrating plant and require no pond for returning it.

The pumps used are the different types of one-stage lift pumps, such as the Cornish walking beam, the crosshead and the steam head, and different types of one- and two-stage motor-driven centrifugal pumps. The water pumped is usually not acid, so there is seldom any difficulty due to its chemical action on the pumping equipment. Most pump troubles are caused by blowing out of gaskets, wearing out of packing, or breaking of pump rods, where the last exist.

General Underground Work

The method of working a mine in the district depends on the size, shape and position of the orebody. When the orebody has been blocked out by prospect drilling, the shaft is located at the most desirable point, usually near the middle of the orebody along the hanging wall, or at the lowest point in the structural basin, or at the point where the orebody is the deepest.

Most of the orebodies lie in a nearly horizontal position, so that they can be worked from one level, or at least the hoisting can be from one level. All the ore is broken down to this level or dumped into hoppers, from which it is drawn at the level. If the orebody is of the long, narrow type, several shafts may be sunk and the ore carried by aërial or surface tramways to the concentrating plant, but the usual system is to operate from one shaft and hoist from one level. In most mines in the district no attempt has been made to grade and classify the ore, or to select the ore to be mined at a given time by blocking out the mine with haulage drifts and crosscuts. The usual system has been to start at the shaft and mine away from it in all directions showing ore, taking the ore as it comes, and leaving it only where necessity requires it in the form of pillars. Experience has shown that about 10% of the ore in the mines of the district has been left in pillars, and subsequently lost.

Recently several mining companies with large orebodies blocked out have introduced new mining methods to meet existing conditions. In one case (shown in Figs. 22 and 23) the orebody pitched along the strike and at right angles to the strike. Fig. 22 shows a vertical cross-section and Fig. 23 shows a vertical longitudinal section of the mine. As shown at *X* in both figures, main haulage drifts were driven along the foot of the pitch of the orebody and at regular intervals raises started; and by overhead stoping, orepockets were made into which all of the ore along the pitch up to the top flat *Z* was broken and drawn at *X*. The ore in the top flat *Z* had to be shoveled into cars and trammed to the edge of the stope and dumped into the pocket below.

In another case the orebody shows variations both vertically and horizontally, in the grade of ore. Figs. 24 and 25 show the method of mining being used at this property. The orebody averages about 100 ft. in width and 60 ft. in height. A main haulage drift *X* is driven along the foot of the pitch, and about every 250 ft. a crosscut drift *Y* is driven across the orebody. In each of these crosscut drifts there are two raises, which are converted into pockets, and the high-grade ore in the upper half of the mine *A* will be broken and dumped into these pockets. The lower-grade ore in the lower half of the mine *B* will be worked out later on a high market. Each of the stopes *C, D, E, F, G* and *H* will be worked in this manner, and the stope to be worked at a given time will depend on the grade of concentrates it will produce and the existing market conditions.

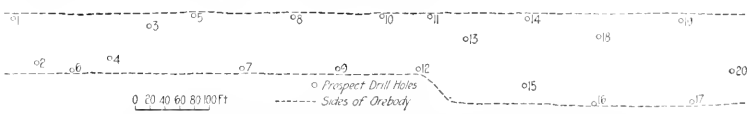


FIG. 20. HYPOTHETICAL OREBODY IN THE WISCONSIN FIELD, SHOWING PROSPECT DRILL HOLES

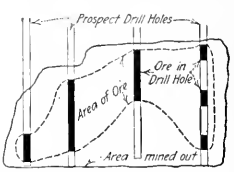


FIG. 21. VERTICAL CROSS-SECTION OF OREBODY

Fig. 26 shows a vertical cross-section of a mine worked on two levels. The part of the stope above the line *XY* was worked out first because the lower part of the stope was mineralized only in the part marked *A*. In several cases in the district the heading above the line *XY* has been carried ahead of the lower part of the stope *A*, and the tracks on the floor of stope *B* are graded down to the level of the floor of stope *A* toward the shaft, so that all of the hoisting is done from the level of stope *A* and mining is carried on simultaneously on both levels.

System of Mining

The usual system of mining is by underhand stoping, as shown in Fig. 27. The heading is usually carried with a machine drill on a 6- or 7-ft. post; and when the heading gets 15 or 20 ft. ahead of the stope the benches are drilled with a machine drill mounted on a tripod, and broken, starting at the top and working toward the bottom. The benches are carried about 10 ft. high. Heading holes are drilled 8 or 10 ft. deep and stope holes are drilled 10, 12 or 14 ft. deep. Three or four holes are usually drilled per round in the heading.

Fig. 28 shows a horizontal cross-section of a mine heading in which *A*, *A'* and *A''* represent the three "set-ups" necessary to drill rounds 1, 2, 3 and 4. The heavily shaded portion represents the portion of the heading broken by these rounds, and *B*, *B'* and *B''* represent the three "set-ups" necessary for breaking the next three blocks of the heading represented by the three unshaded blocks *C*, *C''* and *C'''*.

Drilling Methods

In the earlier use of machine drills in the district it was customary to drill stope holes straight down at right angles to the bedding planes, but this custom has been entirely abandoned. Stope holes are now drilled horizontally, parallel to the bedding planes or pointing down but slightly. The ground foreman has to use the best judgment in placing holes and in determining the depth of holes to get the best results. The nature of the rock has to be taken into consideration—whether it is hard or soft, compact or loose, or full of crevices and openings. In heading work a machine man should be able to drill from 50 to 100 ft. per shift, and in stope work he should be able to drill from 30 to 60 ft. per shift. In heading work there should be at least 1 ton of rock broken for each foot drilled, and in stope work sometimes an average as high as 10 tons per foot drilled is reached. An average mine figure would be from 1.5 to 5 tons of ore broken per foot drilled, depending on the height and width of stope and the presence of openings at the top flat of ore in the heading.

Types of machine drills commonly used in the district are the Ingersoll-Rand Butterfly piston machine, Sullivan "Liteweight" with water attachment, the Wood piston drill, Ingersoll-Leyner hammer machine and the Ingersoll-Rand "Jackhamer."

The common explosives used in the district are 30, 35 and 40% blasting gelatin, and ammonia-nitrate explosives. The explosive comes in boxes containing 50 lb., with 85 to 130 sticks to the box. The explosive is kept in a surface magazine placed at a considerable distance from the surface plant. The thawing house is seldom placed nearer than 300 ft. from the mine buildings.

At most of the mines the machine drillers blow out, load and shoot the holes they drill. Blasting on both day and night shifts is usually done at about 3:30 o'clock. In some of the mines "boulders," or large, loose fragments of rock broken loose by the previous shift, are broken at the lunch hour in the middle of the shift. Some of the mining companies eliminate most of the large boulders and break the rock finer by drilling more holes and using less explosive in each hole. The practice of squibbing except in deep stope holes is disappearing from the district.

After completing drilling for the day each machine man blows out his holes and loads them by shoving the split sticks of powder into the hole with a wooden "tamping" bar tipped with wood or copper. The cap or detonator is put in one of the last two or three sticks of explosives placed in the hole. The detonator used is No. 6 or No. 8. After placing all of the explosive in the hole some companies fill the hole to the collar with a specially prepared tamping, or damp clay or earth. A 50-lb. box of 35% explosive should break from 40 to 60 tons of ore in heading work and from 75 to 100 tons in stope work. A general mine average is from 50 to 100 tons per box of powder.

Few of the mines require any timber. [illegible] few posts to give warning of any settling of [illegible] where

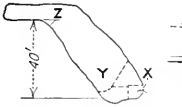


FIG. 22. VERTICAL SECTION OF OREDOBY

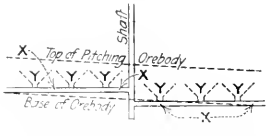
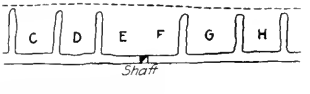


FIG. 23. LONGITUDINAL SECTION SHOWING MINING METHOD



FIGS. 24 AND 25. MINING METHOD ON OREBODY VARYING BOTH VERTICALLY AND HORIZONTALLY

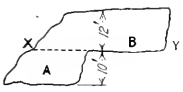
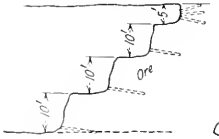


FIG. 26. AS WORKED ON TWO LEVELS



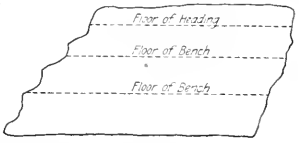


FIG. 27. LONGITUDINAL AND VERTICAL SECTIONS OF STOPE AND HEADING

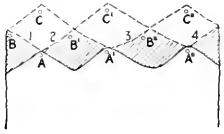


FIG. 28. HOLES FOR BREAKING HEADING

the pillars are not close; but the roof in most of the mines is a solid, thick-bedded limestone. One shallow mine in the district with no solid roof uses the square-set system of timbering.

Mucking Usually Done by Contract

The ore as broken from the stopes and headings is shoveled into sheet-iron tubs or cans, cylindrical in shape and made in sizes 24x24 in., 28x30 in., and 30x30 in.; and where cages are used, cars of different sizes are employed. The 30x30-in. and 28x30-in. cans are called 1000 lb. of ore. Since it takes about 12 cu.ft. of broken ore to make 1000 lb., the 30x30-in. can probably most nearly represents 1000 lb. of ore, especially since the cans are not filled level with the top.

Most of the loading is done by contract shovelers who receive 5, 6 or 7c. per 1000-lb. can, depending on the distance they have to tram the loaded cans. Most of the contract shovelers are foreigners—Bulgarians, Slavs, Poles and Russians.

Several systems of haulage are used. In most of the mines the cans (placed on ground cars), or the ore cars after being loaded, are shoved or trammed to the shaft by men who do nothing else. In other mines mule haulage is used for conveying the ore, and in several others gasoline locomotives are used. When the face of the ore is not more than 300 or 400 ft. from the shaft the contract shovelers convey the loaded ore to the shaft. Underground-rope haulage, electric-motor haulage and compressed-air locomotive haulage have never been attempted in the mines of the district.

Geared and Belted Hoists Used

Motor-driven or steam-driven geared hoists or hoists belt-driven by gasoline engines are used in the district. The latter type is not used in the larger and deeper mines. The hoist is usually placed on the landing platform of the hoisting derrick when "cans" or skips are used for hoisting the ore; but it is usually placed on the ground when cages are used for hoisting. In the former case no attempt has been made to balance the load, but in the latter case the cage has been balanced. When a cage or skip is used for hoisting the ore, cars are used underground instead of cans. When the cage is used the cars are carried to the surface on the cage platform, and when a skip is used the underground cars are dumped into an ore pocket, from which the ore is drawn into the skip.

The hoists in the larger mines are from 35 to 75 hp., and make the round trip with hoisting load in from 25 to 45 sec., and can handle from 200 to 500 tons per 9-hr. shift. The usual size of hoisting cable used is 5/8 in. The can and tub bails are usually 1 1/4-in. Norway iron. The cable hooks are 1 1/4-in. Norway iron. Two types are used in the district—one a snap hook and the other the pig-tail or spiral type.

The larger mines use steam or electric power. Some of the smaller ones use gasoline- or oil-engine power.

Much of the electric power is purchased from the Interstate Light & Power Co., of Galena, Ill., or the Mineral Point Light & Power Co., of Mineral Point, Wis. Most of the mining properties of the district require from 75 to 150 hp. for mining, milling and pumping operations. The tendency of the district is toward all-electric power for mining operations.

(To be concluded)

Tenderfoot Hill, Cripple Creek

Special Correspondence

Tenderfoot Hill, Cripple Creek, is at the north end of the district. It was along Poverty Gulch at the base of this hill that Bob Womack, in December, 1890, found rich ore. Here also, E. M. De la Vergne and T. F. Frisbee, two months later laid off the first mining claim in the district. This was recorded as the El Paso lode claim (not the same as the present well-known mine) but was subsequently renamed the Gold King. From it, the first shipment of ore from the region was made by wagon to Pueblo and gave returns of over $200 per ton. During the early years of the district, this mine produced $262,000. The vicinity was prospected, of course, and numerous mines were operated for a few years. But interest was gradually withdrawn by the successes being made in other parts of the district and, finally, when the official geological survey was published and it was shown that Tenderfoot Hill was on the rim of the extinct volcano, only a few miners and investors retained faith in the vicinity. One by one, after the removal of easily discovered oreshoots, the pioneer mines on this hill were closed down. One such mine was the Mollie Kathleen—just north of the El Paso-Gold King—belonging to M. C. Gortner who, from his 700-ft. shaft and two short levels, prior to 1904, produced about $200,000. His vein was pyritiferous and related to a basaltic dike in breccia.

A revival in prospecting has recently swept over this district and miners have taken leases on mines that were long neglected. Activity is being shown in nearly all the Poverty Gulch and Tenderfoot Hill properties, especially so in the Abe Lincoln, Midget, Proper, Black Diamond, Lady Campbell, Jay Gould, Queen Bess, Ella W., Gold King and Mollie Kathleen mines as well as in the Sangre de Cristo tunnel. These are being reopened and developed anew and very interesting results are being reported. On the Ella W. claim, Lessees Mack and Johnson started a new hole and at grass roots encountered low-grade ore. They are shipping the stuff and have opened a pit or quarry, the limits or walls of the shoot not having as yet been reached in any direction. The few hundreds of tons thus far shipped have shown an average profit of about $16.50 per ton after deducting all costs and royalties.

Close upon this discovery came a strike in the Mollie Kathleen. This old mine recently changed ownership between members of the Gortner family at a valuation of less than $100, if we may believe the deed and the affixed war-tax stamps. It is under lease to Van Horn and Long, who have pushed ahead in the old drift on the 700 level and have opened 28 in. of very high-grade sylvanite and free-gold ore. Contemporaneously with this second disclosure on the north edge of the district, a strike of importance was made in the lower workings of the Ajax mine at the southern edge of the district, some miles distant. Large shipments from this last orebody are returning nearly $200 per ton.

A Blast Furnace Nearly Half a Century Old is reported as making a good record lately. This is No. 8 furnace of the Thomas Iron Co. at Alburtis, Penn., built in 1867. On July 15 the stack made 75 tons of foundry iron, the largest output ever reported from the furnace. The total for the week was 500 tons. The Thomas Iron Co. is now tearing down No. 2 and No. 4 stacks at Hokendauqua. Both are old stone furnaces and have not been in use for more than 10 years.

Cost of Mill Construction

By Harry T. Curran*

SYNOPSIS—Cost of mill construction varies with many conditions and circumstances, but the figures given in this article will serve as a basis for intelligent estimates. Actual costs of various operations are given.

Mill-construction costs are widely variable and the subject is a broad one. No two mills are alike, nor will their construction be carried on under the same conditions, yet the construction work itself is much the same in all. The figures given in this article are taken from my field notes and by modification they can be applied to any similar work.

The results of laborious search into metallurgical literature for mill-construction data are discouraging at the best. Little has been written on the subject, and the operator is prone to place too much reliance on "general figures," which in varied modern practice comprise the last word in unreliability. General figures are useful, however, in rough preliminary estimations. After it has been determined just what kind of a plant is needed, the site selected and drawings made, a thorough organization of plans should be established and every detail gone over in the mind's eye.

Preparation of Costs of Material

The first step is to estimate the yardage to be excavated, the amount of masonry or concrete work required, and then a complete list of all material should be made. The tendency is to overlook a multitude of small things which have considerable value in the aggregate. To the machinery specifications should be added a complete list of lumber, doors, windows, all hardware down to nails, pulleys, belts, lime, sand, broken rock—in fact everything that goes into the construction. The cost and weight of this can readily be determined by consulting reliable dealers and adding the necessary freight charges.

Planning the Preliminary Work

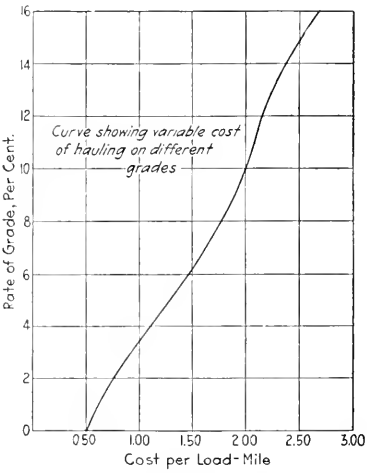
The next step should be the working out of a thorough development plan and an estimate of its cost. Everything should be made ready, so that when actual construction starts there will be neither confusion nor delay. The cost of this work is considerable and it is often neglected, with the consequent addition of excessive costs to some other part of the work. A great amount of future trouble and worry can be avoided by a careful planning for a few important features, which will be mentioned.

Unloading facilities and material and tools to do it with should be provided. A good road to the plant should be built and convenient deliveries arranged for. It is a noticeable fact that many a well-constructed mill has such poor facilities for receiving supplies that the extra cost for a year would probably build everything needed to make such work easy and cheap. Ample room ought to be set aside for timber yards and all lumber should be marked and piled so that a glance will determine just what part of the job it was bought for.

*206 Ideal Bldg., Denver, Colo.

A handy place should be marked off for a storage house and its cost estimated. It is surprising what a number of small things will be lost or misplaced without such storage. Roomy framing plots, as level as possible, should be marked off and handy places for machinery storage determined, keeping in mind pieces which will be first used and their situation. The supply of gravel, sand and rock must be looked into and arrangements made for its cheap delivery at any point. All details for disposing of rock and earth excavated with the least possible amount of handling should be planned.

The labor question must be studied and complete arrangements made for the comfort of the men. Their efficiency will vary directly with the conditions of their surroundings. Recently, in the West, a so-called mining man, who had never given human nature a moment's thought attempted to build a mill in an out-of-the-way place with no fit accommodations for anyone but himself. The results were disastrous for the company. Good men



HAULING COSTS IN MILL CONSTRUCTION

could not be kept and the mill was finished up at an excess in cost of more than $50,000. Some of the tanks collapsed on their foundations with the first filling.

The cost of all this preliminary work can be estimated by the man on the ground; it averages from 5 to 10% of the total. If it is neglected, confusion and delays throughout the job are the inevitable result. Good organization is just as essential to the construction of a plant as to its operation.

Consideration of Erection Costs

Erection costs are variable and can only be obtained by experience or by comparison with other jobs. If all necessary steps are taken to avoid delays estimates can be made dependable within reasonable limits. Fixed rules cannot be given for this part of the work. They will vary with the wages, efficiency of labor, climatic conditions

and the experience of the man in charge. However, if the rules given in this article are applied for summer work in the United States, the estimate will come approximately close to actual cost. Labor wage is based on the average paid in Western mining camps.

Superintendence can be figured when conditions are known, and will average, including cost of plans, from 3 to 5% of the total. Excavation by picking, shoveling, and hauling average earth in wheelbarrows, moving 100 ft., will cost about 15c. per cu.yd.; add 1/3 of hourly wage of laborer for every additional 100 ft. Where mine cars can be used to advantage this may be cut to 35c. per cu.yd., moving 100 ft.; add 1/5 of hourly wage for every additional 100 ft., which covers placing the track. Breaking rock by hand-like hauling conditions, will cost from $1.25 to $1.75 per cu.yd., with 100 ft. haul. It will cost a few cents more per yd. than in earth work for every additional 100 ft. There are so many unknown quantities entering into excavating that these figures are only roughly approximate.

Masonry and Concrete Construction

Rubble masonry will average $5 per cu.yd., using cement mortar. A mix of one part of portland cement to five parts of sharp, clean sand will give good results. Such walls will average about 15-in. courses and will require from 1/4 to 1/3 cu.yd. of mortar per cu.yd. of wall. Concrete work can be figured to a nicety when conditions are known. With a mechanical mixer $1 a yd. will cover the cost of mixing and placing in the average mill. On a large job it is well to determine just what mix is required with the material used. The duty of the sand is to fill the voids in the broken rock and, when the two are mixed, the resultant voids should be filled with cement. It is well to allow 10% excess in each case, but there is nothing gained by using a richer mix for retaining walls and foundation. However, if a weaker mix is desired it can be obtained by puddling instead of cutting down the proportion of sand and cement. In forms of any size puddling is good practice and the strength of the concrete is by no means decreased. Clean, firm rock should be used and the edges should not touch. On the average mill job concrete will not cost more than $7 per cu.yd. for large forms, $8 for medium, and $10 for small and heavy-duty machine foundations, including the cost of the forms. By using old iron, reinforced concrete can be made for 50c. per yd. more. Floors with a 5-in. base and 1-in. covering will average from $10 to $11 per cu.yd.

Unloading and hauling depend upon conditions. There will be a fixed average charge of from 30c. to 40c. per ton. Small pieces should be handled for less, but large unyielding pieces, such as a tube mill, can easily cost to $1 per ton. Probably 15c. per ton-mile would be a good average for hauling on any kind of a decent road and grade. By consulting local freighters these things can be definitely settled. The accompanying curve shows the variable cost of hauling on different grades. For example, consider 50c. per load as a cost unit, representing a reasonable cost per mile on level roads, so that a comparison of costs on different grades can be found.

Carpenter work with a well organized crew of millwrights will average about $24 per M for framing and erecting; $12 to $15 per M for siding and roofing and $2.50 per M for shingles or 75c. to $1 per square for corrugated iron roofing and siding. With a picked-up local crew, $28 to $31 per M for framing and erecting, $19 per M for siding and roofing and $2.50 per M for shingles or $1.25 per square for iron, will be the average figures. The nails required in this work per M will be about as shown in the table.

NAILS REQUIRED IN ERECTION

	D	Lb.
Siding and roofing	8	18 to 21
Flooring (1-in. material)	8	28 to 32
Flooring (2-in. material)	20 or 30	20 to 25
Studding, etc.	10	14
Shingles (per 1000)	4	6

Assembling and erecting machinery depends upon the nature of the machinery. A good point to emphasize here is that poorly stored machinery may easily add several dollars per ton to erection costs. An experienced engineer will size up the job and divide the material into different classes. It is then usually figured on a tonnage basis. Generally speaking, the heavier the piece the less the erection cost per ton. Steel tanks over 3/8 in. thick can be erected for $35 per ton; for 3/8 in. or less from $40 to $45 per ton. To place engines, stamps, crushers, pumps, to line up shafting, set electric motors, including wiring, etc., about $45 per ton of iron. To set up concentrating machinery, classifiers, filters, etc., from $50 to $65 per ton. These figures cover the necessary carpenter work, placing pulleys, belts, and adjustments. When the carpenter work is figured separately these figures are high. Under these conditions it will cost from $25 to $30 per ton of iron to place engines, stamps, crushers, lineup shafting, etc. To set up concentrating machinery, classifiers, filters, etc., from $30 to $45 per ton. This of course includes placing pulleys, belts, and adjustments. The pipe work in the average mill will cost from $40 to $45 per ton. Erecting wooden tanks costs around $12 per M. Reduction works constructed wholly of steel are now becoming popular where the winters are not too severe. Framework of steel can be erected for $12 to $15 per ton by contract. A good contractor with a crew of construction men will make money at these figures. However, the amateur will do well if he shades the figures at all.

Recently the construction of a 50-ton combination concentrating and cyanide plant came under my notice. The contract was taken for just a little under $30 per M, and the same price per ton for machinery erection, which also included all foundations and concrete work. The total cost of the mill was around $30,000, but it is just under a finished product in every way and is bound to give considerable trouble that will eventually cost more, not considering delays, than the extra thousand or two dollars it would have taken to make it a finished mill in the first place.

Small items are important and there are a number of them. Considerable timber is required for staging and a number of unavoidable losses must be allowed for. The building should be painted, fire protection and heating arranged and office and laboratory equipment bought.

Cost of Making Alterations

The expense of the breaking-in period and necessary alterations are often overlooked. Here we have the personal equation entering. It is a bet by the designer and constructor on his own ability. It is a good idea

to allow 10% of the total cost for possible changes, while any excess is often useful to cover the expense of unavoidable delays. I have in mind two mills, designed by two well-known metallurgists, where the starting-up period took in one case 5% of the total expenditure and 15% in the other. The operator has a problem different from that of the man who follows construction only. When the former designs and constructs a mill he must worry through the breaking-in period and come out with a mill that is satisfactory in every way. On the other hand, the construction man generally has a contract and his responsibility ends by turning over a mill that is up to specifications, which may mean a good mill or a very poor one from the operator's standpoint.

Difficulties of Winter Construction

In the northern United States winter work is a tough undertaking at its best and should be avoided if possible. With an average winter the excess cost will easily foot up to 33% of the total labor expenditure. With an open, mild winter these figures are high, but with a cold, snowy winter they may easily reach 50%. Concrete work often costs 35% more, as complete arrangements must be made for heating and protecting against frost until after the preliminary set. After 12 hr., freezing can only retard the final set, but cannot injure the concrete.

A brief description of methods used in a winter concrete job may be of interest. A steam coil 12x12 ft. was made out of 2-in. pipe spaced one ft. apart, and perforated every 6 in. with $\frac{3}{16}$-in. holes. This made it possible to keep plenty of broken rock heated ahead of the mixer. Barrels were arranged on the mixer platform so that the water could be heated to the boiling point with steam. A 10% salt solution was made, which in no way seemed to damage the concrete. The sand was not heated. Live steam was turned into the forms before pouring, sufficient time being allowed to draw the frost a few inches. Large forms were simply well covered with canvas after filling; the concrete stayed above the freezing point for a couple of days even in the coldest weather. Small forms were protected by steam hose and fires for 12 hr. Calcium chloride is probably better than sodium chloride, since its solution freezes at a lower temperature and it also increases the waterproof quality of the concrete. It has been proven that concrete with 2% of calcium chloride gives the best resistance. More than 2% of it unduly increases the speed of setting and weakens the concrete. Since from 10 to 15% of water is used in mixing concrete, a 2% mix would be given by using a 15 or 20% solution. A 20% sodium-chloride solution freezes at about 7° F., while a 20% calcium-chloride solution will not freeze until it reaches about the zero mark.

On a winter job of any size an inclosed framing shed will pay for itself many times over. It is not only useful during the framing period, but is a happy addition on a bitter cold day during the erecting period when the carpenters would otherwise have to be laid off. There are always launders, doors, plate beds, or a multitude of small things that they can work at under protection from the weather. When the mill is finally under cover it can be kept comfortable and the work will go on much more efficiently.

Remodeling old mills is in a class by itself and each case presents a special problem depending upon the extent of the work and the condition of the mill. Like a new mill the cost of excavating, concrete, machinery, etc., can be rather accurately figured on, but the amount of hardware and lumber that can be used again and the amount of new material required is often misleading. The carpenter work and assembling of machinery will generally cost twice as much as in a new plant. It is a tearing down and building up process that no rules can be given for.

The main causes for underestimates are:

Guess work, lack of good organization, false economy, omissions and change of plans, neglect of preliminary work, too much reliance placed on general figures, and inefficiency of labor resulting from surroundings. Under unavoidable circumstances may be mentioned unexpected strikes or inefficient labor, bad-weather delays and the failure of railroads or supply houses to deliver material as expected.

Any reputable machine house will give valuable information. Nearly all have one or more experienced engineers and will gladly go into all details with the buyer. It is a mistaken idea to think that they let their responsibility end with the last car of machinery that leaves their plant. This is far from being the truth, as I know through personal experience that they will go to considerable expenditure of time and money to start a plant right or to give sound advice at any time. There are plenty of would-be metallurgists who are always willing to build a plant for half the bid of a reputable house, but without exception they are a most expensive "economy." This also applies to the manufacturer of untested goods. Almost without exception a small mining company cannot afford to experiment with such things. If there is merit in the innovation the larger companies will soon pick it up and demonstrate it.

While realizing that these figures are subject, to a certain extent, to the criticism of experienced construction engineers, they are given with the hope that they may be useful to some operator who finds himself up against a mill-construction job. If the plans are followed, a good organization maintained and efficient labor secured, the figures will be found a little higher than actual costs. Mill construction is by no means an exact science, but experience will give every one his own empiric formulas upon which he can bank. Sectionalized machinery for mule-back haulage cannot be erected at these prices.

Platinum Production in 1914

According to statistics compiled by J. M. Hill for the Geological Survey, the production of refined platinum in the United States in 1914 was 3541 oz., or more than three times that reported in 1913, when it was 1034 oz. The production in 1914 included 570 oz. crude platinum from placer mining in Oregon and California, equal to 525 oz. refined metal; this was an increase of 141 oz. over the previous year. Of the crude metal 108 oz. came from Oregon and 462 oz. from the dredge operations of Butte, Yuba, Sacramento and Calaveras Counties in California.

The second source of platinum in 1914 was the Boss gold mine near Goodsprings, Nev., where platinum was first recovered and saved in 1913. In 1914 the mine produced 110 oz., which was parted from the gold.

Besides the platinum thus obtained from placers and mines there was 2906 oz. saved by smelters and refiners of gold and copper bullion and matte. This includes material of both foreign and domestic origin, and the total compares with 650 oz. in the previous year.

The secondary platinum industry in 1914 handled 40,826 oz. metal, which was obtained from scrap and sweepings of the jewelry and dental manufacturing trades, and from scrap dishes and other chemical utensils. Imports in 1914 were 40,156 oz. ingots, bars, plates, etc., and 32,111 oz. unmanufactured; a total of 72,267 oz. platinum, besides chemical ware valued at $39,143, the weight of which is not given.

Proposed Export Tax in Peru

The mining industry of Peru after enjoying immunity from special taxation for 18 years, now faces a serious problem in the proposed export-tax bills, which have been drafted by the Consejo Superior de Minería and which will be acted upon by the Peruvian Congress in November. The *West Coast Leader* of July 1, 1915, publishes some of the proposed tariffs and discusses the effects that such taxes may have on the mining industry of Peru:

> When the period of 18 years was set for the free exportation of minerals from Peru, it was doubtless considered that in this time the industry would achieve such prosperity and vigorous life that it could well afford to pay a special contribution into the coffers of the state. Unfortunately this has not been the case. Railway development, the primary factor

PROPOSED AND EXISTENT EXPORT DUTIES ON COPPER*

Peru (proposed)		Chile (proposed)		Bolivia (existent)	
London Quotation, £	Tax L.p.†	London Quotation, £	Tax converted to L.p.	London Quotation, £	Tax L.p.
50-55	0 2 50	55-60	0 9 00	50	1.0.40
55-60	0 5.00	60-65	1 3 10	51-60	1.6 00
60-65	0.8.23	65-70	1 8 75	60-70	1 8.40
65-70	1 2.20	70-80	2.6.25	70-80	2.0 80
70-75	1 7.07	80 and up	3.7.50	80-90	2.3.20
75-80	2 2.85	.....	.....	90-100	2 5 60
80-85	2.9.70	.....	.....	100 and up	2.8 00
85-90	3 7.50	.....	.....	.....	.
90-95	4 6 70	.....	.....	.....	.
95-100	5 7.00	.....	.....	.....	.
100 and up	6 6 10	.....	.....	.....	.

* As reported by the "West Coast Leader." With copper selling at 17c. per lb., the proposed tax on, say, a 50,000,000-lb. production in Peru by Cerro de Pasco would mean an annual tax of about $250,000. In Chile the proposed tax would cost the Chile Exploration Co. over $600,000 annually for a production of 120,000,000 lb. † L.p. = libra peruana, equivalent to the pound sterling when exchange is at a parity.

> in exploiting the natural resources of Peru, has fallen thousands of kilometers behind the expectations of two decades ago. In fact, during this period there has not been a single line of the first magnitude constructed. With the exception of the connections established by the Cerro de Pasco company, the principal mining districts are as remote from important railway lines as they were in the days of Pizarro. The casual reader may pick up any one of a dozen articles on mining possibilities of Peru and find somewhere the damning information that such and such rich deposits are "too far from railway or water transportation to be worked profitably." The mining industry of Peru, in other words, is still in its infancy. Its future prosperity depends on that magical touchstone of all new countries—the ingress of foreign capital.
>
> The ingress of foreign capital depends primarily upon the wisdom and farsightedness with which the Government formulates its laws and regulations pertaining to the exploitation of the natural resources. The vital question now awaiting resolution is how heavy a mortgage the lawmakers of Peru will place upon the future of the mining industry in order to obtain a few thousand pounds ready cash for the exigencies of today.

The *West Coast Leader* presents for comparison the proposed export tax on copper now before the Chilean Congress and the export tax actually in existence in Bolivia. The high scale of both of these countries in comparison with the proposed Peruvian scale is, it says, easily explainable through the fact that in Chile the transportation of mineral products from mines to ports is comparatively easy; in Bolivia, the principal producers work a native copper ore which is easily reduced.

The Sociedad Nacional de Minería has submitted to the council its protest against the proposed measures as they stand, claiming they will be oppressive to the mining industry and subversive in ultimate effect on the progress of the country, as well as on the people directly employed in mining. Mineral exports in 1913 were 46.82% of the total exports of the country. The committee on copper recommended that the proposed tax of L.p.0.2.50 per metric ton, instead of applying to the London price of £50-£55, begins at £65-£70, and continues upward as shown in the table to a maximum of L.p.3.7.50 when copper is £100 or over in London.

The main sources of revenue from the proposed tax in Peru will of course be the Cerro de Pasco and the Backus & Johnston companies. Notwithstanding that these companies will be badly affected by the new tax, the small producer will be in a still more hazardous position. The discouragement of the small producer or of the operator of moderate size will mean a serious setback to the mining industry of Peru. It is putting a premium on the sort of development that took place in Peru from the 15th to the 20th century, instead of the building up of such industries as that of Cerro de Pasco, which has spent over $25,000,000, built 125 miles of railway, and furnishes steady employment for several thousands of people in its various towns.

Shipping Ore by Parcel Post

SPECIAL CORRESPONDENCE

Shipping ore by parcel post will be continued even at increased cost by the mines in the Clearwater district of central Idaho which will not suffer so much as was feared from the new parcel-post schedule effective Sept. 1. From a ton to a ton and a half of concentrate has been shipped weekly by parcel post to the Washoe smeltery by way of Spokane at a cost of $1.08 a hundred, or $21.60 a ton. On account of poor roads from the mines to the railway the Government has been losing heavily on the deal and it was proposed at one time to spend $100,000 on roads in order to overcome the difficulty.

In the recent order of the postmaster-general advantage is taken of the roundabout routing of the mail to place the mines in the third-rate zone from Anaconda instead of the second. The mines are about 150 miles in an air line from the Anaconda plant, but the distance by the mail route is about 300 miles. The new regulations provide that, where the second-zone rate should apply but the distance by the mail route is more than 300 miles, the third-zone rate shall apply beginning Sept. 1. Clearwater operators propose to meet the situation by shipping by parcel post to Stites, a station on the Northern Pacific Ry., at $21.50 a ton, and reshipping from there to Butte by freight at $5 a ton in carload lots. The total cost of transportation from the mines to the smelter will therefore be $26.60 instead of $21.60, but this difference is not considered to offer a serious handicap to profitable operations. Several new mines at Elk City, Newsome, Ten Mile and Dixie are being put in shape for production and it is probable that shipments of concentrate will soon be materially increased.

Electrical Plant of the Wakefield Iron Co.

By Holman I. Pearl* and Joe Green†

SYNOPSIS—Electrical power plant in district where electrical installations are rare. Supplies two shafts 2000 ft. apart. Boilers fitted with automatic stokers, superheaters and induced draft. Turbo-generators provided with new overload device to absorb peak loads of hoisting without resort to expensive Ilgner flywheel installation. Elaborate switchboard equipment. All underground pumps driven by induction motors.

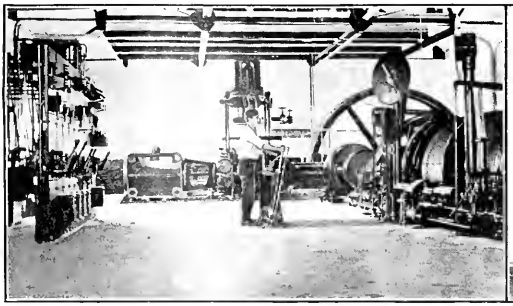
The advantages of electrical power over steam power for mine operation and the relative merits and efficiency of the two methods have long been favorite topics for discussion among mine operators and managers of the Lake Superior district, and yet the advocates of electrical operation who have actually put their theories to the test in this district, are few. The most recent electrical installation on the Lake Superior ranges is that at the Wakefield mine at Wakefield, Mich., on the Gogebic Range; and mining men of the district are awaiting with interest the results to be obtained by some of the modern features of this new plant.

The Wakefield mine, a soft hematite property, is a comparatively young entrant into the producing field—shaft-sinking having started in February, 1913. With the exception of underground and stock-pile trestle haulage, the mine has been operated by steam power up to the present. Construction of the new power plant and its substations was begun a year ago, and the electrical installation is expected to be completed and put into operation on Sept. 1. As soon as the underground pumping installation is completed the plant will be run on full time, all the hoisting, underground and surface haulage, lighting, underground fan ventilation, air compression and pumping being done by electricity generated on the Wakefield property.

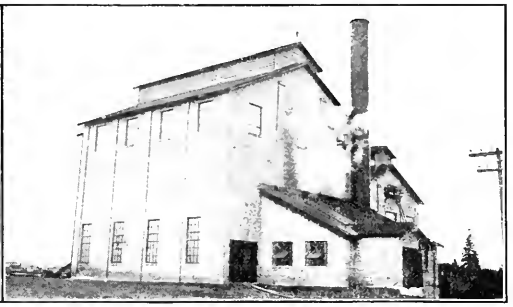
The mine is worked by both underground and open pit methods, the Wakefield Iron Co. being the only one to have successfully worked an openpit on the Gogebic Range. Stripping was started in September, 1913. During the season of 1914 there were shipped from the pit 240,000 tons of ore. Two shafts, 2000 ft. apart, are being operated; *A* shaft, now at a depth of 250 ft., and *B* shaft, at a depth of 100 ft. The relative locations of the shafts, pit and mine buildings are indicated on the accompanying plan (p. 350).

The power plant, which is steam driven, is located for convenience of water supply on the banks of a branch of the Black River, 2000 ft. east of *B* shaft. Electrical power is transmitted at 2300 volts from the generators to the hoist houses at *B* and at *A* shafts.

The power-plant building measures 48x80 ft., with a 20x37-ft. addition, to house the feed pumps and draft fan. The boiler room is 48x48ft. with a height of 38 ft. to the roof trusses; the engine room is 32x48 ft. with a height of 15 ft. to the roof trusses, and a basement with 8-ft. headroom.



INTERIOR OF B HOIST HOUSE



THE STEAM POWER PLANT

High Pressure and Superheat Used

The boiler-plant equipment consists of two 250-hp. vertical water-tube Wicke boilers, fitted with Roney new model automatic stokers. The boilers are designed to operate at 175-lb. pressure and are provided with Foster superheaters, in the first pass, designed to give 100 deg. of superheat. The gases from the boilers pass through a Green fuel economizer to a short stack, and draft is maintained by a 7-ft. induced-draft fan. Automatic control of the draft is maintained by a Foster regulator, which varies the speed of the fan in accordance with the steam pressure in the header. Provision has been made in the boiler room for the addition of another boiler, and the economizer is also arranged so that another section of tubes can be installed when the load conditions demand the third boiler. As a further allowance for extensions a temporary end wall has been built on the boiler house, so that the building can be enlarged conveniently.

The steam-piping system is all constructed of extra-heavy pipes, and all fittings are cast steel. All valves are specially constructed for use on superheated steam.

*Mining engineer, Wakefield Iron Co., Wakefield, Mich.
†Electrical engineer, Wakefield Iron Co., Wakefield, Mich.

Edwards non-return valves are fitted on the boilers to prevent accident in the event of the blowing out of a tube.

Screenings, having a calorific value of 13,000 B.t.u., will be used as fuel, being stocked by trestle in a storage yard of 6000-tons capacity adjacent to the power plant, and conveyed by car to the boiler room through a tunnel running under the coal pile. At the boiler house the coal car is raised by an electrically driven elevator, to a track running over the coal bunkers which have a capacity of 60 tons. The coal is fed through chutes, having regulating gates, into the stokers. It is estimated that one man working one shift will handle coal enough for a 24-hr. run.

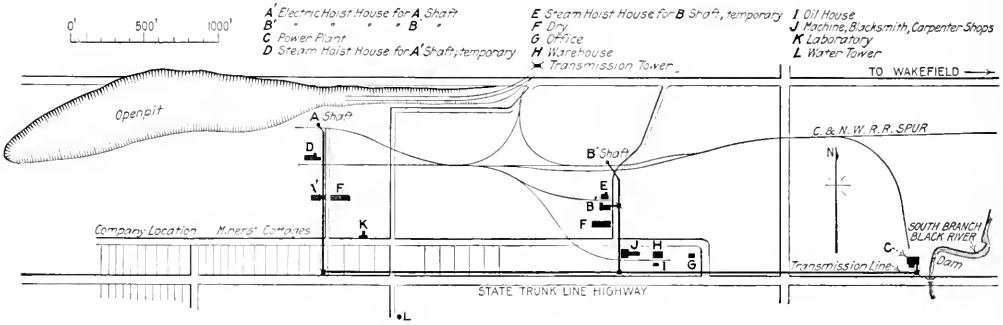
Ashes are dumped directly from the grate into concrete hoppers which feed into a car running in a tunnel under the boilers and are then hoisted by an hydraulic lift elevator to the dumping ground.

Boiler feed water is obtained from a centrally located storage tank, having a capacity of 30,000 gal., which also furnishes the water supply for the whole mine operation. Cast-iron water mains are laid throughout the system. The tank is served by a two-stage motor-driven turbine pump having a capacity of 180 gal. per min. against a 160-ft. head, located in the basement of the power-station engine room, and controlled automatically from a float in the tank.

A steam pump has also been installed as a standby in case of failure of electric power at any time. The boiler-feed water, before going to the economizer, is passed through a Hoppes open-type feed-water heater, which receives the exhaust steam from all the auxiliaries in the plant. In connection with the heater a Hoppes water weigher and recorder has been installed, which records on a chart daily the amount of feed water passing to the boilers. The boiler-feed pumps consist of two 10x6x10-in. duplex center-packed Worthington plunger pumps. Special attention has been given to the feed-water piping to eliminate any possibility of shutdowns. As a result, each boiler is provided with two independent sources of supply which are piped in at two separate places, one supply coming from the economizer and the other direct from the pump. The pumps also have two sources of supply—one from the heater and one from the main tank direct—and as throw-over valves are provided in both the suction and discharge it is possible to operate the pumps simultaneously on hot and cold water, and at the same time feed one boiler through the economizer and the other direct.

To provide for sufficient power to carry over the peak load of acceleration of hoisting and at the same time to avoid the heavy expense of the Ilgner flywheel system or the maintenance of otherwise unnecessarily large generating units, a specially designed Curtis turbo-generator was made for the plant by the General Electric Co. The design of this unit marks an innovation in electric-hoisting practice, with respect to absorbing peaks.

The governor is arranged to pass live steam into the second stage of the turbine at peak load. Normally the unit is rated at 750 kv.-a., but it is capable of developing 1125 kv.-a., and maintaining it for 10 sec.—the accelerating period of the hoists. The turbine runs condensing and is provided with an Alberger spiroflo surface condenser and dry-vacuum pump. The condensate is pumped back to the feed-water heater by a small electrically driven centrifugal pump. Circulating water for the condenser is pumped from a concrete well in the basement of the generator room—connected by a tunnel to the river above a small dam—and discharged into a well connected by a second tunnel with the river below the dam, a difference in head being thereby maintained, so that a syphon action is obtained which materially reduces the power required by the circulating pump.



PLAN OF SURFACE ARRANGEMENTS, WAKEFIELD IRON CO.

A second unit is provided consisting of a 100 kv.-a., two-stage Curtis turbine with a jet condenser. Provision, however, has been made throughout for the future installation of another unit similar to the special turbo-generator first described. The condensing apparatus and pumps are installed in the basement of the generator room; the turbines, dry-vacuum pump, and switchboard are on the main floor.

Power is generated at 2300 volts. Three-phase, 60-cycle a. c. is used throughout the system, with the exception of the lights and some of the small motors for which it is transformed to 440 and 220 volts, and the underground and surface haulage which operate at 250 volts, d. c., furnished by motor-generator sets.

Switchboard

The switchboard in the power plant consists of a six-panel board divided as follows: Two generator panels, a regulator panel, an exciter panel, and two feeder panels, with remote-control oil switches mounted on pipe framework in the back of the board. Each feeder panel is provided with a recording wattmeter and an ammeter; generator panels are provided with indicating wattmeters and

ammeters, turbine-governor control switches and proper arrangements for synchronizing. Voltage is maintained constant on the feeders by a Tyril voltage regulator. All current and potential transformers, rheostats, etc., are installed in a vault directly under the switchboard. Lightning arresters and choke coils are installed where feeders leave the building.

Power is transmitted to the substations at *A* and *B* hoist houses by two 3-phase circuits, with switching arrangement at *B* for cutting either *A* or *B* stations, or both, onto either feeder. A 3-phase circuit is also carried for lighting of residences and mine buildings, and a series lighting system with type-C Mazda lamps for lighting highways and yards.

Substations

The hoist house at *A* shaft is 34x62 ft. with a height of 12 ft. to the roof trusses. The *B* hoist house is essentially the same size, with a 21x52-ft. addition to house the compressor, which supplies air to both shafts.

Both stations have the same hoisting equipment, consisting of a double drum ore hoist capable of lifting three tons of ore in 3400-lb. skips with a rope speed of 750 ft. per min.; driven by a 250-hp., 450-r.p.m. induction motor of the slip-ring type, and a single drum man-hoist driven by a 150-hp. motor. The hoists were manufactured by the Nordberg Co., and were described in the *Journal* of Apr. 24, 1915. They are controlled and operated by a contactor panel with master controller arranged for automatic acceleration. Complete automatic safety devices to prevent overwind are installed. These are driven from each drum of the hoist and automatically slow up the motor as the skip approaches the surface and shut the current off entirely through the master controller as it enters the dump. Provision is made for the automatic application of the brakes as soon as the skip passes the winding limit, and as an added precaution a limit switch is installed on the headframe which is engaged by the bail of the skip.

A motor-generator of 100 kw. capacity, generating 250 volts d. c., is provided for underground and surface haulage. A low frequency current of 80 volts furnished by a small motor-generator set is used for the signalling bells, which are of the a.c., polarized type. Return push buttons and tell-tales are provided at the landing, collar, and on all levels of the shaft.

The compressor, of 1800 cu.ft. per min. capacity, is rope driven from a 325-kv.-a., 2200-volt, synchronous motor running at 360 r.p.m.

Underground Pumping Equipment

On the 250-ft. level at *A* shaft there is being installed a power-type geared pump, supplied by the Imperial Iron Works of Duluth, having a capacity of 1000 gal. per min., driven by a 100-hp., 2200-volt slip-ring induction motor through herring-bone gearing. This pump is arranged for automatic control from a float in the sump so that it will always operate at full-load conditions. This tends to economy, since the pump has a capacity of nearly twice the normal water flow owing to the necessity of handling the drainage from the open-pit, which of course varies with the rainfall. Large water storage permits of this method of operation. As a further protection in case extremely heavy rains suddenly increase the flow from the open-pit, a Worthington two-stage centrifugal pump, having a capacity of 1500 gal. per min. and driven by a 150-hp. motor, is being installed.

On the 100-ft. level at *B* shaft the pumping equipment consists of a power type Prescott pump with a capacity of 600 gal. per min., driven by a 75-hp., 2200-volt slip-ring motor through herring-bone gearing. This pump is also automatically controlled by means of a float in the sump.

Power will be transmitted to the pumping stations in both shafts through self-supporting three-conductor armored and leaded cambric cables.

All electrical units are of G. E. manufacture and are housed in modern buildings of brick and steel construction erected during the summer of 1914 by the Worden-Allen Co., Chicago. These buildings are of the same type as and designed to harmonize with two large "drys" (one at each shaft, accommodating 400 men each), a combined machine, blacksmith and carpenter shop, a warehouse and an oil-storage house.

The plant was designed by Robert S. Walker of Duluth, chief mechanical and electrical engineer of the operating company. Aleck Noal, master mechanic of the company, had charge of the construction and installation. W. C. Hart is superintendent for the Wakefield Iron Co.

Electro-Thermic Iron-Ore Smelting in Scandinavia

Special Correspondence

Professor Farup, comparing the relative progress of Norway and Sweden in the domain of electro-thermic iron-ore smelting, gives the total of Sweden's electrically produced pig iron from Jan. 1 to June 30, 1914, as 16,367 tons, and the estimated amount in 1915 at about 40,000 to 50,000 tons. At the Tinfoss ironworks in Norway the treatment of Norwegian ores is proceeding satisfactorily. In Sweden, especially at Domnarfvet and Trollhattan, there are a number of smelting plants in full operation. Dealing with the several types of furnace in use Farup does not take it for granted that, as in the blast-furnace industry, a special type would be adopted and that type a shaft furnace. It should be borne in mind that in the electro-thermic method the available gas quantities are far less than those derived by the ordinary blast-furnace process. As a matter of fact, it was only one-tenth as much. As a result the use of these gases, which is the main object of the shaft furnace, is of lesser consequence and thereby also the shaft. The advantage of the shafts consists in the lesser consumption of coke as a reducing material—about 60 kg. less per ton of pig iron. There is also about 10% less electric power used. On the other hand the shaft furnace involves the so-called "shaft troubles," which the shaftless type naturally does not. The shaftless furnace is much cheaper in construction and of far greater unit power. An undoubted advantage in the shaft furnaces is, nevertheless, the shaft reduction. Economically considered, too little regard is paid to ore costs. In Norway, the latter is anything up to 40 kroner (1 kroner = 27c.), whereas in Sweden the limit is 15 to 16 kroner per ton of pig iron. In Sweden, rich ores (60% Fe) are used. In Norway low-grade ores are partly resorted to (the Hardanger iron works uses those of 40% Fe). And the lower the grade of ore the less should be the ore costs. In that connection, Norway's

ore cost per ton should be less than that in Sweden, but it should be noted that the committee appointed in Norway in 1907 to consider the question did not even take the low-grade ores into account. But where power and ore are cheap it will be possible to employ low-grade ores. The utilization of the electric energy by the electric furnace is of the utmost importance. In Norway, the loss is put at 10%, while in Sweden (at Trollhattan) it is 15% of one furnace. With the construction of more furnaces this loss, however, will be reduced. The unequal load, peculiar to the electric furnace, is most unfortunate. Were it possible to establish a contract for electric power on the basis that a certain minimum could be maintained and the overloading paid per scale, it would be of immense advantage. At the Hardanger ironworks, Norway, the load was not only very unequal, but the transformer was too small to deal with higher tensions. Low-grade ores were also used, with a consequent large consumption of limestone; the cold limestone so affected the electrodes that they would not "bite," so to speak. When in addition the ore was likewise zinc-containing, it is strange that the Hardanger proposition held out as long as it did.

Straight Briquettes Work Poorly in Furnace

Sydvaranger, Norway, briquettes were also brought into use, but these showed the unfavorable property of carbonizing and increasing in volume in the shaft. The briquettes split and collapsed. This might be considered as of bad omen for Norwegian smelting, where only slig and briquettes are available, but Professor Farup has no fears for the future in that respect. At Hardanger a roaster was also experimentally employed to bring the slig together in lumps, but the result was not as anticipated, for not a single lump was formed. Failing this, the slig was used together with a cheap ore which, being also associated with much limestone, formed a solid mass, as the tension was insufficient. Too much stress should not, however, be laid upon the unfortunate result of the workings at Hardanger. For when one has reached an ore cost of 40 kroner per ton, without a sufficiently high tension to deal with the ore, electro-thermic iron-ore smelting is no longer justifiable.

As regards the question of limestone, it was certain that burning before use would have to be adopted. Many limestones have the quality of crumbling to a powder and choking the furnace, and in many cases this defect has been attributed to the coke when the limestone was solely in fault. Not all limestones, however, have this defect. They may be divided into three groups: (1) Those which crumble to powder before the maximum temperature is reached; (2) those which collapse on burning; (3) those which do not crumble. By previously burning the limestone, one obviates all that CO_2 gas which permeates the furnace when the limestone is directly used. This, so to speak, is like laying a "cold poultice" on the furnace shaft. A trouble in using burnt lime is its taking up water and thereby dissolving to powder. But this point can be inexpensively met by "dead-burning" the lime.

Passing to the much debated subject of coke versus charcoal, one of the most important questions connected with electric iron-ore smelting is, "Can coke be employed where charcoal can be used?" The volume taken up by charcoal is three times that of coke. This property in the charcoals should be of the greatest advantage over coke, as the gases have a better opportunity of working on the charge and the furnace is not so easily obstructed. But it is not volume alone which is the favorable factor in this respect. Equally advantageous is the interspace formed by the material in the furnace. And in that connection coke is the better of the two. The charcoal's quality of taking up water is very unfortunate. Charcoal which has been stored a short time often contains over 30% water. To dissipate this, a shaft heat is necessary. Likewise the charcoals may vary considerably in quality. Some of them are so loose that they collapse in the furnace and thereby stultify their claim to a large volume. As a reducing material coke is less variable, but the shady side of the coke problem is its large ash and sulphur content (10% ash and 0.8 to 1.0% S). One is accustomed, in Norway, to the dictum that charcoal cannot be procured in that country at reasonable prices. But this is not always the case. Swedish charcoal is furnished from the northern part of that country, right up to Finland. From those tracts as cheap a charcoal can be transported to Trondhjem, Norway, as to middle Sweden, the center of the Swedish furnace industry. An even cheaper freight may be obtained to the Norwegian port of Narvik. In Jämtland, Sweden, charcoal can be had for 75 ore (100 ore = 1 kroner = 27c.) per hl., and in central Sweden from 75 to 80 ore per hl. It was at one time thought that the byproducts from charcoal would prove valuable. At the most, the byproducts can be represented by 10 to 12 ore per hl., if they all may be utilized; but this is impossible, as one would thereby secure a considerable over-production of them, and prices would be depressed.

Coke Probably Not Responsible for Choking Shaft Furnaces

The charcoals are about 10 kroner per ton of pig iron dearer than coke. As against this disadvantage, there is the trouble connected with the use of coke, namely, the alleged obstruction of the furnace, though it is very improbable that it actually does this. More probable is it that the obstruction is due to inferior limestone. It has been said that it is possible to treat more slig with charcoal than with coke. The worst defect of the slig consists in its liability to run down and cause obstruction. To obviate this, coke is often better than charcoal. Part of the trouble with slig is associated with the smelting chamber where it forms "bridges" in the mass. That coke contributes to an uneven load is barely probable. Experiences at Hardanger do not prove this.

The use of coke in Norway is greatly to be preferred, even if others choose to adhere to charcoal. Consequently, it is for Norwegians to pursue their own investigations in a country where water power and coke are cheap. If charcoal iron is of better quality than coke iron, the latter, on the other hand, can be marketed at a much lower figure.

Coal and Petroleum Mining in Venezuela, according to a recent U. S. consular report, is still largely in the prospecting stage, the most active perhaps being the Caribbean Petroleum Co., an American corporation which has discovered oil in large quantities and should soon be exporting its product. The Venezuela Oil Concessions, Ltd. (British), is also making progress. The Caribbean Coal Co. has had engineers on its properties north of Maracaibo throughout the year and has about completed the preliminary work. If its plans meet the approval of the Government, it expects to build a railroad from its mines to the small port of Cojoro, which is outside the Maracaibo bar, deepening and enlarging the harbor.

Details of Practical Mining

Fourth of July Hand-Drilling Contest Results

The usual single- and double-hand drilling contests were held the Fourth of July in Western camps. From Idaho and Nevada came the following results:

At Wallace, drilling 15 min. in hard granite, Kinsella and Leaf, from the Tamarack & Custer mine, won first money, $350, by putting the steel down 31 11/16 in.; Rossman and Haff, with 33 7/8 in. to their credit, took second money; while St. Germain and Morrison, the Osburn drillers, were third with 33 3/16 in. Stokes brothers, of Moon Creek, drilled 32 3/16 in.

At Goldfield, drilling in a block of granite from Rockland, Calif., Collins and Lindquist won first money, $500, by drilling 40 3/4 in.; Hughes and Jelik were second, 39 7/16 in.; Schram and Olson third, 38 3/8 in. Single handed, Lindquist drilled 23 7/8 in., winning $252; Brooks was second, with 19 5/16 in., and Malli was third, with 18 9/16 in. to his credit.

Quick Solar Reduction by Slide-Rule

Engineers and surveyors do not make so much use as they should of direct solar observations by transit to locate the meridian. The principal reason for this is the fact that the formula for the reduction is involved and is easily forgotten. Recently a slide-rule has been developed for solving this equation, and the process is so much shortened that it may become popular. Accuracy is obtained by making the slide-rule scales 20 in. (50 cm.) long.

The front face of the slide-rule of the duplex type carries 7 scales which solve the equation

$$\cos Azimuth = \frac{\sin d}{\cos h \cos l} - \tan h \tan l$$

in which d = declination, l = latitude, h = altitude of the sun, ascertained by observation.

The scales on the front of the rule are, in order downward: Regular D scale; sin d from 2° 22′ to 24°; cos l and cos h scale from 0 to 84° 15′; regular C scale in the middle of the slide; tan scale from 5° 43′ to 45°; inverted tan scale from 20° 50′ to 55° and at the bottom an enlarged cos scale with adjacent scale of equal parts, for angles from 0° to 60°. Either this scale or the cos l and h scale in conjunction with the C scale is used for getting the final result, the azimuth angle, from the cos *Azimuth* which is obtained by subtracting two slide-rule results.

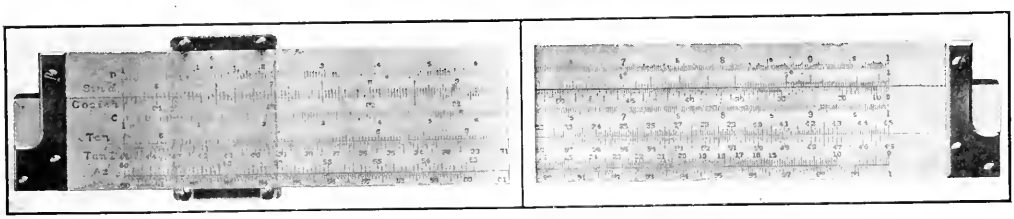
The following example to illustrate the use of the rule is given by B. J. Campbell, of the Keuffel & Esser Co., makers of the rule:

Latitude 40° 45′ N.; Longitude 74° 1′ W.; date Mar. 18, 1915, 3:57 p.m.; observed altitude 23° 49′; horizontal circle 156° 30′. Required the bearing angle with the meridian of an east station at zero of the horizontal circle.

The refraction correction to the observed altitude is,

$$\frac{0.96}{\tan h} = 2\ 2'$$

which is to be subtracted from the observed altitude, making the corrected altitude 23° 47′. The declination, taken from the ephemeris as —1° 15′ 49″ is corrected for change from Greenwich noon by multiplying the hourly correction by the elapsed time between noon plus the hour-angle of longitude of the place of observation west of Greenwich, in this case $59.3'' \times (4 + \frac{74}{15}) = 8'\ 50''$, making the corrected declination —1° 7′. This gives all the quantities necessary for solving the formula. The first part of the equation is solved by setting opposite 1° 7′ on the scale of sin d[1] the value cos 23° 47′ on the top scale of the slide, then moving the runner to the 0 index of the slide and again shifting the slide to bring cos 40° 45′ under the runner. The index of the slide then reads 281, which is to be read as —0.0281. The second half of the formula is obtained by setting 23° 47′ on the tan scale opposite 40° 45′ on the tan inverted scale just below, and reading opposite the left-hand index of the tan inverted scale the value 3798 on the C scale on the middle line of the slide. This is to be read as 0.3798. Subtracting the second term from the first gives —0.4079 as cos Azimuth. Setting this value on the C scale we read on the cos l and h scale the angle 65° 56′. This is measured from the 180° point, as the cosine is negative; since the observation is in the afternoon, the actual azimuth is 245° 56′. Subtracting the reading of the horizontal circle gives the true bearing of the zero point as 89° 26′.



FRONT OF SLIDE-RULE FOR REDUCING SOLAR OBSERVATIONS FOR AZIMUTH

A 20-in. rule, of duplex construction. The back carries regular slide-rule scales and a pair of stadia reduction scales

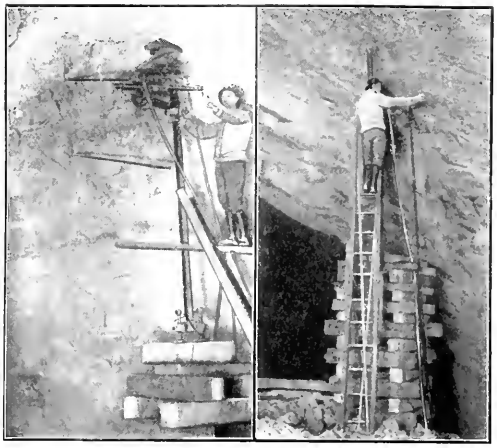
The slide-rule is of still further interest because of the equipment on its reverse side. This has the regular A, B, C and D scales (20 in. long), and on the middle of the slide an inverted C scale; and a pair of scales for reducing stadia observations, one of them a 31-in. scale for ($\frac{1}{2}$ sin 2 a), and the other a 6-in. scale for ($\cos^2 a$), giving respectively the elevation and the horizontal correction.—*Engineering News.*

[1] The sin d scale does not go below 2° 30′; but for other angles ½ sin 2d is equal to sin d, with very small error, and as one of the scales on the back of the rule gives ½ sin 2d, the present example uses this scale instead of

Backstoping with Breast Holes

By H. K. Sherry*

In a stope of Mine No. 1 of the American Zinc Co., at Mascot, Tenn., the sill floor had been cut out in previous operations to a height of 8 to 10 ft., leaving from 20 to 25 ft. of ore above. A longitudinal section of the



BACK STOPING WHERE HIGH BACK REQUIRES MUCH BLOCKING AND LONG COLUMNS

stope before beginning work and a cross-section of the stope parallel to the dip are shown in Fig. 1.

Leyner-Ingersoll machines with Carr bits were used in drilling holes up to 14 ft. in depth. Uppers were first drilled as deep as the steel could be changed, and shot. These left the stope in some such shape as shown in Fig. 2. The machine was then set on the muck pile and 14-ft. holes drilled nearly horizontal. In this manner a breast

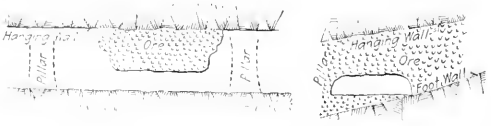


FIG. 1. LONGITUDINAL AND CROSS-SECTIONS OF STOPE

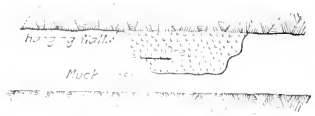


FIG. 2. SHOWING METHOD OF BREAST-HOLE STOPING

was carried 8 or 10 ft. high across the stope, after which another round of uppers was put in and another breast carried across. At times an irregularity in the back was taken advantage of, and by letting the holes look up, a new breast was started. A round of such holes, 10 to 20 in number, often broke as high as 300 tons of ore and re-

*Mine foreman, Mine No. 1, American Zinc Co., Mascot, Tenn.

presented two or three machine shifts. Some blocking-holing of slabs was necessary. Enough muck was drawn from the stope, which was underlaid with tracks, to allow sufficient headroom. At the extreme ends of the stope where the old back was high, cribbing was necessary, as can be seen in the flashlight illustrations.

Flume Without Side Braces*

In the construction of the City Trunk Line, by means of which the municipality of Los Angeles receives its apportionment of water from the Los Angeles Aqueduct,

FIG. 2. VIEW OF FERNANDO FLUME, LOS ANGELES WATER-WORKS

flume work is employed in the crossing of a shallow creek bed. The flume erected differs from the standard form of flume construction in that no outside struts or braces are employed.

The flume has a total length of 676 ft. and is designed to carry a flow of 20,000 miner's inches (approximately 258,000,000 gal. per 24 hr.) at the high velocity of 22 ft. per sec. The grade is 2.58 per cent. The allowance for n in Kutter's formula was 0.011. The structure is

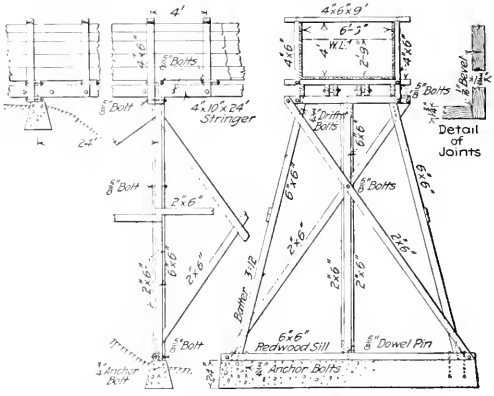


FIG. 1. DETAILS OF FERNANDO FLUME, LOS ANGELES WATER-WORKS

built on a tangent and carries the full flow of the aqueduct 18 ft. above the creek bottom.

The flume proper is built of 2-in. redwood plank, dressed on one side, calked with oakum, with inside di-

*An article by Burt A. Heinly, in "Engineering News," July 22, 1915.

mensions of 6½ ft. in width and 4 ft. in depth, with an allowance of 15 in. for freeboard.

Since the usual side struts were considered likely to loosen and weaken the structure, the side walls are held firm by bolting the outside posts to both the cap of the bent and the cross-tie under the flooring and by employing a 4x6-in. cross-tie doweled in at the top.

The bents are of selected Oregon pine, set 12 ft. apart, on concrete foundations, except over the stream bed, where there is a truss with the end bents placed 48 ft. apart to permit the passage of drift in winter freshets. The cost complete amounted to $7.50 per lin.ft.

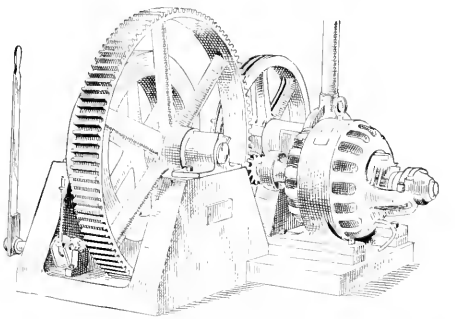
High Steam-Shovel Stripping Rate

A high daily record for stripping was made recently at the Locust Mountain Coal Co.'s Colliery at Shenandoah, Penn. A 70-C Bucyrus digging in a 15-ft. bank loaded 605 4-yd. dump cars, or approximately 2118 cu.yd. of material, in a 10-hr. day. During this period the shovel lost 105 min. for moving up and 50 min. waiting for cars, making the actual working time 7 hr. and 25 min. The material handled was from a face consisting of 5 ft. of rock and 10 ft. of clay. Three 22-ton locomotives were used, each pulling a train of seven 4-yd. Koppel cars. The labor around the shovel consisted of two men at the jackscrews and four in the pit, besides the regular shovel crew. The labor on the dump consisted of six men and one subforeman.—*Excavating Engineer.*

Handling Stock-Pile Cars

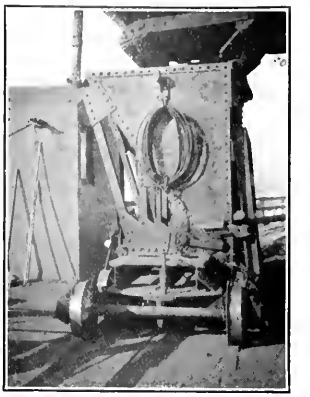
By F. H. Armstrong*

The tramcar used by the Penn Iron Mining Co. for stockpiling is shown in the accompanying illustration. It is a single-side dump car having a bottom at an angle to the horizontal of 56 deg. The door is hinged at the top and held closed by the catches at the ends of the car. In the illustration the door is held open by a block to show the catches.



HAULAGE UNIT INVOLVING WHITING-HOIST PRINCIPLE

The haulage plant for handling this car uses the principle of the Whiting hoist, the driving sheave having four grooves. There are three idler sheaves independent of one another and the rope is wound around these sheaves and drum. The ring on the driving sheave is in two parts, so that it can be replaced readily when the grooves wear to different diameters. The fact that the idlers are independent largely eliminates the differential strains that would be caused by grooves of different diameters. The motor driving the plant is reversible. A brake and an indicator give the operator complete control over his car. With this method it is not necessary to have anyone on the trestle with the car, in inclement weather or at other times, and "off-the-track" or a broken trestle does not endanger life. The tram plant can be set where most convenient and ropes run to the car. The indicator, brake and controller for the motor can be installed within easy reach of the tram man at his post near the chute.



TRAM CAR FOR STOCKPILING

A Simple Chain Ladder

By Clinton P. Bernard*

The use of chain ladders during shaft-sinking operations is compulsory in some states. Frequently the ladders will be found "hanging up in the shaft somewhere," because of carelessness or sloth on the part of the shaftmen. Chain ladders should always be within easy reach of the bottom, and especially so when not timbering close.

A simple and economical chain ladder, easy to repair when "shot up" is made by using ⅜-in. chain; the rungs being made by using $\frac{7}{16}$-in. bolts, passed through the links, and through a piece of ¾-in. pipe between the chains. The nut should be drawn up tight on the bolt to keep the pipe from turning. Rungs are usually spaced 12 to 14 in. apart and 12 in. wide between chains. For hanging to timbers, a square hook fitting over the timbers and attached to the two chains by a ring is sufficient, though often two hooks are used, one on each side of the ladder.

Such a ladder will weigh about 10 lb. and cost made up about $1 per foot.

Sewer Tile of Concrete

In the paper on "Sewer Tile of Concrete" in the *Journal* of July 31, p. 188, the outside form was made of 1¼-in. dressed-pine staves, instead of ¼-in., as stated in the article.

A Copper Discovery in Argentina is reported by U. S. Consul William Dawson, Jr., at Rosario. The deposit is [illegible] per-bearing pyrites and was found at a height of [illegible] ft. in the Planchon Pass between the Colorado and A[illegible] in the Argentine Province of Mendoza.

*Mechanical engineer, Vulcan, Mich.

*34 Herriman Ave., Jamaica, N. Y.

Details of Milling and Smelting

Making Use of Segregation in Electrolytic Tank

The facts that the various constituents of an electrolyte, both those which are essential and those accidentally introduced by corrosion of the anodes, tend to stratify or segregate rapidly in the tank is well known by electrolytic refiners, and a great deal of ingenuity has been lavished on the effort to prevent this. An invention has been patented by Francis R. Pyne and H. M. Green (U. S. pat. No. 1,118,398) in which this segregation is made use of, the electrolyte being drawn off at various levels.

In copper refining it is the common custom to withdraw a certain proportion of the electrolyte daily, treating it to get rid of the various elements introduced by the impurities in the anodes. The patentees state that these undesirable elements have a great tendency to concentrate in the upper portions of the electrolytes, and that if the circulation of the tank be kept up by withdrawing the electrolyte at two different levels, it is only necessary to treat a small portion drawn from the top in order to perform the same purifying action as would be attained by the treatment of a much larger portion of the electrolyte, in case the portion withdrawn were a fair sample of the total content of the tank.

The portion withdrawn on the lower level can of course be returned to the regular electrolyte circulation. This means then that a great saving is made by treating a small instead of a large amount in those tanks using insoluble anodes where the tank efficiency is low and producing a greater amount of copper in the regular electrolytic tank where the current efficiency is high. Apart from this, most of the copper produced in insoluble anode tanks is of inferior grade, which must be sold at a lower price than good electrolytic copper. If the amount thus produced in the insoluble anode tank can be cut down by withdrawing a stratified solution, there is a saving attained in this way also. The inventors state that the invention is not limited to copper refining, but may be applied to any electrolytic refining process.

Oil-Fired Settlers at El Paso

With the curtailment of the supply of lead ores at El Paso, Texas, it became impracticable to operate the Rhodes separator furnaces that had long been a distinctive feature of the El Paso Smelting Works. When the lead plant got down to a 2-furnace basis, the amount of fuel required for the separators was greater than it would have been had a larger volume of molten material been handled. H. F. Easter describes[1] the experiments that led to the substitution of an oil-fired settler capable of serving two furnaces, the slag and matte being first passed through the usual rectangular settling boxes to separate any lead that has left the furnaces. Circular oil-fired settlers were first tried but finally a magnesite-lined settler, approximately 10x20 ft. inside, was adopted.

At the El Paso Smelting Works, a change to any standard plan was impracticable, except at excessive cost. One serious difficulty was the lack of sufficient elevation in front of the blast furnaces, the space between them and the separators being comparatively level and only 4 ft. below the furnace tap holes. This was practically all made ground, having been built up of loose boulder slag, which made excavation difficult and dangerous on account of its tendency to ravel and cave. Another trouble was the lack of room for any arrangement of tracks such as are generally to be found in front of a line of modern blast furnaces.

It was decided therefore to proceed along somewhat original lines, and on July 25, 1914, there was put into operation in front of one furnace a round, oil-fired settler, 8 ft. in diameter. This was intended to serve merely as a second settler to remove the last traces of matte from the slag before going to the dump. For the main separation one of the old rectangular boxes, 3 ft. 4 in. by 6 ft. 4 in. by 2 ft. deep, was relied on, being placed between the round settler and the furnace. Results obtained from this settler were not particularly satisfactory as numerous particles of matte persisted in floating across the surface of the bath direct from intake to outlet. Also, the settler shortly began to fill up with a zinc mush that interfered seriously with proper settling. While the slag that was being run at the time contained only 4% of ZnO, there seemed to be present in the Huntington & Heberlein roast enough unaltered zinc sulphide to give trouble.

The furnace to which this settler was attached was blown out soon afterward and was replaced by another furnace, in front of which was a similar arrangement of box and round tank, except that in this case the latter was 10 ft. in diameter. The tank was set off center far enough to give the furnace tapper a chance to work, which made necessary a rather long curved spout from the box to the tank. The greatest trouble encountered was the lack of elevation, as the round settler was erected on the original level of the ground in front of the furnace and it was necessary to have both slag and matte taps high enough for the hand pots to get under them. It was thus necessary for the slag to flow a total distance of about 23 ft. with a drop of only 11 in. between the tap hole and the outlet from the settler. This of course caused trouble every time the slag happened to get thick and pasty. The first settler or box was easily removable, had a firebrick lining (magnesite was afterward used with great success) and measured 66 in. long, 28 in. wide, and 21 in. deep inside the lining. The round settler had a 9-in. lining of magnesite brick, both sides and bottom, and a 9-in. arched roof of fire-brick upon which rested at the edge of the tank, just over the slag outlet, a short brick stack with an iron pipe con-

[1] In a paper, entitled "Lead Smelting at El Paso," to be presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

nection above. The oil burner was placed at the exact center of the roof and was directed straight down upon the surface of the bath. A small combustion chamber was later placed on the roof and proved successful in getting more efficient results from the oil.

It was thought that a baffle extending across the tank close to the inlet and partly immersed in the bath might compel the floating particles of matte to go down and join the main body of matte instead of going straight across and out with the slag. Accordingly, such a baffle constructed of brick was placed about 12 in. from the inside of the lining. This feature of the experiment was a complete failure and the floating specks of matte continued to pass out on the surface of the slag as before. These small particles, however, proved upon investigation not to involve so serious a loss as had been feared. Several hand pots of slag were set aside to cool and put through the small automatic sampler. The average results were: Silver, 0.65, metallic lead, 1.00, copper, 0.15%.

After starting off favorably, this new settler soon began to fill up with zinc mush. Some of this material had a specific gravity lower than that of the slag, while some of it appeared to be slightly heavier, the tendency as a whole being to form a layer between the slag and the matte. Various samples of this material were analyzed, a typical one being as follows: Insoluble 6.6, iron 19, lime 3.4, zinc 24.3, sulphur 21, lead 10, copper 4.6%. When this crust was broken up with a bar, it floated for a while at or near the surface in lumps resembling dry dross. This was not a new condition, having frequently been observed in the Rhodes separators. The only way to overcome it seemed to be to let the settler fill up with matte, thus forcing the mush to the top where it was skimmed off with rabbles through a hole cut for the purpose. This of course involved a considerable loss of matte and a large proportion of the slag made at this time had to be saved for resmelting. This condition of affairs was finally remedied by changing the charge so as to use less of the Huntington & Heberlein roaster product.

As already mentioned, the original idea with regard to this type of settler was to use it simply as a safeguard against letting any matte go to the dump. As much matte as possible was tapped directly from the box; it was found that this amounted to about 88% of the total matte produced. The shells from the hand pots, in which the slag was removed, were frequently sampled. They assayed so little higher than the regular slag samples that they were thrown away.

The comparative success attending the use of these round oil-fired settlers encouraged the installation of a somewhat similar but larger settler intended to serve two furnaces instead of one. The apparent advantages of this were the greater volume of leady copper matte that could be accumulated at one time, the certainty that one such settler would require less fuel oil than two of the earlier type, and some saving in labor.

This new settler is placed about 6 ft. forward of the line of the front crucible plates of the two furnaces and equidistant from them. It is 10 ft. inside by 20 ft. long, extending close enough to the edge of the train pit to make it easy to tap matte and slag into the cars below without the use of excessively long spouts. The whole structure is supported upon rails running crosswise and providing air spaces beneath the bottom pan. This feature has proved to be of considerable importance inasmuch as there is a constant seepage of lead through the bottom and the open air spaces arrest its progress downward into the foundation and facilitate its removal.

The ends of the settler are made slightly curved in order to give a stronger structure. The sides are braced with I-beams set upright and tied across the top with steel rods. The sides and ends have a lining of 9 in. of magnesite brick. A matte tap is provided on each side close to the front, and there is a single lead tap in the middle at the rear end. This lead tap is used every day, but little lead is obtained, as experience with the Rhodes separators indicated the inadvisability of maintaining a bath of lead in contact with the matte, and every effort is made to keep lead from getting into the large settler in the first place. The roof of the settler is sectional, being composed of a number of rail-bound firebrick arches that can easily be lifted off if necessary. The stack is situated at the rear end between the slag inlets from the two furnaces and over the lead tap. Two oil burners were installed, one playing downward through the roof at a point about 6 ft. back from the front, and one playing nearly horizontal through the front wall.

Between each furnace and the large settler is a removable rectangular box, 2 ft. 6 in. wide by 9 ft. 2 in. long, lined with 4½ in. of magnesite brick all around. The furnace is connected with the box and the box with the settler by short water-coil spouts. Each box is set at an angle of about 45° to the furnace, giving the tapper a clear field for his work.

As it is no longer necessary to provide for the use of hand pots under the slag and matte spouts, it has been possible to arrange the elevation of the various parts of the system to much better advantage than in the case of the round settlers. There is a difference of 20 in. between the tap hole of the furnace and the bottom of the slag outlet from the main settler, which greatly facilitates the handling of the spouts. There is a difference of 10 in. between the bottom of the inlet and the bottom of the slag outlet, which allows plenty of time for switching and changing slag cars after the outlet hole has been closed up. The normal depth of the bath in the settler is 25 in. with the slag outlet open, and it is customary to maintain about 10 to 12 in. of matte at all times, as this seems to assist materially in keeping the settler in good condition.

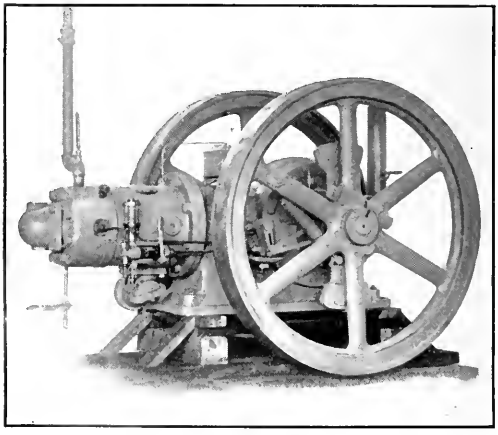
Although this settler was designed for operation with two furnaces, it was decided to try it out with only one, in order to see if it might be kept open under such circumstances. At the time of writing it has been in successful operation with one furnace for exactly one month, although the amount of fuel oil necessary to keep it in good condition is somewhat greater than was the case with the former round settlers. The larger settler requires about 7 bbl. of oil per day, whereas the others averaged about 4.5 to 5 bbl. However, with two furnaces running it is probable that less oil would be required.

Mining & Metallurgical Machinery

Fairbanks-Morse Internal-Combustion Engine

Fairbanks, Morse & Co. has placed upon the market an internal-combustion two-cycle engine designed to consume any grade of crude oil or distillate. No change in the engine is required in adapting it to different oils excepting a slight adjustment of the injection pump. The pronounced advantages of the two-cycle over the four-cycle system, especially in heavy service such as in pumping and in driving a loaded generator, induced the design of this semi-Diesel type-Y engine.

The crank case is closed and serves as an air chamber in which slight compression occurs on every outward stroke of the piston. This air is used for two purposes—as a scavenger of the combustion gases from the cylinder and to maintain pressure oil lubrication for every bearing and in the cylinder. The engine is valveless, the piston itself



FAIRBANKS-MORSE DIESEL ENGINE

covering and uncovering the ports. There are no cams, gears, carburetors, batteries, igniters, magnetos, spark-plugs or switches.

A complete cycle is as follows: Starting with the working stroke or when the piston is moving forward toward the crankshaft under the pressure of the gases produced by the burning mixture, effective work is done until the piston passes and uncovers the exhaust port in the wall of the cylinder and permits the larger part of the gases to escape under their residual pressure. Immediately thereafter, the piston uncovers the inlet port to admit compressed air from the crank case. This inrush of air sweeps out most of the inert gas remaining in the cylinder at the end of the stroke and leaves the cylinder filled with almost pure air at atmospheric pressure. As the piston returns on its inward stroke it covers both ports, thus entrapping the air and subjecting it to high compression. Just before dead-center is reached, the pump injects a very fine spray of the fuel into the combustion chamber, shown as a rounded development of the cylinder head in the illustration herewith. The walls of this chamber keep hot from the successive combustions, and as the engine turns over its center, the mixture ignites. The cycle is then completed.

When starting the cold engine, an ordinary kerosene torch is placed on the bracket below the combustion chamber until the metal is heated red. A few minutes suffices for this preliminary duty; then a few strokes given to the injection pump by hand and the turning over of the fly-wheel will start the engine into continuous operation. A feature is that the injection of oil is so regulated that the walls of the combustion chamber maintain an almost uniform temperature when running under light, heavy or variable loads. The governor varies the stroke of the injection pump with the demands for power on the engine.

The engine operates almost noiselessly. The inclosed crank case eliminates dust troubles in the bearings. The cylinder is water-jacketed. A very small amount of heated jacket water is conducted through an adjustable nozzle into the air passage leading to the cylinder, thus moistening the combustible charge and increasing its efficiency. The engine is carried in stock sizes from 10 to 75 hp., but is built to order for any capacity. The 25-hp. engine runs at 325 r.p.m., occupies floor-space 64x88 in. and weighs packed for shipment 5300 lb. Full particulars may be had from the Denver house of this company.

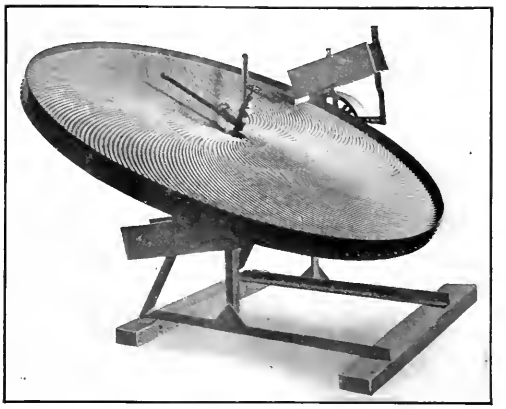
Concentrator and Classifier

The Rotary Concentrator & Classifier Co., 1215 Foster Building, Denver, is offering machines designed to do concentration, classification and separation in a new way. In the accompanying photograph is shown a top view of a 72-in. machine. It consists of a round shallow pan, built of California redwood, with a steel rim. The deck or bed is covered with linoleum, upon which are mounted many involute wooden riffles, the whole being supported upon a light but substantial steel frame. The pan may be quickly adjusted to any angle of slope and when in operation is revolved slowly by a cast-iron gear ring secured to the under side of the deck, the ring thus acting also as a stiffener. About ⅛ hp. is required for each unit.

Feed is delivered to the machine through the launder adjacent to the circumference of the pan, the direction of rotation being such as to carry the material upward. Dressing water admitted through perforations in the longer pipe shown, combined with the slope of the deck, washes the lighter or gangue particles toward the lower edge of the pan, the progress of such material being continually impeded by the many riffles that catch the particles of greater specific gravity. Rotation of the pan causes the concentrated heavier particles to tumble along

behind the riffles to feed the discharge-hole at the center, this spout being really the hollow shaft that drives the pan. Should any heavy particles wash over one or two riffles, they will be promptly caught by the succeeding ones and forced toward the concentrate discharge.

Near the center of the pan, a shorter pipe delivers water for completing the wash and driving the concentrate into its discharge pipe, and thus into the concentrate launder beneath. If the feed be coarse, say from 4 to 30 mesh, the riffles are made $\frac{1}{4}$ in. high; while for all finer feeds the riffles are but $\frac{1}{8}$ in. high. Thoroughness of concentration is brought to a maximum by adjustment of the quantity of water used and the slope of the deck; both of these adjustments are easily made while the machine is running. The manufacturers claim that fine sizing of the feed is not essential, since the principle of operation is more that of hand-panning or of differences in specific gravity than of sizes of particles. Ore must therefore be ground only so fine as to free crystals of differing minerals which it is desired to separate. On the other



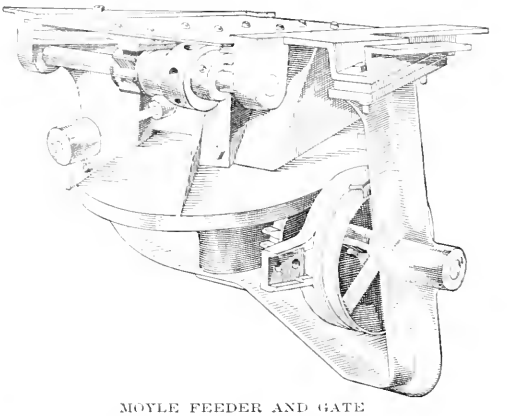
ROTARY CONCENTRATOR AND CLASSIFIER

hand, where the feed consists of a fairly uniform material ground to all sizes of particle, the machine can be readily adjusted in slope and quantity of wash water to act as a classifier to produce two general sizes. It will thus handle 25 to 100 tons per day, depending on the fineness of the grinding. Again, separation of concentrated minerals may be accomplished by suitable adjustments, this in practice being done on additional machines placed below the concentrating units. Another adaptation of the machine is for handling very fine material, such as slimes. When used for this purpose, however, there is a difference in the deck of the pan, which is made saucer shaped and is covered with canvas, which serves to hold the very fine, floaty, metallic minerals and to carry them to the upper zone, where they are rinsed into the riffles near the discharge.

The most recent adaptation of this machine is in amalgamation, a considerable quantity of mercury being charged into the pool that is maintained at the pan-floor margin. Without flouring in the least, a small amount of this mercury is picked up by the succeeding riffles and carried upward. Unless this mercury encounters free gold and forms amalgam, it will eventually roll over the riffles and collect again in the pool, but any amalgam formed will generally be forced upward and into the concentrate discharge. Suitable mercury traps are provided to obviate any losses at both points of discharge, and the machine is said to perform very good work.

Moyle Feeder and Bin Gate

A combined stamp-mill feeder and ore-bin gate is being offered by the E. H. Moyle Engineering & Equipment Co., Los Angeles, Calif. The feeder itself presents no new features except that it has a horizontal bin gate as one

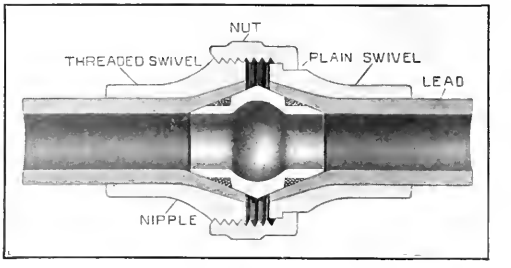


MOYLE FEEDER AND GATE

of its integral parts. The device is intended to be placed in the bottom of the ore bin, feeding directly thence to the mortar boxes. Motion is transmitted through a lever, much as in the case of the ordinary feeding devices.

Anderson Pipe Coupling

The Anderson coupling, put on the market by the Chapman Valve Manufacturing Co., Indian Orchard, Mass., is not a new piece of apparatus, but one which seems to have but lately invaded the metallurgical field.



ANDERSON PIPE COUPLING

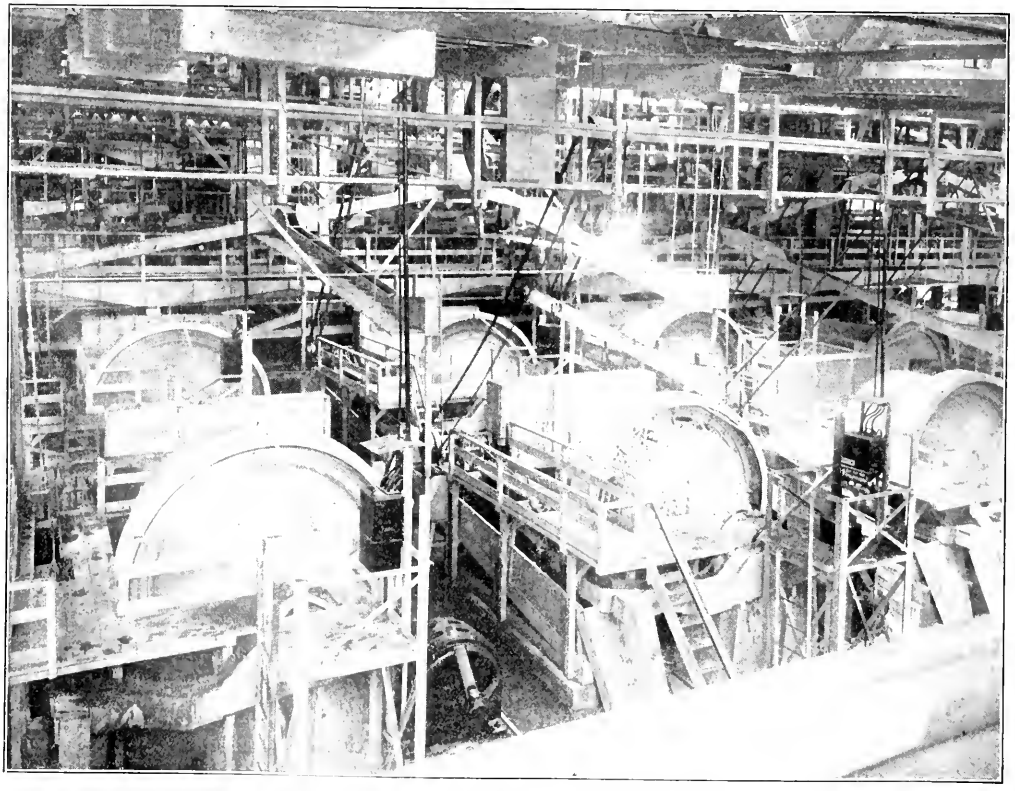
This coupling was originally designed to eliminate the necessity of wiping or soldering a joint when using either lead or iron pipes.

An order for some couplings of unusual [illegible] to the company's tracing their further history. It was found that they had been put into service on the [illegible] lines of an experimental leaching plant, where they were giving satisfactory service.

Photographs from the Field

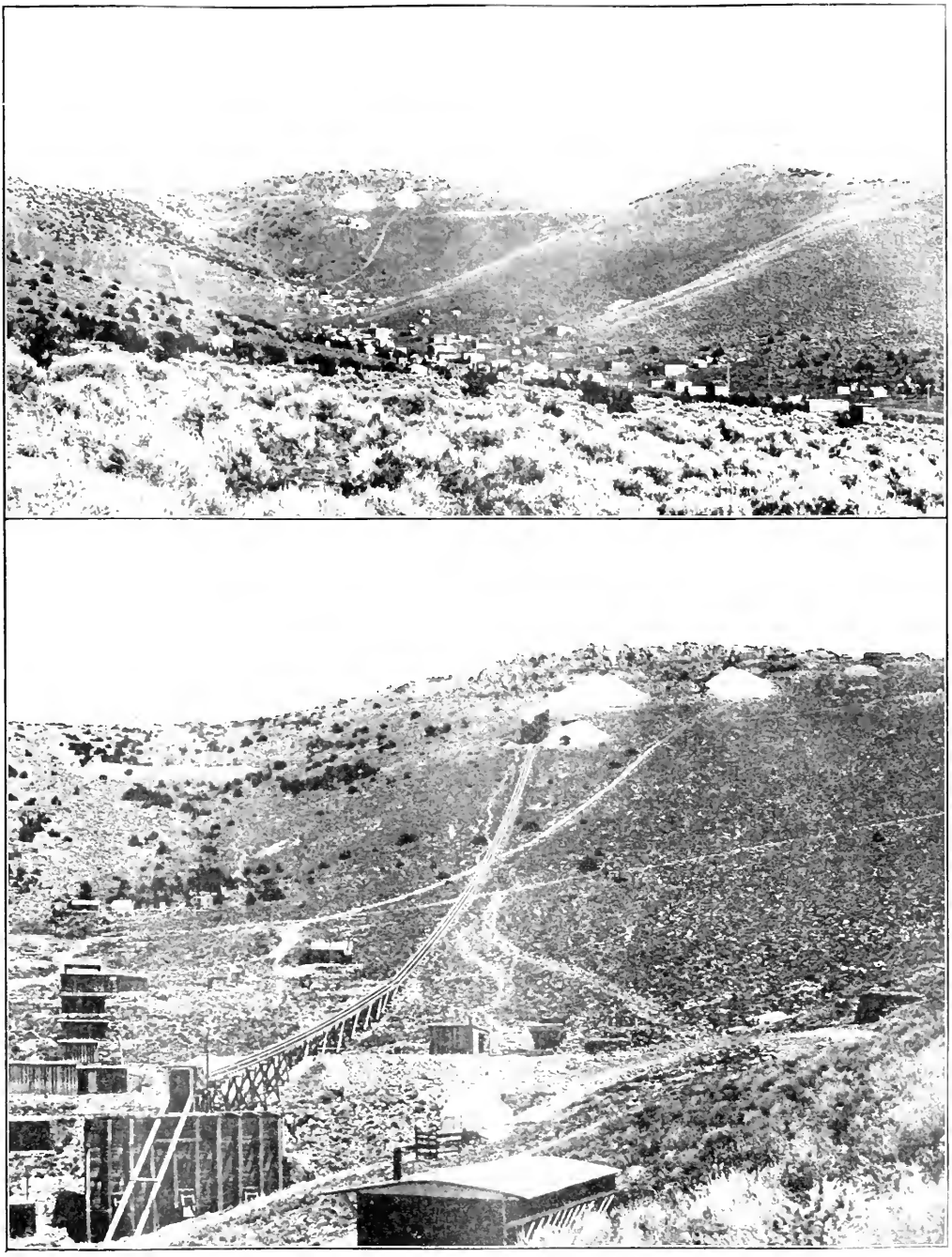
IN THE TINTIC MINING DISTRICT, UTAH

Sioux Con. ore bins on Knight R.R. Opencut on Dragon, showing vein in contact



ANACONDA COPPER MINING CO., ANACONDA, MONT.

A view of No. 2 section of the remodeled concentrator, showing some of the grinding mills



THE NEW AND IMPORTANT SILVER CAMP OF ROCHESTER, NEV

Upper view shows the town of Upper Rochester, the famous Rochester Hill showing in the background. L. shows the tramway of the Rochester Mines Co., which brings ore from the Friedman tunnel to the

Otto H. Hahn

Otto H. Hahn, one of the most distinguished American silver-lead smelters, died at Jena, on July 26, at the age of 70 years. Mr. Hahn had been in poor health for some time, and the news of his death did not therefore come unexpectedly.

Mr. Hahn was born at Appolta, in Thuringia, and was graduated from the Bergakademie at Clausthal in the Harz, and also studied at the University of Jena. Having completed his studies he came to the United States in 1863 and found employment with the firm of Adelberg & Raymond, one of the earliest firms of mining and metallurgical engineers in this country. Another member of the staff was Anton Eilers. The friendship among Hahn, Eilers and Raymond which then began was never broken. After completing some work for Adelberg & Raymond, especially in connection with some lead mines in the state of New York, Hahn decided to venture into the newly developing West, hoping to find a broader field for his activities. He went first to California and found

OTTO H. HAHN

some difficulty in occupying himself, but before long he fell in with C. A. Stetefeldt, and after working with him for a while in California, went to Austin, Nev., to take charge of Stetefeldt's assay office there. Later he moved to Virginia City, Nev., where he was engaged in assaying and mining for several years, and during this time was associated with Luckhardt, another of our early metallurgists.

When the great silver-lead deposits of Eureka were discovered, Hahn found his great opportunity. He went there about 1870, first being superintendent of the K. K. smelting works. He remained at Eureka for several years engaged in silver-lead smelting, and from there went to Salt Lake City, Utah, to assist Mr. Eilers in running the Germania works. Later he was associated with Mr. Eilers in silver-lead smelting at Leadville and Pueblo, Colo. In an interval, however, he was occupied in running the great smeltery and refinery at Argentine, Kan. During his active experience in the United States he was connected with a great many of the important smelting works. His experience extended also to foreign countries. Once he went to South Africa to erect and operate a lead smeltery there, and one of his latest professional engagements was in operating one of the works of the American Smelting & Refining Co. in Mexico.

About ten years ago Mr. Hahn retired from active practice and since then resided at Jena, Germany. During most of this time he acted as the regular correspondent of the *Engineering and Mining Journal* in Germany, and his valuable contributions have been widely appreciated among our readers. Mr. Hahn, during his long experience in the United States, became thoroughly Americanized and acquired the ability to write in English with a precise, pungent style. During the last year of his life, while sojourning in Germany, he was wont to express himself in no unmeasured terms respecting the backwardness of German metallurgists, especially the lead smelters, in many particulars.

Mr. Hahn made several important contributions to American literature. The first of these was "The Smelting of Argentiferous Lead Ores in Nevada, Utah and Montana," a paper in which he collaborated with Raymond and Eilers, and which was published in "Mineral Resources West of the Rocky Mountains for 1871." Another highly important monograph was on "The Smelting of Argentiferous Lead in the West," which was published in "Mineral Resources of the United States for 1882." A third comprehensive monograph on lead smelting was published in the "Transactions" of the Institution of Mining and Metallurgy, of which he was a member.

The name of Hahn is indelibly associated in the annals of American silver-lead smelting with those of Eilers, Arents, Raht, Billings, Schneider and others—that brilliant group of German-American metallurgists that did so much to develop this branch of metallurgy in the United States.

China Refuses a Monopoly to Standard Oil

Cable dispatches announce that the Chinese Government has declined a proposal of the Standard Oil Co. for a monopolistic concession containing the following provision:

> A joint company to be formed in which the Standard Oil Co. has a controlling interest, the company having the right to explore all China and register exclusive claims in selected localities; the company further to monopolize the refining and transportation of the total production of crude oil by whomsoever mined, while the Standard Oil Co. would have a monopoly of marketing the refined article for a given period.

It will be recalled that about a year ago the Chinese Government entered into a temporary agreement for the exploitation of oil fields in northern China in the provinces of Chihli and Shensi. There have been occasional reports of success in the exploration work, but the present cables state that the Chihli field is "commercially worthless and that in Shensi appears of doubtful value"; therefore a fresh proposal was made to the Chinese Government. No confirmation of the cabled reports could be secured at the local offices of the Standard Oil Co.

Chrome Iron Ore Production in the United States increased from 255 long tons in 1913 to 591 long tons in 1914, according to the Geological Survey.

Correspondence and Discussion

What the Dip Needle Can and Cannot Do

I have read with much interest the article by C. A. Cheney, Jr., on "What the Dip Needle Can and Cannot Do" in the *Journal* of July 31. Mr. Cheney has clearly stated, and for the most part correctly answered, some of the common misunderstandings with regard to the dip needle, but in so doing he has, I fear, put the emphasis in such a way that some of your readers will obtain an unfavorable impression of what is one of the most important methods of conducting preliminary exploration for iron ores.

The dip needle has been condemned by many mining men because of a false impression that it was supposed to be capable of locating ore. In the Lake Superior region the dip needle and its inseparable associate, the dial compass, are essentially instruments for the study of the geology in areas where rock outcrops are too few to indicate the character and structure of the formations. No actual orebody in the Lake Superior region has, so far as I am aware, ever been determined by magnetic means. But many ore bodies have been located by drilling directed according to intelligent use of magnetic observations. This is the history of exploration for iron ores the world over. These observations are bound to be of even greater importance in the future than in the past, as exploration extends away from the developed ranges into areas where the drift-cover more completely obscures the rocks.

Every user of the dip needle should be aware of the fact that any kind of rock, sedimentary, igneous or metamorphic may contain sufficient magnetite or magnetic sulphide to affect the magnetic needle. In so far as he is capable of analyzing his observations and determining from them what they indicate—to this degree is he capable of using the dip needle and dial compass.

The Wisconsin Geological Survey is making extensive magnetic surveys of the lands in the northern part of the state and has recently issued a report covering over 2,000,000 acres. In this area thousands of acres of land are clearly indicated as being worthy of further exploration with the drill. This report—Bulletin XLIV—contains a chapter of over 60 pages devoted to a comprehensive discussion of magnetic observations, in which both the theoretical and practical sides of the interpretation of such observations are discussed fully, and in language as non-technical as possible.

In the field work on which this report is based, it has been found possible to make fairly accurate determinations showing the depth of burial of the magnetic formation, its general character, dip, strike and thickness. Of course these features cannot be determined with all the accuracy desired but they serve most effectively to guide drilling in regions where outcrops are not available to give greater accuracy.

This chapter on magnetic observations is practically a small text book on the subject and anyone doing such work anywhere will be amply repaid by a careful study of its contents.

W. O. HOTCHKISS.

Madison, Wis., Aug. 10, 1915.

On Zinc Poisoning

I read with interest the comment on "Zinc Poisoning" in the *Journal* of Aug. 14, as it bears on an experience of ours. During the past year, we have experimented extensively with the distillation of zinc from ores and in some phases of the work used graphite crucible retorts discharging into the body of a cylindrical down-draft melting furnace fired by natural gas. This furnace was not connected to a flue, but discharged its waste products directly into a large room, fully 30 ft. high. The charge of zinc ore in the retort was approximately 10 lb., the ore containing about 48% zinc. The distillation would last from 8 to 12 hr. and at times the presence of finely divided zinc oxide in the room was very noticeable.

My assistant, who was present in the room the greater part of the time that distillation was actively proceeding, noted no ill effects during the day, but at about 10 o'clock at night was suddenly seized with lassitude, nausea, great weakness and severe chills, as well as a seeming loss of control of the joints. A fever probably accompanied these symptoms although no temperature measurement was taken to make certain of this. At about 4 o'clock in the morning the symptoms gradually disappeared and the next day he felt reasonably well, had a good appetite, but was still weak. He had three attacks of this kind, each occurring after such an experiment as described above.

The furnace temperature was as high as 1325° C. at the end of the distillation period. The zinc ore used in the experiments contained about 3% lead, and as lead is rather freely distilled at this high temperature and there was a relatively long time of distillation, some lead oxide was undoubtedly present in the air. The furnace previous to the zinc experiments had been used a number of times to melt copper, some of which had spilled on the inside lining of the furnace. The presence of this copper was plainly indicated by the characteristic flame colors at the discharge flue of the furnace, but the amount was small so that it seems hardly probable that the copper has any bearing on the case. Moreover, the furnace, after the contamination of its lining with copper, had been used for other purposes than zinc distillation and its use had produced no ill effects.

The symptoms experienced are essentially the same as those described for "brass shakes," and I believe that the case was one of zinc poisoning, the zinc oxide being the active agent. The question of the presence of lead complicates the case somewhat, but the symptoms are [illegible] from those ascribed to lead poisoning that it seems questionable whether lead was responsible.

CHARLES H. [illegible]TON.

Cleveland, Ohio, Aug. 18, 1915.

Editorials

Securities of the American Smelting & Refining Co.

The recent offering to the public of a large block of the A preferred stock of the American Smelters Securities Co. at a price upon which the expected dividends will yield 7.06%, with the further promise of a profit of $15 per share in from one to 32 years, according as the shares are drawn by lot for cancellation, prompts the inquiry why one of the premier securities of so solid a company should be available at so low a price. It is interesting therefore to examine the status of the several issues of this company and the American Smelting & Refining Co., the affairs of which are so closely interwoven. So intimate have they been indeed that for several years nothing but a consolidated financial statement has been issued to the shareholders of the A. S. & R. Co. and the public, but it appears nevertheless that the accounts of the American Smelters Securities Co. have been kept separately, for the banking house making the recent offering was able to publish a circular revealing the figures of that company alone.

The history of the two companies is something like this: After the A. S. & R. Co. had been a going concern for a number of years, its managers organized the A. S. S. Co. to acquire another group of smelteries and refineries. The money for this was supplied partly by the public and partly by the Guggenheim Exploration Co. The plants acquired were situated at Tacoma and Selby. Subsequently the Baltimore works were bought, the Federal and Garfield plants were built, and a group of lead mines in Missouri were purchased, the expansion of the company's interests being made chiefly out of its profits. The securities issued were: The A preferred stock, 6%, owned partly by the public and partly by the Exploration Co.; B preferred stock, 5%, owned by the public; and common stock, divided between the A. S. & R. Co. and the Exploration Co. For many years these companies carried this stock on their books at a merely nominal value. Each had received it as a bonus—the A. S. & R. Co. for guaranteeing the B preferred stock, and the Guggenheim Exploration Co. for supplying capital in consideration of the A preferred.

A few years ago the A. S. & R. Co. purchased from the Exploration Co. the A. S. S. Co.'s common stock that it held, paying $60 per share therefor. In doing this it used a large part of its cash surplus and also obtained money for this and other purposes by the issue to the public of $15,000,000 of 6% debenture bonds of the A. S. S. Co., convertible into common stock of the A. S. & R. Co. at par. This was a curious and complicated transaction, the nature of which has never been clear to anybody, we think, except the financiers who conducted it. One thing certain, however, was that the Guggenheim Exploration Co. realized a large amount of cash by virtue of it.

Lately there has been talk about the Guggenheim Exploration Co. going into liquidation. Whether or not there is any truth in that we do not know. Anyway, it was its holding of the A preferred stock that was recently offered to the public.

As well as we can determine the position of the several stock and bond issues of the two smelting companies, they are as follows, stated in the order of priority of claim upon earnings:

Issue	Amount	Rate	Mkt. price	Yield
1. Debenture bonds.....	$13,534,500	6	106	5.30
2. A. S. S. pfd. B.....	30,000,000	5	80½	6.21
3. A. S. & R. pfd.....	50,000,000	7	106	6.60
4. A. S. S. pfd. A.....	16,648,800	6	85	7.06
5. A. S. & R. common....	50,000,000	5	79	6.33
6. A. S. S. common.....	30,000,000	..	..	...

We arranged the above table before filling in the figures. When the latter was done it appeared that the standing of several securities in the market is just what they ought to be, dismissing, however, the common stock, which is the special speculative issue. The debenture bonds of the A. S. S. Co. are undoubtedly the supreme lien upon the property and business of both these smelting companies. Next in order we put the A. S. S. preferred B stock inasmuch as it is guaranteed by the A. S. & R. Co., and being issued prior to the debentures is manifestly a superior claim upon the earnings of the company. However, that claim would be exercised only if the A. S. S. Co. should fail to earn anything. The A. S. & R. Co.'s preferred stock, and the A. S. S. preferred A have claims only upon the earnings of the respective companies after all other claims have been satisfied. Similarly, as to the common stocks. Inasmuch as all of the A. S. S. common is owned by the A. S. & R. Co., its position does not matter.

The preferred stock of the A. S. & R. Co. does not appear to occupy the place it once held. However, it is due to remark that there have been no failures in the payment of dividends on any of these issues. All told, they represent an enormous capitalization of a very profitable business. Nevertheless, it would seem to be desirable to have a thorough consolidation of the interests of the two smelting companies that live and work together in the same family.

Mineral Export Taxes in South America

Is South America going to kill the golden goose of its mineral industry? Following the distressing financial situation resulting from the war conditions, these countries are looking about to see where they can increase their revenues, and in many instances have hit upon the mining industry as a special field for exploitation in this respect. The South American governments need more revenue but their people need more industries. Any drastic action inimical to new industries will be a costly piece of legislation, the bad effect of which will make itself felt in meager development of a country for years afterwards.

Peru is just now considering one of the most important features of mining legislation that has been before

it in over a decade. In November the period of 18 years fixed by law for the free exportation of mineral products will expire, and the possibility of increasing the Government's income from this source has been occupying the attention of the administration. The Consejo Superior de Mineria, which has the direction of matters pertaining to the mining industry, has made public the proposed bills designed to increase the country's revenue by taxing the mining industry in various ways. It is expected that the Sociadad Nacional de Minería will protest on behalf of the mining interests, not against the export tax in principle but against the magnitude of the tax proposed by the Consejo Superior de Minería. The mineral industry of Peru is already handicapped by the lack of railways. It is largely on this account that there has been comparatively little development of its mineral deposits during the 18 years of freedom from special taxation. It is hard to see how the development of the mineral resources will be stimulated by the imposition of an export tax, especially if that tax be made an onerous one.

Most of our South American neighbors are in need of capital for the development of their countries, and there is an excellent opportunity at this time for the entrance of mining capitalists into those countries. But capital will not flow in that direction if there appears to be evidence of an intention to increase the burdens of taxation to the point of discouragement. The great and rapid development of North America suggests that these countries would benefit more from the establishment of industries within their borders than from a high taxation of the limited development that would ensue with the latter policy. Equitable taxes will not be objected to by the mining industry, but if a hold-up policy be adopted these countries will not see the rapid development which they are on the verge of accomplishing.

*

Zinc Falling to Its Normal Price

The price for spelter has fallen a long way from 25c. per lb., but it is still at a high figure. Some producers talk as if they had been robbed of something rightfully belonging to them in that they can no longer sell their output at 20@25c. per lb. They forget that it is scarcely eight months ago that zinc was selling under 5c. per lb., and that a normal price for zinc—based upon averages for long periods, the cost of production, etc.—is regarded as being about 5@5½c. per lb.

There have been no recent developments to alter ideas respecting a normal price for zinc. The enhanced price of 1915 was due to temporary shortage arising from the isolation of the German and Belgian smelters. An acute situation developed, but it could and would be cured naturally with time, even if the war were to continue indefinitely. In other words, there had only to elapse sufficient time to enable the deficiency in smelting capacity to be made good. The rapidity with which this is being done is a matter of marvel among persons versed in the zinc industry. Six months ago no zinc expert would have admitted that it could be done so swiftly.

As has been pointed out repeatedly in the *Journal*, the scarcity of spelter was due wholly to temporary shortage of smelting capacity and in no degree to shortage of ore supply. On the contrary, the immensely swollen list of furnaces in this country has been supplied easily without drawing upon the ore supply of Australia and other countries to any considerable extent. The military consumption of spelter is very large, but the peaceful use of it has been greatly curtailed. As soon as ample smelting capacity is provided there is no reason why spelter should not be selling around 5c. per lb. again, even if the war continues.

The price for high-grade and superior intermediate spelter has not yet declined to so large an extent as in the cases of prime western and brass special. High-grade spelter, strictly speaking, is practically a monopoly of the New Jersey Zinc Co., which of course may charge for it whatever it sees fit. The superior intermediate spelter, on the other hand, may be made by the redistillation of common spelter, at an extra cost of a few cents per pound. Obviously, therefore, the price for such spelter must follow the price for common spelter.

The events in the spelter market of 1915 are ascribable to nothing short of commercial insanity. There will be adverse consequences from which the zinc industry will be years in recovering.

*

Buying of Metals for Ammunition

The buying of metals for ammunition is done now in a way very different from that of three months ago. Then the contractor found himself with engagements calling for large quantities of copper, spelter, etc., during the next six months. He went into the market to buy the whole lot at once, acting as if there were never going to be any more of these metals in the world. He went about this business with a beating of tom-toms and created among sellers the impression that about ten times as much metal was needed as was really the case. Let a large number of buyers start operations in such a way and nobody had to consult the seventh son of a seventh son to discern what was going to happen.

The ammunition contractor of today is more canny. A few months ago he bought spelter at 25c. per lb. for fear lest it might go to 50c. But it halted at 25c., then receded, and appears to be likely to recede some more. The buyer is once more thinking about the equilibrium of demand and supply and has come to the conclusion that the nature of the markets is still just the same as it used to be before the war. So he says to himself that although he is going to need some thousands of tons of copper and spelter during the coming six months he will take his time about buying it—there will be enough for everybody—and perhaps there will be some opportunities for the bargain hunter.

*

Kennecott as a Cheap Producer

The developments in the Copper River region of Alaska, including a long railway through a difficult country and the opening and equipment of the Bonanza mine, cost a great deal of money. The gossip used to be that it was well toward of $20,000,000. This was furnished by J. P. Morgan & Co. and M. Guggenheim's Sons, the [illegible] subsequently taking in Kuhn, Loeb & Co. Among [illegible] there was always considerable doubt respecting [illegible] out-

come of [illegible]'s investment considered as a whole, although of course it was recognized that either the mine or the railway could make a fine showing at the expense of the other.

According to a Boston paper the syndicate put from $25,000,000 to $30,000,000 into the enterprise and so far has received $7,500,000 in dividends from the Kennecott Mines Co. (Bonanza mine), and $10,000,000 from the sale of Kennecott bonds. The Copper River & Northwestern Ry., which necessitated the greater part of the capital expenditure, has paid nothing. Apparently therefore the Alaska venture has been conducted on the basis of a cheap mine and a dear railway. Kennecott is advertised as the cheapest producer of copper in the world, its average cost being said to be only about 5c. per lb. The contributory factors in arriving at such a cost are high-grade ore—some of it almost pure copper glance—and what is substantially the free use of a large amount of capital.

By the sale of Kennecott stock the syndicate will further recoup itself, it is to be supposed. This company has an issued capital of 120,000 shares, and there are 400,000 additional shares reserved for conversion of the bonds, a total of 1,120,000, which at $25 per share—the promotion price—represents a valuation of $28,000,000, or about what the syndicate is said to have put into the venture. It will be interesting to see how the public will make out in its investment in this mine of very rich ore, which probably lacks the elements of long life that the porphyry mines have.

BY THE WAY

Delays are usually expensive—but not always. Shortly after the great war began the price of copper declined to what was for many an unprofitable level; commercial conditions generally were so upset that companies which normally could produce profitably at this price were not at all certain whether a further decline during transport might not wipe out any profit, or even make a deficit. For months the German raiders roamed the oceans and between actual captures and rumors of captures and the stimulated European trade, it was exceedingly difficult for ocean shippers to secure "tonnage." Toward the close of the year a certain copper producer desired to make a shipment and wrote his agents in the United States to contract for ships. This was easier said than done. Each week as no boat appeared, the mine owner would write again to his agents urging action. As the price of copper rose, he began cabling frantically. Eventually ships were secured, and when settlement was made by the smelters it was found that, owing to the advance in the price of copper, the amount received was about $90,000 in excess of what it would have been if shipment had been made when first attempted.

The following reasons from *Engineering News*, showing why a contractor has a snap rather than the engineer, are apparently the outburst of a municipal engineer, but the miner and metallurgist will probably sympathize.

The question "Has the Engineer a Snap?" may be answered perhaps better after itemizing the expense and trouble which the engineer must undergo, some of which are as follows:

1. Expense of looking over the proposed work and closing the contract for employment.
2. Expense of making necessary investigations and surveys.
3. Expense of getting out report.
4. Expense of traveling and time in submitting report.
5. Expense of time in convincing clients and local "home-grown" or "native" engineers that the report, plans and specifications are correct, or rather trying to convince them.
6. Expense of defending plans, specifications and ideas against the "butting-in" engineer.
7. Expense of assisting clients to carry on a campaign of education against the onslaughts of the public.
8. Expense of getting out the final working plans, specifications and estimates.
9. Expense of attending letting of contracts for construction work and for purchasing of materials, machinery, etc., and assisting clients in getting legal contracts closed up.
10. Expense caused by having to defend plans and specifications against the "salesman-engineer," who has something to sell, and promoters of "blue-sky" schemes, whose pose as public benefactors and do everything that they possibly can to have the specifications drawn so that competition is eliminated. (These same fellows are always the first ones to howl if the specification is closed against their particular article, and I have noticed that their particular article is always the best.)
11. Expense of time in examining forms or bonds to be furnished by the contractors.
12. Expense of time in approving manufacturer's plans of machinery, details, etc.
13. Expense of time in getting contractor started on his work.
14. Expense of starting resident engineer out on the work.
15. Expense in straightening a hundred trivial matters as the work progresses. (The resident engineer can handle the situation, but clients always want the "main guy" on the ground in person.)
16. Expense of making final inspection and test of the work.
17. Expense of getting out complete record, plans and maps.
18. Expense of time in getting plant running in good shape.
19. Expense of time in getting what is coming to one of the "balance due."
20. Expense of taking a vacation to recuperate and nurse oneself back to health.

The poet of the Safety Bulletin of the Nevada Consolidated Copper Co. is often effective and euphonious. The following, with trifling emendations, is his latest effort:

SUMMER JOBS FOR COLLEGE STUDENTS

With the summer sun and sunshine come green and greener trees;
Come the college boys to work the while to earn tuition fees,
With a chance to hatch an egg or two of theories in mind,
In the old-time incubator of experience and grind.

As a mucker energetic in a deep-sunk copper mine,
With the wallop of an athlete he can always hit the line.
Though the strain comes on strange muscles he has never read about—
Though his hands are skinned and blistered, he is game and sticks it out.

Some will grab a job as millhand, pushing tailings down the race,
Greasing ore for oil flotation, chasing slimes all o'er the place;
Classifying tanks and tables, grinding mills and crushing rolls,
And the like familiar duties, leading up to cherished goals.

One may take a try at smelting, making effort to acquire
Metallurgical experience in the heat of furnace fire;
Eating smelting smoke and calcines, with sulphurous perfumes,
And absorbing useful knowledge with the flue dust he consumes.

Thus they learn through stress and striving, holding fast to purposed aim,
Fate will favor him most fairly who most squarely plays the game.
And as rocks o'er which it ripples wake the mountain stream to song,
So should knocks of toiling effort make for music for the strong.

PERSONALS

Walter Harvey Weed is in Newfoundland examining a property at Notre Dame Bay and expects to return to New York City about Sept. 1.

W. H. Aldridge started West last week to make a general inspection of the mining interests in his charge. He expected to be away for a month or two.

W. L. Wotherspoon, consulting mechanical and electrical engineer of the Canadian Mining & Exploration Co., Ltd., has returned to New York after a three month trip in the West and Alaska.

H. D. Pallister has resigned as assistant professor of mining at the School of Mines of the Pennsylvania State College to become professor of Geology and Mining at the School of Mines of the University of Texas, El Paso, Tex.

Howland Bancroft sailed from New Orleans on Aug. 11 on the United Fruit Co.'s steamer Turrialba for South America, where he expects to spend the next few months in and about Bolivia examining various tin properties.

J. P. Hutchins writes from a boat on the Volga River whereby he was returning from a journey to the Caucasus. He was en route to Samara, thence to Omsk, after that intending to go up the Irtish river to the Altai region.

A. L. Queneau who was gassed in the battle of Ypres and feared that he would lose his eyesight writes that his eyes are now well. At St. Omer, July 5, he received the Distinguish Conduct Medal from the hands of Prince Arthur of Connaught, and having been "Cité a l'orde de l'Armee" he received the Croix de Guerre on Aug. 2 from the French general. Mr. Queneau writes "Although I have received the decorations given to the heroes, I do not consider that I have fully earned them, considering the immense number of wonderful deeds performed by our comrades of the Infantry." Mr. Queneau is still with the British engineers.

OBITUARY

John T. Morris, former president of the Isaac Morris Iron Works, of Kensington, Penn., died at Bretton Woods, N. H., on Aug. 15, aged 67.

John Ulrich Mef, professor of chemistry at the University of Chicago, died suddenly on Aug. 13 at Carmel-by-the-Sea, Calif. He was born in Switzerland 53 years ago.

Willis B. Burns, ex-mayor of Syracuse and president of the Syracuse Malleable Iron Co., died in that city Aug. 15, at the age of 64. He was a native of Syracuse, and in 1886 was elected mayor, after having served a term as alderman.

D. Austin Brown died at New Haven, Conn., Aug. 11. He was connected with the asbestos industry of Quebec for many years, as manager of Bell's Asbestos Co., Ltd., then as president of the Asbestos Packing Co., and finally as district manager of the H. A. Johns Co., of New York.

INDUSTRIAL NEWS

The Burd High Compression Ring Co., of Rockford, Ill., announces the appointment of O. P. Hand as director of publicity.

At a meeting of the Board of Directors of the American Locomotive Co. held Aug. 17, J. O. Hobby, Jr., was appointed treasurer.

The firm of A. Milne & Co., dealer in steel and iron, will be continued by the surviving partners, Luther Little and James K. Hoyt, under the same firm name and at the present addresses.

The Pacific Tank & Pipe Co., which has grown in 15 years from a small manufacturing plant originally started at San Francisco, to a company with factories at Los Angeles, San Francisco, and Portland, Ore., has seen such a rapid increase of business in Portland that it has found it advantageous to incorporate a separate company to take over its Northwest business. It has therefore organized the National Pipe & Tank Co., and from Aug. 16 all business handled from Portland will be under the name of the National Tank & Pipe Co., an Oregon corporation. The plant is situated at Kenton Station, within the city limits of Portland, and occupies 12 acres of land served by rail and water.

TRADE CATALOGS

R. & J. Dick, Ltd., Passaic, N. J. Catalog. Balata Belting. 20 pp., illus., $3\frac{1}{2}$x6 inches.

A. M. Byers Co., Pittsburgh, Penn. Folder. Byers Black Pipe. 4 pp., illus.; 3x6 inches.

Lea-Courtney Co., Newark, N. J. Catalog H-2. Centrifugal pumps. Illustrated, 64 pp., 6x9 in.

American Pulverizer Co., E. St. Louis, Ill. Catalog No. 21 Pulverizers, air separators. Illustrated, 12 pp., $3\frac{1}{2}$x9 in.

Coppus Engineering & Equipment Co., Worcester, Mass. Catalog. Coppus turbo blower. Illustrated, 40 pp., 6x9 in.

The Cutler-Hammer Mfg. Co., Milwaukee, Wis. Loose Leaf Catalog. Electric-controlling devices. Illustrated, $4\frac{1}{2}$x$7\frac{1}{2}$ in.

Templeton, Kenly & Co., Ltd., 1020 S. Central Ave., Chicago, Ill. Bulletin Catalog 115. Simple jacks. 24 pp., illus.; 6x9 inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1093. Engine-type direct-current machines. Illustrated, 16 pp., 8x$10\frac{1}{2}$ in.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 130. Lubrication of pneumatic tools. Illustrated, 4 pp., 6x9 in.

Emerson Pump & Valve Co., Alexandria, Va. Catalog. Steam pumps, foot-valve and quick-cleaning strainer. Illustrated, 80 pp., 6x9 in.

The Brown Hoisting Machinery Co., Cleveland, Ohio. Bulletin. Brownhoist Schnable patent drag-line bucket. 12 pp., illus., 6x9 inches.

The Globe Iron Roofing & Corrugating Co., Cincinnati, Ohio. Catalog H. Sheet-metal building materials. Illustrated, 166 pp., 6x9 in.

Burd High Compression Ring Co., Rockford, Ill. Directory of piston-ring sizes for engines, tractors, trucks, etc. Illustrated, 134 pp., $4\frac{1}{2}$x7 in.

The Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Catalog. Titanium aluminum and other standard bronze castings. 32 pp., illus., $3\frac{1}{2}$x$8\frac{1}{2}$ inches.

Bausch & Lomb Optical Co., Rochester, N. Y. Catalog. Optical instruments for inspection and testing of materials. 36 pp., illus., $6\frac{1}{2}$x$9\frac{1}{2}$ inches.

W. N. Best, 11 Broadway, N. Y. Catalog. Oil and tar burning apparatus for marine, locomotive and stationary boilers. 32 pp., illus., 6x9 inches.

Armstrong Mfg. Co., Waterloo, Iowa. Catalog. Armstrong special blast-hole drills. 64 pp., illus.; $10\frac{1}{2}$x8 inches.

The steam-shovel mining has resulted in more attention being paid to blasting for the shovels and to the machines that drill the blast holes. Catalog B-1 describes the special blast-hole drilling machines developed by the Armstrong company. The machines are made for either electric or gasoline drive and are claimed to be much superior to the ordinary well-drilling machine and to the piston drill both in speed of drilling and cost per ton of rock broken. The special blast-hole drilling machines are manufactured both in the portable and traction type. The tractors are provided with two speeds so that they may negotiate steep grades readily. From 25 to 35% of lost time occasioned through the use of ordinary well-drilling machines is eliminated by the special blast-hole drill.

SOCIETIES

Mining Institute of Scotland—A general meeting of the Mining Institute of Scotland was held in the rooms of the Institute, 39 Elm Bank Crescent, Glasgow, Aug. 7, 1915, for election of members and discussion of papers previously read before the society, original contributions were read by [illegible] and Gillieaux on lining shafts with concrete Z-blocks, [illegible] Ferguson on the origin and development of [illegible] and metallurgy in the ancient empires of Chaldea, Assyria, Medea, and Persia.

NEW PATENTS

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

ABRASIVE—Electric-Furnace Abrasive and Method of Making the Same. Herbert T. Kalmus, Brookline, Mass., assignor to The Exolon Co., Cambridge, Mass. (U. S. No. 1,149,-064; Aug. 3, 1915.)

ALKALI AND ALUMINA—Treating Leucite-Rock for the Extraction of Alkali and Alumina Contained Therein. Elmer E. Dougherty, Bloomfield, N. J. (U. S. No. 1,148,156; July 27, 1915.)

ALKALIES—Process of Recovering Alkalies from Cement Kilns. Spencer B. Newberry, Baybridge, Ohio. (U. S. No. 1,150,295; Aug. 17, 1915.)

ALLOY—Noble Alloy (Cobalt, Chromium and Iron). Elwood Haynes, Kokomo, Ind. (U. S. No. 1,150,113; Aug. 17, 1915.)

ALLOYS of Platinum and Osmium. Fritz Zimmermann, Newark, N. J., assignor to Baker & Co., Inc. (U. S. No. 13,961; Aug. 10, 1915.)

ALUMINA—Method of Making Alumina. Herbert T. Kalmus, Walter L. Savell, and Kenneth B. Blake, Kington, Ont., Canada, assignors, by direct and mesne assignments, to The Exolon Co., Cambridge, Mass. (U. S. No. 1,148,092; July 27, 1915.)

ALUMINUM—Process of Plating Aluminum. Joseph A. Holl, New Britain, Conn. (U. S. No. 1,147,718; July 27, 1915.)

ALUMINUM CHLORIDE—Production of Aluminum Chloride. Franz von Kügelgen, Holcombs Rock, Va., and George O. Seward, East Orange, N. J., assignors to Virginia Laboratory Co., New York, N. Y. (U. S. No. 1,147,832; July 27, 1915.)

AMALGAMATOR. Charles O. Haskell, Los Angeles, Calif., assignor, by mesne assignments, to Centrifugal Machinery Co., Los Angeles, Calif. (U. S. No. 1,148,770; Aug. 3, 1915.)

AMALGAMATOR—Rotary Amalgamator and Concentrator. Lloyd C. Dewart, San Francisco, Calif. (U. S. No. 1,147,314; July 20, 1915.)

ANNEALING—Continuous Annealing Furnace. Frederick Ingraham and Daniel Lynch, Joliet, Ill., assignors to The American Steel & Wire Co., of New Jersey, Hoboken, N. J. (U. S. No. 1,147,731; July 27, 1915.)

CAGE—Automatic Cage Safety. John L. Clarkson, Gillespie, Ill. (U. S. No. 1,150,341; Aug. 17, 1915.)

CALCINING FURNACE. William R. Clymer, Cleveland, Ohio, assignor to National Carbon Co., Cleveland, Ohio. (U. S. No. 1,147,706; July 27, 1915.)

CAST IRON—Process of Treating Cast Iron to Remove Oxygen. Joseph E. Johnson, Jr., New York, N. Y. (U. S. No. 1,150,201; Aug. 17, 1915.)

CASTING METALS. Samuel Price Wetherill, Jr., Philadelphia, Penn., assignor to Wetherill Finished Castings Co., Philadelphia, Penn. (U. S. No. 1,150,318; Aug. 17, 1915.)

CONCENTRATION—Improved Apparatus for the Water Concentration of Ores or the Like. W. M. Martin, Redruth, Cornwall. (Brit. No. 2845 of 1915.)

CONCENTRATION—Improvements in or Relating to the Concentration of Ores. H. W. C. Annable, Egham, Surrey, Eng. (Brit. No. 15,962 of 1914.)

CONVEYOR—Reciprocating Conveyor or Screen. Bertram Norton, Dudley, England. (U. S. No. 1,146,947; July 20, 1915.)

COOLING ORE. William H. Hubbard, Jr., Salida, Colo., assignor to The Ohio & Colorado Smelting & Refining Co., Denver, Colo. (U. S. No. 1,149,264; Aug. 10, 1915.)

CORROSION—Composition for Coating Surfaces of Iron and Steel. Robert S. Perry, Cave Spring, Ga. (U. S. No. 1,147,971; July 27, 1915.)

CRUCIBLE-LIFTING MECHANISM. Thomas B. Barr, Bethlehem, and Franklin G. Hoyer, South Bethlehem, Penn. (U. S. No. 1,148,138; July 27, 1915.)

CRUSHER. August W. Warsen, New York, N. Y. (U. S. No. 1,148,315; July 27, 1915.)

CRUSHER. William H. Liber, Milwaukee, Wis., assignor, by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. 1,149,146; Aug. 3, 1915.)

CRUSHING Keying Means for Crushing Rolls. Charles G. Buchanan, New York, N. Y. (U. S. No. 1,149,626; Aug. 10, 1915.)

CYANIDING APPARATUS. Frederick E. Carman, Jamaica, N. Y., assignor to Miriam E. Carman, Babylon, N. Y. (U. S. No. 1,146,783; July 20, 1915.)

DRILL. Pneumatic Drill. George H. Gilman, Claremont, N. H. Assignor to Sullivan Machinery Co., Claremont, N. H. (U. S. No. 1,150,357; Aug. 17, 1915.)

DRILL-ROD COUPLING. Euclid Jerome Lowe, Balboa, Canal Zone. (U. S. No. 1,148,977; Aug. 3, 1915.)

DRILLING—Improvements in Valve Gear for Rock Drilling and Like Machines. W. C. Stephens, Carn Brea, Cornwall. (Brit. No. 16,035 of 1914.)

DRILLS—Improvements in or Relating to Fluid-Operated Percussive Drills. Ingersoll-Rand Co., New York, N. Y. (Brit. No. 1274 of 1915.)

DRILLS—Improvements in Valves and Valve Gears for Percussive Rock Drills, Tools and the Like. G. H. T. Rayner, Sheffield, Eng. (Brit. No. 4004 of 1915.)

ELECTRIC FURNACE. John W. Brown, Lakewood, Ohio, assignor to National Carbon Co., Cleveland, Ohio. (U. S. No. 1,147,703; July 27, 1915.)

ELECTRIC-FURNACE REGULATOR. Ray Hill White, Niagara Falls, N. Y., assignor to Norton Co., Worcester, Mass. (U. S. No. 1,149,238; Aug. 10, 1915.)

ELECTRICAL FURNACE. William H. Hampton, New York, N. Y., assignor to The Conley Electric Furnace Co., Inc., Wilmington, Del. (U. S. No. 1,147,165; July 20, 1915.)

ELECTRICAL TREATMENT of Ores, Improvements in or Relating to the. R. W. Highfield, Oxford, Eng. (Brit. No. 6866 of 1914.)

FELDSPAR—Process of Treating Feldspar for Use as a Fertilizer. Charles William Drury, Kingston, Ont. (U. S. No. 1,150,815; Aug. 17, 1915.)

FILTER MEDIUM or Other Article of Manufacture. Ernest J. Sweetland, Montclair, N. J. (U. S. No. 1,147,279; July 20, 1915.)

FILTERING APPARATUS. William E. Holderman, Salt Lake City, Utah. (U. S. No. 1,150,369; Aug. 17, 1915.)

HAULING PLANT. Anton Godan, Kattowitz, Germany, assignor to the Firm of E. Nack's Nachfolger, Kattowitz, Germany. (U. S. No. 1,148,225; July 27, 1915.)

HOISTING ENGINES—Controlling Apparatus for Hoisting Engines. Clarence R. Welch, Pittsburgh, Penn. (U. S. Nos. 1,150,720; 1,150,721 and 1,150,722; Aug. 17, 1915.)

INGOT MOLDS—Adjustable Feeder for Standard Ingot Molds. Ernest J. Turner, Pittsburgh, and Bloomfield H. Howard, Aspinwall, Penn. (U. S. No. 1,149,228; Aug. 10, 1915.)

INGOTS—Treating Iron and Steel Ingots. Benjamin Talbot, Middlesbrough, England. (U. S. No. 1,150,401; Aug. 17, 1915.)

JIG. Guy H. Elmore, Swarthmore, Penn., assignor to William O. Elmore, Oneonta, N. Y. (U. S. No. 1,149,641; Aug. 10, 1915.)

LAMP—Miner's Lamp-Attachment Means. Frank A. Casteel, Washington, D. C., and Robert M. Mayfield, Kingwood, W. Va. (U. S. No. 1,148,889; Aug. 3, 1915.)

LEACHING—Ore-Leaching Apparatus. Murray C. Godbe, Salt Lake City, Utah. (U. S. No. 1,150,263; Aug. 17, 1915.)

LEACHING—Process for Leaching Ores or Minerals Containing Copper Carbonate. J. Erdos, Kolozsvar, Hungary. (Brit. No. 4658 of 1914.)

METAL RECOVERY—Process for the Recovery of Metals from Ore or Slags and Other Furnace Products. W. Troeller, Bad Homburg von der Hohe, Germany. (Brit. No. 7113 of 1914.)

METAL-SEPARATING APPARATUS. Charles O. Haskell, Los Angeles, Calif., assignor, by mesne assignments, to Centrifugal Machinery Co., Los Angeles, Calif. (U. S. No. 1,148,-771; Aug. 3, 1915.)

METALLURGICAL FURNACE. George Campbell Carson, Denver, Colo. (U. S. No. 1,149,495; Aug. 10, 1915.)

NITRIC ACID—Apparatus and Method for Producing Nitric Acid. Harry Dalton Rankin, Pittsburgh, Penn., assignor to Rankin Process Co., Phoenix, Ariz. (U. S. No. 1,150,786; Aug. 17, 1915.)

ORE TREATMENT—Apparatus for Treating Ores. William A. Hoffman, Hazleton, Penn. (U. S. No. 1,150,367; Aug. 17, 1915.)

PHOSPHATES—Method of Treating Phosphates. Charles N. Meriwether, Clarksville, Tenn. (U. S. No. 1,149,390; Aug. 10, 1915.)

PHOSPHORIC ACID—Process of Recovering High-Grade Phosphoric Acid. Frank S. Washburn, Nashville, Tenn. (U. S. No. 1,149,233; Aug. 10, 1915.)

PRECIPITATION—Feeding Apparatus for Feeding a Precipitant. Herbert C. Colburn, Victor, Colo. (U. S. Nos. 1,149,-426 and 1,149,427; Aug. 10, 1915.)

PYROMETER METHOD and Apparatus. Theodore W. Clark, Pittsburgh, Penn., assignor to Gibb Instrument Co., Pittsburgh, Penn. (U. S. No. 1,147,483; July 20, 1915.)

RADIUM—Portable Generator for Producing Radio-Activity in Varying Substances. Cassius R. Heberling and Albert H. Low, Denver, Colo., assignors to The Colorado Radium Products Co., Denver, Colo. (U. S. No. 1,149,829; Aug. 10, 1915.)

REDUCTION—Improvements in or Relating to the Reduction of Metallic Oxides and the Like. R. W. Highfield, Oxford, Eng. (Brit. No. 6865 of 1914.)

REFINING—Metallurgy of Copper. Lawrence Addicks, Perth Amboy, and Clarence L. Brower, Chrome, N. J. (U. S. No. 1,148,814; Aug. 3, 1915.)

RESPIRATORY APPARATUS—Mask, Helmet, or the Like for Use with Respiratory Apparatus. Alexander Bernhard Dräger, Lübeck, Germany. (U. S. No. 1,150,508; Aug. 17, 1915.)

ROASTING—Improvements in Ore-Roasting Furnaces. P. Picketty, Paris, France. (Brit. No. 149 of 1915.)

SEPARATOR. George Allen Fowler, Miami, Ariz., assignor to Crown Mill Equipment Co., Miami, Ariz. (U. S. No. 1,146,-931; July 20, 1915.)

SEPARATOR—Dry and Wet Ore Separator. Joseph Stanley, Geary, Okla. (U. S. No. 1,149,302; Aug. 10, 1915.)

SIZING APPARATUS—Harry W. Hardinge, New York, N. Y., assignor to Hardinge Conical Mill Co., New York, N. Y. (U. S. No. 1,149,826; Aug. 10, 1915.)

SLIME SEPARATOR and Classifier. Charles Allen, El Paso, Tex. (U. S. No. 1,147,356; July 20, 1915.)

SMOKE—Fume and Smoke Filter. Ernest H. Gagnon, Billings, Mont. (U. S. No. 1,148,508; Aug. 3, 1915.)

STEEL—Improvements in or Relating to the Manufacture of Steel by the Basic Open-Hearth Process. A. E. Davies, Bilston, Staffs., Eng. (Brit. No. 20,582 of 1914.)

ZINC—A Method of Treating Zinkiferous Ores with Sulphurous Acid. Erzverwertungs-Ges. m. b. h., Berlin, Germany. (Brit. No. 8197 of 1914.)

ZINC—Process for Recovering Zinc from Zinkiferous Materials. F. C. W. Timm, Hamburg, Germany. (Brit. No. 22,519 of 1913.)

ZINC OXIDE—Improvements Relating to the Reduction of Zinc Oxide. W. Buddeus, Charlottenberg, Germany. (Brit. No. 26,379 of 1913.)

Editorial Correspondence

SAN FRANCISCO—Aug. 18

State Oil and Gas Supervisor has been Appointed by State Mineralogist Hamilton. R. P. McLaughlin has the appointment. His duty is to carry out the provisions of the new law passed by the last legislature for protection of oil and gas wells from water infiltration. Mr. McLaughlin will appoint deputies to be stationed in the oil fields to collect the necessary engineering data, study local problems and advise operators. Mr. McLaughlin has had charge of the oil department of the State Mining Bureau during Mr. Hamilton's incumbency and is author of Bulletin 69, the most comprehensive and complete contribution to petroleum literature ever produced in the state. It was chiefly through Mr. McLaughlin's efforts that the oil bill became a law.

Smelter Fume Question in Redding-Kennett district is again being investigated. Dr. Charles Keane, state veterinarian and member of state smeltery-waste commission, is gathering information, and has sent out notices to farmers in 20 or more townships in Shasta county. This action is direct result of request by farmers for more time in which to present evidence. At recent hearing of state smeltery-waste commission, Mammoth Copper Mining Co. presented much evidence showing damage to vegetation since installation of bag house is very slight, if any; farmers claim they did not have notification in time to prepare evidence and collect witnesses. On account of Mammoth company's evidence, commission decided to reopen case, although it had previously reported to Governor Johnson that smelting-plant fumes were injurious to vegetation of county.

State Highway Labor will be performed for the first time by inmates of the state prison beginning in August. The last legislature under authority of what is known as the Convict Labor Law provided that convicts should be detailed for this work. The highway in Mendocino County to be thus constructed is 33 miles long between Cummings and the south fork of Eel River. In Humboldt County the highway will extend from Miranda to Barberville, a distance of 15 miles. Three camps will be worked on the system of 60 men to each camp. They will consist of three groups, the working crew, the cooking and camp tending crew, and the policing crew. It is said there will be no armed guards. The system will be under the general supervision of the State Highway Commission and the State Board of Prison Directors. Each camp will have a superintendent and foreman in direct charge; and only men who can be trusted, in the opinion of the authorities, will be assigned to employment in these camps. The Colorado modified honor system giving the men additional credits and other advantages will be followed. The work in these counties will be done by men from San Quentin prison.

First-Aid Contest Between California Teams will be held at the Panama Pacific Exposition on Sept. 22, in addition to or conjunction with the third annual field meet of the American Mines Safety Association and the U. S. Bureau of Mines to be held on Sept. 23 and 24. The California contest will be held under the direction of the California Metal Producers Association. The entire cost of this meet of California contestants will be paid out of current revenues of the association without recourse to assessment. This contest will be in first aid work only, while the national contest will be in both mine rescue work and first aid work. The association will provide for each member of each team entered on Sept. 22 a souvenir bronze medal and offers, to the team making the best record on that day, a silver trophy cup, for which annual contests will be had in the future. Each member of the winning team will receive a silver medal provided by the association. Entries for the contest on Sept. 22 must be in the hands of the secretary, Robert I. Kerr, 1109 Merchants National Bank Bldg., San Francisco, not later than Sept. 1, and the names of the members of each team must be in the hands of the secretary not later than Sept. 10. No substitutions will be allowed after the names of the members of the teams have been sent in. All teams competing in the California contest will be allowed also in the national contest on Sept. 23. Entries in this contest must be directed to the committee in charge of national events. It is probable that the same judges and recorders acting for the national events will also act for the California contest. There should be a great deal of interest attached to this California contest since the demonstrations given by the U. S. Bureau of Mines rescue car in various mining districts in the state have been attended by miners who were enthusiastic in the work and who realized the great benefit to follow a thorough knowledge of mine rescue and first aid work. In fact there has been a greater demand by the miners for this class of instruction than the Bureau of Mines has been able to meet.

Rumored Sale of the Zelia Mine on the east belt of the Mother Lode in Amador County has been printed in Amador papers and others in the state, not without some reason. But the sale has not been made. It might be a wise guess that the Zelia will go into the hands of one of the big operating companies and that the newspapers which printed the item first may claim the honor, but it is not a safe statement to make with due consideration of the rights of the operators who may be actually contemplating the purchase. Inquiry today at the office of the company reported to be the purchaser, brought the reply that they had also seen the item printed and that was all they knew about it. The Zelia mine after successful operation for 30 years closed down at the beginning of 1915 and there have been several efforts to sell it. Large bodies of low-grade ore have been explored below the old workings and sufficient development done by intended investors to prove that the Zelia is still a good low-grade mine. The necessity for an entire and complete new equipment, both mining and metallurgical, on the surface and underground will be necessary in order to operate the property by former methods. The owners have dismantled the entire surface equipment except the hoist at the old shaft. So that the mine is in readiness for renewed operation. But if the company which is said to be negotiating for the purchase at present should take the property over, it is quite likely that the mine may be worked from another direction and through another source, so that such new equipment would not be necessary.

SEATTLE—Aug. 17

Nome Mines Are Working Full Swing and outlook for the season is most favorable. The lateness of the season was a drawback for a time but lots of water is now at hand and sluicing is general even where dumps had to lie idle temporarily. The payroll is as large as in any of the last few preceding years.

The Drought Is Seriously Interfering with mining operations in the Fairbanks district and owing to lack of water some of the miners are running half shifts. The problem of the 8-hr. shift is still a live subject of interest, and owing to some of the workers refusing to accept a reduced wage scale for an 8-hr. shift, several plants remain idle and the output of gold for the season will be somewhat decreased. Interest is being enlivened by the building of a government road to the new Tolovana district.

Alaskan Gold, Copper and Silver shipped to Seattle in the first seven months of this year are valued at practically twice the total for the same period last year according to the statement of the collector of customs. So great has been the development in Alaska for the past two years and so huge are the plans now being carried out that it is figured by competent mining men that the years mineral output of the territory will be $24,000,000 in copper alone, and that by 1917 the gold production will be increased to considerably more than $80,000,000 and may possibly reach $100,000,000. Of this sum about $72,000,000 will come from the Juneau gold belt. The principal increases this year so far have been in copper and gold, and these are due to the fact that Cordova since last June has been shipping copper ore at the rate of approximately $2,000,000 a month, and the gold properties in the Juneau region, which began crushing last March, are now in good running order. Sufficient ore has been blocked out in the Kennecott and Jumbo copper mines from which the greater part of the production has come to keep the mines running for several years, and some of the gold mines at Juneau are arranging to double their capacity before the close of the year. Mining men figure that the value of the copper product this year will exceed that of the entire gold output of 1914 which fell a trifle short of $16,000,000 and that

this year will undoubtedly prove a record breaker in the production of silver also. The record for the first seven months of the year already has been badly shattered. Besides the additional gold that is being produced in the Juneau gold belt, several small mills are working in the Port Wells, Kenai, Knik and Fairbanks regions and more are being installed. All of the copper mines of Alaska, many of which were closed down at the beginning of the war because of the drop in the price of copper, are being opened up as rapidly as possible, and many of them are beginning to ship. Besides copper ore, a considerable amount of antimony ore is being shipped and a big increase in the production of tin is expected from the new dredges that have been installed this season. The production so far this year to be shipped through Seattle is about as follows: Copper ore, $5,758,000; gold and silver, $6,496,000; marble and gypsum, $96,000.

SALT LAKE CITY—Aug. 19

There Were Withdrawn during July 3760 acres of land in Utah, Colorado, Idaho, and Montana from all forms of entry, on account of possible value for power-site purposes. The Utah area includes 1800 acres along the Blacksmith Fork river in Cache County.

A Narrow-Gage Railroad for Alta is being exploited. Promoters of the contemplated railroad to connect Alta with the Wasatch terminal of the Salt Lake & Alta railway have been soliciting tonnage of ore for the proposed line provided it is built. There is an old narrow-gage roadbed part way up the cañon and it is said this might be used to great advantage.

Earnings in Utah are placed at $250 per capita on a population of 400,000, according to statistics, recently compiled. It is estimated that new wealth added to the state this year will be at least between $25,000,000 and $30,000,000, and that the mining industry will pay in excess of $10,000,000 in dividends. The figures are conservative, as indicated by the production and dividends during the first half of the year.

Suit Against the Ohio Copper Co. has been started by the Empire Trust Co., of New York to foreclose a mortgage, given to secure $2,000,000 worth of bonds issued by the Ohio Copper, and to determine the interests of other companies claiming certain rights to the properties securing the mortgage. The property will revert to the mortgage holders on Sept. 17, 1915. Three sections of the mill are now working, and treating between 2400 and 2500 tons of ore daily; and 225 men are employed by the General Exploration Co., lessees.

In the University of Utah Controversy the investigating committee of the American Association of University Professors has just returned a final verdict against President J. T. Kingsbury and the board of regents. The report is a book of 82 pages, constituting a scathing indictment of Doctor Kingsbury and the majority of the board of regents. It is signed by all of the seven members of the committee. These investigators conclude, after weighing all the evidence, that the dismissal of the four professors last spring was a grave injustice.

BUTTE—Aug. 19

That the Long Hoped-for Railroad between Radersburg and Three Forks is about to be constructed, is reported, and work on it will be begun within a week or two. Julius Rosholt, a North Dakota capitalist, it is said, will build the road with his own funds. Construction officers have been ordered by Mr. Rosholt to begin preliminary work. It is said that the Keating Gold Mining Co. has entered a contract with Rosholt to pay $1 a ton for all ore hauled over the road from the mine and to furnish a minimum tonnage.

Carrying Out One of the Provisions of the Compensation Law passed by the last legislature of Montana, the state accident board, consisting of A. E. Spriggs, chairman; William Keating, state auditor, and W. J. Swindlehurst, commissioner of labor and industry, is at present on a tour of inspection of the mines, mills and smelting plants in Butte and vicinity. On Aug. 12 the board took a trip through the Washoe smeltery at Anaconda which was most satisfactory, according to the members of the board. Everywhere in the big plant steps are being taken to safeguard the employees in every way, and the most modern equipment is being installed not only in the new departments, but in the older departments as well. The board, while in Butte, will also inspect the Timber Butte and Butte & Superior mills and the East Butte smeltery. "The compensation law is elective," said Mr. Spriggs, in speaking of the method in which it is worked out. "In the six weeks that it has been in operation 90% of the employers in Montana have accepted it—a remarkable fact when compared with other states where a large percentage of the employers had not complied with its provisions within a year." Although in Montana an employer is not compelled to accept the law and may not give his employees recourse to its benefits, he sacrifices his common law rights in court." State mine inspector, W. B. Orem, looks after the safety inspection of the mines in the regular course of his work; the coal mine inspector does the same for the coal mines; the grain inspector looks after the safety of the elevators; the state dairy inspector after the creameries, and the state boiler inspector, while looking after all boilers, inspects other machinery used in connection with boilers. This leaves practically only plants using electric power for the members of the board themselves. The system is working out very well and the members of the board are much gratified with the results to date. Since July 1, when the law went into effect 485 accidents have been reported, of which seven were fatal. Not more than 20% of the injured employees will receive compensation, most of them having been able to return to work within two weeks time.

HOUGHTON, MICH.—Aug. 24

The Annual Report of Wolverine which is now being received by shareholders in Houghton presents some particularly interesting figures to those who were certain that the company soon would be out of business. The cost of copper put on an eight-cent basis is commendable and particular credit is due to the fact that the content of copper was close to 18 pounds to the ton of rock which is quite different from the old time 24-lb. average. Wolverine shares are never active in the market but it must be remembered that Wolverine has comparatively no construction figures to worry about in the future and that it has considerable rich ore yet to take out. Instead of three or four years it is far more reasonable to figure that Wolverine is good for at least ten years on just the ore that can be figured on reasonably from present openings.

The Movement of Lake Superior Stockholders of Centennial to ask the management of the Osceola Consolidated to buy out their interests and have the Centennial retire completely as a separate corporate entity is growing rapidly and a meeting likely will be called in the near future. It is figured that 32% of the stock not owned by the Calumet & Hecla is owned by people of this district. The great majority of these people bought their stock at prices higher than the present market price of the stock. They believe too that the stock is worth a great deal more than the present market price, and that it is particularly valuable to the Osceola Consolidated, which organization is able to operate it through the South Kearsarge shaft. They figure that the stock value ought to be higher to the Osceola Consolidated than to themselves or to the Centennial as an individual organization. Their proposal, as far as it has gone, is exactly the same as that which the Tamarack outstanding shareholders are making to the Calumet & Hecla company and the shareholders here believe it to be more plausible, as the quality of their yet-to-be-mined rock is considerably higher than the Tamarack's development on the Osceola lode.

TORONTO—Aug. 21

Canadian Zinc Co. is the name of a new company with an authorized capital of $500,000, which will build an electric zinc-smelting furnace at Welland. The Weedon Mining Co., which has a lease on large lead-zinc deposits in Quebec, is behind the new venture.

To Insure a Domestic Supply of Zinc at reasonable prices suitable for use in the production of brass for shell and cartridge cases the Canadian Government has passed an Order-in-Council providing for bounties on refined zinc produced from Canadian ore. The order is a tentative one and provides for bounties on a sliding scale not exceeding 2c. per lb. for zinc containing not more than 2% of impurities. These bounties however will not be payable unless the standard price of zinc in London falls below £33 per ton, nor upon zinc produced during the progress of the war, or after July 31, 1917, or upon zinc contracted for by the Shell Committee at a price of 8c. per lb. or over. The total amount to be paid in bounties is not to exceed $400,000. Hitherto zinc ores have not been distilled in Canada, and owing to the high price of the refined metal and the uncertainty of being able to obtain supplies from abroad the Government has been impressed with the necessity of establishing Canadian smelteries. Canadian producers were reluctant to incur the heavy expense of intalling reduction works, unless insured against the drop in prices which is inevitable at the close of the war. The bounties were therefore decided on as a means of overcoming this difficulty. The Shell Committee is prepared to pay the refiner 8c. per lb. or more during the continuance of the war and the requirements at this price, coupled with the bounty in case of a sudden cessation of hostilities will guarantee smelters against loss. It is announced that the Shell Committee has already contracted for several thousand tons of zinc at reasonable rates, which will secure an adequate supply of brass for the manufacture of fixed ammunition, and further large orders for shells are anticipated.

The Mining News

ALASKA

SPEEL RIVER PROJECT (Juneau)—W. P. Lass has returned to Juneau after trip to San Francisco on business in connection with the power plant to be installed at Speel River.

KENNECOTT COPPER (Kennecott)—Reported that on 500 level, 60-ft. vein running 70% copper has been cut. Also reported that Kennecott stock will soon be listed on New York Stock Exchange and quarterly dividends inaugurated.

GRANITE GOLD (Valdez)—Is now crushing steadily and producing about $1000 per day. Plates return from $15 to $48 a ton. Seventy men are now employed and an orebody sufficiently large to keep the present plant busy about three years has been developed.

ANACONDA GROUP (Fairbanks)—J. H. Russell and his associates have sold this property for about $150,000 to be paid from workings; vendors getting 10% of gross output until they are fully paid. New owners who have not been announced will work ground with dredge next summer.

ARIZONA

Gila County

MIAMI (Miami)—In July produced 4,087,611 lb. of copper, largest month's production to date. Reported record low cost of 8.195c. per lb. made. Reported extraction during last 11 days of month, 79.26%. Mill heads average 2.24% copper.

NEW KEYSTONE (Miami)—At special meeting of stockholders will vote on proposed reduction of capital stock from 600,000 shares of $5 par to 39,797 shares at $1 par. Company holds in treasury 39,797 shares of Inspiration stock received for sale of its property to Inspiration. Distribution of Inspiration shares to New Keystone shareholders is contemplated.

Greenlee County

ARIZONA COPPER (Clifton)—Some of company's copper is now being refined electrolytically, owing to disparity in price of casting copper.

Mohave County

TOM REED (Oatman)—Has purchased 51% interest in Crown City group of claims for $200,000. This is reason given for passing of dividend.

BLACK RANGE (Oatman)—Shaft has been retimbered and 60-hp. hoist, 800-ft. compressor and other equipment installed. Shaft will be sunk an additional 150 ft. before any crosscutting will be done.

WHALE (Kingman)—Leviathian Mining Co. represented by J. H. Conway and Geo. H. Pudden, of St. Paul, has exercised its option on Whale molybdenum mines. Operations have been begun under direction of J. W. Cornelius.

BIG JIM (Oatman)—A 25-hp. Fairbanks Morse hoist has been ordered. Efforts for present will be concentrated on group adjoining Black Eagle belonging to Tom Reed company. Sam Warmbath is manager.

Santa Cruz County

BLAND (Alto)—This mine now shipping copper ore, carrying iron, also valuable for flux.

CALIFORNIA

Alameda County

MANGANESE DEPOSITS in Corral Hollow district reported leased to E. A. Wiltsee. Property is owned by McLaughlin Co. Several years ago coal was mined here and used for the manufacture of briquettes by mixing with oil. Manganese has been known to operators, but has never been practically developed. Development work is now said to be in progress. Wagon road will be built from mine to Western Pacific tracks in the vicinity of Carnegie.

Butte County

EXPOSITION (Mooretown)—F. C. Burroughs and A. Khorelius have finished installing new 2-stamp mill. High-grade quartz is reported.

FORBESTOWN CONSOLIDATED (Forbestown)—C. W. Reese has taken lease on property including Gold Bunk, operated 1887 to 1904, Golden Queen and Shakespeare. Operations just beginning.

Calaveras County

ROYAL CONSOLIDATED (Hodson)—Mill is crushing low-grade ore running from $4 to $5 per ton; 125 men on the pay roll.

COLUMBIA MINES (Angels Camp)—The 200-ft. shaft is to be deepened 50 ft. and new drifts started. Mine is equipped with 5-stamp mill; stamps weighing 1250 lb. each.

CALAVERAS COPPER (Copperopolis)—Reported that experiments with flotation process have been very satisfactory and that it has been decided to increase extraction and treatment of ore. Main plant is handling 125 tons per day and flotation unit 25 tons. New grinding machinery and increased flotation capacity will be provided.

Eldorado County

GEORGIA SLIDE (Georgetown)—Property reported to be under consideration by New York men under management of H. K. Montgomery. An option of bond and lease has been taken. Property includes large acreage and number of claims. Mines have been worked almost continuously since 1852 but in later years operators have not been successful in adapting metallurgical methods.

PLACER CLAIMS on middle fork of American River embracing river bed and bars and extending from Horse Shoe Bar, have been sold to L. C. Burpee, of Oakland, by John A. Britton, of San Francisco.

RYAN (Shingle Springs)—Arrangements made for installation of pump with capacity for raising water 300 ft. a distance of 3000 ft. from supply ditches. Machinery for new equipment has been assembled. Gravel will be put through sluice boxes. Gasoline engines will be used.

Humboldt County

GEM (Blue Lake)—Reported that mine has been sold for approximately $40,000 by Gus Perigot and George Teal. Property consists of old Schauber mine; original Gem mine aggregating 400 acres on the Trinity River at confluence of the south fork. Operation has been by hydraulicking. Four miles of flume for carrying water has been constructed. Schauber was one of famous Trinity River gold producers in early day. It was here that Horsehead nugget was found.

Kearn County

CAR LOAD OF ANTIMONY ORE from Poso Creek property, operated by O. H. F. Hansen, will be shipped to New York. Reported to be worth $185 per ton. Hansen owns claims also on Cedar and Caliente Creeks. Poso claims were located 30 years ago. Until recently price of ore was too low for profitable working, because of lack of transportation facilities.

Kings County

C. F. FRANCIS VS. WILLIAM GRAY—Case dismissed by stipulation of attorneys. Question of possession has been settled by litigants. Controversy is over possession of Kings quicksilver mines.

Nevada County

UNION HILL (Grass Valley)—Deepening of shaft to 1200-ft. point is contemplated. Recent reports state that new high-grade orebodies have been disclosed.

KENOSHA (Grass Valley)—Reported that New York men, represented by C. C. Levitt, of San Francisco, considering negotiations for purchase. Property has been idle for about four years and must be unwatered. There is a double pumping system at mine which can be readily put in operation. All machinery is in good condition. Property developed by 450-ft. shaft.

WILLOW VALLEY (San Francisco)—Permission granted by State Corporation Commission to issue 350,000 shares to W. E. Wright in exchange for the North Montana mine and an option to purchase for $64,000, five-eighths interest in the Montana mine; also to issue 400,000 shares to A. W. Hogo in exchange for remaining two-fifths interest; and to sell 250,000 shares at 25c. per share. Properties are in Willow Valley district. Charles W. Hornick, president of company.

Placer County

BARTON (Westville)—New air-lift has been installed. Recent test lowered water in mine 25 ft. in 24 hours. Mine was reopened by Hermine Operation Co., S. H. Brockunier, manager

DEWEY CONSOLIDATED (Iowa Hill)—Sacramento men recently undertook reopening of gravel deposits. Slope is being sunk to reach pay gravel and extensive development is expected.

DELLORSI GOLD MINING CO. (Dutch Flat)—New incorporation; capital stock $100,000, paid up. Directors are J. M. Dellorsi, J. T. Patrick, Fred C. Dill of Dutch Flat; Will McPatrick of Auburn; Toney Dellorsi, Forest Hill.

Plumas County

JAMISON (Johnsville)—Fifty men are employed under management of George Redstreake. Good ore is reported.

PLUMAS-EUREKA (Johnsville)—Cleaning out tunnel is in progress and it is reported that mine will be reopened. There has been talk of driving lower tunnel to orebodies which are said to persist below old working. Charles D. Etark, Jr. is superintendent.

DIVING FOR GOLD at Rich Bar will be undertaken by an organized company of nine men known as E. C. Lang Manufacturing Co. Claims are situated on Feather River at upper edge of bar. Large platform and derrick and 35-hp. donkey engine have been installed. Clamshell dredging bucket will be used to lift large boulders from bed of river and sand and gravel pump will handle sand and larger gravel. In deeper water below main plant, floating platform is installed for use of divers, A. B. Knapp and A. E. Johnson. They use regulation diving suits and alternate in shifts. Point where work is now going on, river is 30 ft. deep and current swift.

Shasta County

NOBLE ELECTRIC STEEL (Heroult)—State railroad commission has been asked to sanction lease to this company of Sacramento Valley & Eastern R.R., running from Pit to Bully Hill; lease to run until Dec. 31, 1918. This railroad was built by Bully Hill Copper Mining & Smelting Co. which discontinued operations five years ago on account of damage done to crops from its smelting plant. Since that time Noble Electric has been chief patron of railroad, and needs better service than railroad company can give. Agreement between the two companies fixes rental at $1 per year; steel company to bear all expenses of operation and upkeep, and to post bond of $10,000. Steel company to be allowed to terminate lease on 60 days' notice.

EMMA (Buckeye)—Shoot of good-grade ore opened recently. Plans called to drive long tunnel to explore this group.

OLIVE (Redding)—M. V. Collins has made preparations to add more stamps to stamp mill.

GLADSTONE (French Gulch)—Vertical shaft will reach depth of 250 ft. below lowest, or 1200 level, in August, at which depth it is expected vein will be cut on its dip.

SUMMIT (French Gulch)—Ore will be treated in Brunswick 5-stamp mill. Small-track incline tram being built from mine to mill; ore will be lowered in car, and car returned by hoist and cable.

RED TOP MINING CO. (Redding)—New incorporation organized by French and Spanish residents of Stockton. Capitalization, $25,000. Directors are Fermin Alustiza, Manuel Llano and Jose Dominguez. Company will operate Black Cloud and Red Top claims in Quartz Hill district, north of Redding.

Yuba County

YUKON GOLD (Hammonton)—Has acquired control of another dredging property, adjoining Yuba Consolidated, which contains, according to official estimates, approximately $4,000,000 gross. One of largest dredges ever constructed has been ordered and is scheduled to begin operation about end of year.

COLORADO

Boulder County

ROYAL GEM (Cardinal)—New Orleans capitalists have incorporated company to operate this Caribou hill group.

CARIMAN (Caribou)—Cyanide mill handles daily about 100 tons of stuff from old dumps of Caribou and Poorman mines. Recovery chiefly in silver. Both mines are being re-opened and developed, Caribou shaft being retimbered to 500 level, depth at which Boulder County adit will tap these workings.

Clear Creek County

HUDSON MILL (Idaho Springs)—Cyanidation has been abandoned in this custom plant and is superseded by flotation now in commercial operation a month. New equipment treats only tails from amalgamation and concentration.

LITTLE GIANT (Lawson)—Has few men engaged developing its large group of lode claims some of which were prominent for notable shipments in early days. Tabor adit is being driven to intersect Little Giant vein while Tabor vein itself is showing shoot of good ore.

WESTERN METALS (Georgetown)—Old company, organized to commercialize Madan dry-chlorination process in large mill erected here several years ago, languished for lack of capital but has been revived as the Colorado Metals Mining & Milling Co., with Prof. F. W. Traphagen as president. John L. Malm, inventor, will continue as metallurgist.

Lake County

WATERLOO (Leadville)—George Cramer, leaser, is shipping high-grade manganese ore.

FOREST CITY (Leadville)—Leasers, following vein in bottom level, struck shoot of silver-gold-lead-copper ore. Winze will be sunk in vein prospecting for large body.

MAYFLOWER (Silverton)—Winze being sunk from adit level follows galena shoot that, at 50 ft. depth, is 6 ft. thick. All ground broken is packed out on burros.

PENROSE (Leadville)—Station for first pair of pumps of Downtown Pumping Co. having been completed last week, pumps have been lowered and placed. Full duty will now be placed on equipment until depth for last pump station is reached.

VALLEY (Leadville)—Station for electric-driven air compressor is being cut at 1150 ft. from portal of adit, this bringing station at about 50 ft. from present breast that should be close to anticipated ore-bearing contact for which this bore was projected by Warren F. Page.

Ouray County

VALKYRIE (Ouray)—Leasers McDonald and Garrett have installed 2000-ft. pipeline to convey compressed air from plant at Mountain Top mine and will hereafter push development by use of machine drills.

San Juan County

SUNNYSIDE (Silverton)—Shipped 45 cars zinc concentrate in one train recently to smeltery at Blende. Huff electrostatic plant being enlarged to 2000-tons per month capacity.

THE SILVER CROWN MINING AND DEVELOPMENT CO. (Silverton)—This is a new incorporation which has been recently organized by James T. Burns for the purpose of operating the Lee mine on Grouse Mt. A long-term bond and lease has been secured on property which has been idle for several years. Recent exploration has disclosed a strong vein containing promising amounts of gold, silver and copper. Vigorous development will be started by new company.

San Miguel County

MATTERHORN (Ophir Loop)—Development work will be resumed on larger scale in this property on Yellow Mt.

CARIBEAU (Ophir)—J. C. Shortevant has installed two flotation machines next old Caribeau mill and will work over old tailing dumps and make tests on ore from mines.

Summit County

WELLINGTON MINES (Breckenridge)—Under management of R. M. Henderson, has been able to produce abundance of zinc-lead ore and to dispose of its high-grade concentrates under contract. Zinc concentrate goes to Empire Zinc Co. Between Dec. 1, 1914 and June 30, 1915, gross sales of concentrates—zinc and lead—amounted to $255,182. Total mining, milling and other expenses were $101,258, leaving net profits about $154,000.

BLUE BIRD (Independence). This property being developed vigorously by Franklin Leasing Co., under direction of Nelson Franklin, who is president. Forty to fifty men are employed in mining and development on the 19th and 20th levels, which have recently yielded several rich pockets of smelting ore. Careful sampling of the dumps is in progress with view of determining advisability of erecting mill for the treatment of old dumps, said to average above $4 a ton in gold.

Teller County

SPECIMEN (Victor)—Leaser McFarland has set up washers and screens on surface and is recovering, from mine dump, concentrate that sells for $50 per ton.

C. O. D. (Cripple Creek)—New heavy hoist being installed. Compressor will also be put in. Shaft will be sunk 500 ft. below present depth of 800 ft. Several sets of leasers shipping.

PORTLAND-INDEPENDENCE (Victor)—To tram ore from old adit on Portland ground into Independence mill, company is building large trestle. Dump material, as well as ore, will be treated.

VINDICATOR (Independence)—New shafthouse will be erected at No. 2 shaft to replace building destroyed by fire last spring. It will be equipped with new hoist and compressor.

MARY McKINNEY (Anaconda)—Plant was closed down two months ago for repairs to hoisting shaft and installation of electric-driven compressor and hoist that have now been tested and accepted. New drifts will be started from shaft at 1100 level.

ANNIE D. (Cripple Creek)—John A. Smith and Fred S. Cropper, pioneers in this district, upon learning of recent Tenderfoot Hill strikes, have returned from Waterloo, Iowa, and have bought this claim which they prospected years ago. They propose immediate development.

IDAHO

Cassia County

BELCHER (Albion)—First car of ore ever shipped from this property is at Salt Lake being sampled. Assays of ore show average about $16 in gold, 35% lead, 28 ounces silver and 2% copper.

Shoshone County

REINDEER QUEEN (Mullan)—Plans to erect milling plant of 150 ton capacity.

CONSTITUTION (Kellogg)—Teams are engaged in hauling zinc ore from mine to station on railway, distance of nine miles. One car-load has been shipped and another car is loading. Ore carrying 45 to 50% zinc is being taken from both tunnels for width of 6 to 8 ft. Eighteen men are employed and new messhouse and bunkhouse for 30 men are nearly finished. Charles van Horn is manager.

HIGHLAND-SURPRISE (Kellogg)—Satisfactory smelter contract having been negotiated and 100-ton mill having been renovated, Highland-Surprise mine, Pine Creek property credited with a past production of $100,000, is again on shipping basis. Fifteen men are employed in mine and there is said to be sufficient zinc ore developed to keep mill running at capacity for long period.

CASTLE ROCK (Wallace)—At stockholders' meeting Aug. 7, decided to levy small assessment to obtain funds for further development work. Mine is located on Placer Creek two miles from mouth. Contract for 200-ft. shaft has been let and driving of 50-ft. crosscut to vein is under way. Capacity of compressor, driven by water obtained from flume on Placer Creek, will be increased by addition of second nozzle.

SILVER CABLE (Mullan)—Workings of this company are all in Montana, although some of claims lie on Idaho side. Raise connecting upper and intermediate levels has been completed. Upper tunnel cut top of shoot of zinc ore and intermediate tunnel 92 ft. lower follows shoot for 300 ft.; ore is said to be of milling grade across width of 12 ft. For 70 ft. along drift there is a 3½-ft. streak of ore assaying 40% zinc, and it is planned to make shipments from this.

RAY-JEFFERSON (Wallace)—Recently announced plans of this company, which owns group of claims adjoining Interstate-Callahan on Nine Mile Creek, call for construction, at cost of $100,000, of thoroughly modern concentration plant of 250 tons daily capacity. Underground development during winter and electric-haulage system connecting mine with proposed mill will cost an additional $100,000. Heavy timbers and much of the equipment for the mill will be delivered this fall and preliminary work will begin during winter, so that actual construction work can start as soon as possible in the spring. It is hoped to have mill running by Aug. 1, 1916.

MICHIGAN

Copper

LAKE (Houghton)—Working force has been increased by 30 men. Manager Walker is getting things in shape for continued increase in tonnage.

SOUTH LAKE (Houghton)—Has increased its compressor capacity so that now has full crew on night shift as well as day shift.

ALLOUEZ (Allouez)—Is maintaining rock tonnage enough to keep more than two heads busy all of time. Increase recently has reached 1900 tons daily, which is close to 3-ton average in mill.

CHAMPION (Painesdale)—Experiment of shooting tailings from stamp mills into mine for filling where waste rock is scarce, is generally looked upon as successful. Champion rock recently has been of such good grade that there is small discard and larger shipments of sand could be used.

Iron

RICHMOND (Palmer)—Working force here has been added to lately. Mining is carried on by openpit method. About 150,000 tons will be shipped this year.

CASCADE (Cascade)—First train load of ore was shipped from this company's property on Aug. 21. Mine is now operating steadily and working force has been considerably increased. Shaft is 960 ft. in depth. It is lined with concrete from collar to sump. It is considered one of finest shafts on ranges.

MINNESOTA

Cuyuna Range

ROWLEY (Barrows)—Diversion run from Duluth to property of the Barrows Mining Co. on Sunday, Aug. 22, to permit stockholders to see progress being made. Shaft will be concrete one, with 29,000-lb. shoe.

Mesabi Range

CROSBY (Nashwauk)—Concentrating plant is rapidly nearing completion. Believed mine will be started when mill is ready. This will be third plant of its kind for Nashwauk.

BUTLER BROS. (Nashwauk)—Is operating Hawkins and Quinn-Harrison properties. Both mines have washing plants. About 60 cars of concentrates being shipped daily.

HELMER (Kinney)—Contract recently placed for electrification of entire mine. After an idleness of several years, mine will resume operations immediately upon completion of electrical installations.

MONROE (Chisholm)—Shaft 200 ft. in depth will soon be lined with concrete from top to bottom. Pump station at bottom is being repaired. Mine will be in good shape for getting out ore when all of improvements are finished.

SECTION 27 (Chisholm)—Shaft here is now down 200 ft. Pumps are now able to take care of all of water. Some trouble was experienced from this source short time ago. Timber shaft is down 90 ft. Hoisting engine is being installed. Boiler house, and change house will soon be started. Temporary boilers are now taking care of pumps.

Vermilion Range

B. M. PATTISON (Ely)—First shipment made from mine went forward Aug. 14, being 50 carloads. Entire stock pile has been sold.

MONTANA

Beaverhead County

BOSTON & MONTANA (Elkhorn)—Former Lieutenant Governor Allen, the chief promoter of company, who has just returned from east, reports that the New York banking firm of W. W. Cohen & Co. has become fiscal agents for company in East. Present plans call for continuation of development work at Elkhorn mines. Railroad project will be held in abeyance until fall. Main reason for waiting is on account of war conditions which have sent price of steel up and made it difficult to push plans through at present.

BANNACK GOLD (Bannack)—Excellent progress being made driving company's main tunnel near Bannack. Tunnel now in distance of 500 ft. being driven for contact between limestone and syenite, along which gold ore occurs. There is said to be at present blocked out in mine approximately 100,000 tons of milling ore that will average $10 per ton. Treatment tests have demonstrated that highest extraction, amounting to 96%, can be attained by straight cyaniding. It is intention of management practically to double present tonnage blocked out before taking steps toward building mill. Flume carrying water for power development to the extent of 150 or 200 hp. has been completed. Property consists of 13 patented claims. Grasshopper Creek traverses holdings of company and placer beds lying below claims have been worked for years by dredges and have produced in neighborhood of $12,000,000 in gold.

Broadwater County

BLACK FRIDAY (Radersburg)—With construction of proposed railroad into Radersburg district actually begun, attention is again being directed to development of this mine and adjoining properties, located in same group with Keating properties. Mine was closed down three years ago on account of litigation which has been settled since; ground in dispute having been secured by Black Friday company. Strike of rich gold ore was recently made by leasers on one of company's claims and preparations are being made by company for further development. Black Friday vein is about 2 ft. wide carrying mineral in foot- and hanging-wall streaks from $38 to $200 per ton.

Deer Lodge County

WASHOE REDUCTION WORKS (Anaconda)—Work on No. 9 reverberatory is going on at rapid pace. Waste gases from this furnace will fire two Stirling boilers, after which they will be carried to big stack through brick and steel flue. Steel work for this flue is now complete and brick work is under way. Steel stack will be 200 ft. high and self supporting. It will be 12 ft. in diameter. No. 4 converter of Great Falls type is being installed and is fourth of its kind to be put in building. In main reverberatory section are five furnaces using pulverized coal and three more of same type will complete this part of plant.

Lewis and Clark County

NORTHWESTERN METALS (Helena)—Involuntary bankruptcy proceedings were begun in Federal Court against this company, which proposed to refine ores by electrolytic and other processes and erected an expensive plant in Helena. Petitioning creditors are M. L. Hewett with a claim of $38,236; C. C. Titus with a claim of $8668, and the Helena Adjustment Company whose claim is $531. For some time the promoters of this enterprise were very enthusiastic about success of their processes but it seems that results of laboratory experiments failed to materialize when applied to operations on commercial scale.

Silver Bow County

BUTTE & LONDON COPPER (Butte)—After idleness of more than five years work will be resumed at company's property northeast of Meaderville. Situated outside confines of generally acknowledged mineral zone, company's engineers are satisfied that their exploration work will result in fixing new and enlarged mineral area for Butte. Shaft will be sunk from 1130 to 1830-ft. level and then crosscut of 1200 ft. made each way, north and south to cut vein which, it is believed, runs from Butte & Superior hill, directly on west, toward Columbia Gardens. Half a million dollars have already been spent on property. Splendid three-compartment shaft was sunk and up-to-date electric machinery installed. There are 20 men at work now on property. Crew will be increased to upward of 100 when driving of crosscuts begins. Point of interest is fact that should promising mineral be encountered in this section of Butte camp, it will indicate that ore bodies of the Anaconda hill may again be found to east of Silver Bow Creek. W. W. McDowell, of Butte, is president of company. He is backed by T. F. Cole and C. A. Congdon, Duluth financiers.

Silver Bow County

RAINBOW DEVELOPMENT (Butte)—All water has been pumped from shaft of Rainbow mine and company is prepared to do development and exploration work on large scale. Shaft was found to be in excellent condition. Pumping station was installed on 1000-ft. level, pumps having capacity to guarantee freedom of shaft from water.

TIP-TOMMY (Butte)—After nine months of idleness, during which shaft was allowed to fill with water, company's mine is ready for operations to be resumed. Everything was found in good condition and there will be no delay in general mining work. Three shifts have been put to work comprising same number of men employed before shut-down. Shipping of ore will begin at once. Later it is probable that shaft will be sunk to 2800-ft. level.

BUTTE & SUPERIOR (Butte)—According to company's report for quarter ending June 30, the work of sinking shaft has been completed to short distance below the 1700 ft. level. Ordinary routine development work resulted in blocking out new tonnage of an amount equivalent to that mined. It is expected that old tailings produced prior to this year will be worked over at favorable time and produce substantial profit. Additional ground acquired for disposition of tailings will permit of storing separately, tailings now being produced, so that earlier accumulations can be worked over when desired. Additional area will also provide ample tailings storage facilities for many years.

NEVADA

Elko County

BUNKER HILL (Bullion)—Frederick Davis, manager, leased old smeltery site to T. R. Moe and associates of San Francisco who will erect 50-ton smelting plant within next 90 days.

Humboldt County

FIRE SWEPT ROCHESTER shortly after midnight Aug. 15 and destroyed upper half of town. Little or no insurance was carried. Loss is heavy. Fire burned several hours. Rebuilding already underway.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 14 amounted to 10,320 tons valued at $211,720 compared to 10,722 tons week previous. Producers were: Tonopah Belmont, 3529 tons; Tonopah Mining, 2800; Tonopah Extension, 1850; West End, 1002; Jim Butler, 1050; and miscellaneous leasers 89 tons.

Storey County

OPHIR (Virginia)—At Central tunnel 250 level winze cleaned out and compressed-air line for hoist and drills laid from C. & C. shaft to the tunnel.

JACKET-CROWN POINT-BELCHER (Gold Hill)—In joint incline Belcher ground 3 new sets of timbers installed below 1500 level. On 1300 level 90 tons of mill rock saved. Jacket mill received 1052 tons of dump rock.

CON VIRGINIA (Virginia)—In connection with Ophir and Comstock Pumping Association repairs to airways on 1600 and 1900 levels have been continued. Two compartment winze station on 2500 level cleaned out and enlarged. Hoist will be installed at this station and the winze equipped for hoisting from 2700 level.

MEXICAN, UNION, SIERRA NEVADA (Virginia)—Connections made on 2500 level, completing system of airways. Union saved 14 tons ore averaging $12.85 from air connections. Mexican vein widened 3 ft. Quartz assaying low. Mexican 2700 level west crosscut advanced 39 ft.; face in porphyry and stringers of quartz. Mexican mill crushed 123 tons. Mexican ore averaging $8.77 and 14 tons Union ore sampling $12.85.

Washoe County

GEORGE WINGFIELD (Reno)—Has purchased controlling interests in Boundary Red Mountain Gold Mining Co. in Mt. Bacon district, Washington, one mile from British Columbia boundary and 90 miles east of Vancouver and plans to erect 10-stamp mill, power plant, and install mining machinery.

TENNESSEE

Washington County

CLINCHFIELD PRODUCTS CORPORATION (Johnson City)—This Corporation of 100 William St., New York City is building $500,000 chemical plant at Johnson City for manufacture of lithophone and kindred products.

SOUTH DAKOTA

Lawrence County

GOLDEN REWARD (Deadwood)—Astoria roaster is at present outputting 50 to 60 tons daily which is shipped to cyanide mill at Deadwood for treatment. Results indicate 90% extraction on hard-blue, or unoxidized ores.

RATTLESNAKE JACK (Galena)—Fifty tons daily are being put through new mill which is one of most modern in Black Hills, containing 10 stamps, Hardinge 22-in. by 84-in. pebble mill, Dorr classifier, Trent cyaniding machinery, Merrill zinc-dust precipitating equipment. Amalgamating plates are installed, but have not been used since first clean-up. Plant is driven by electricity.

TROJAN (Trojan)—In preparation for thorough [illegible] improvements Holt-Dern roaster will be installed. Company believes that cyanide recovery on average ore can be increased to 90% by previously giving it a chloridizing roast. Under present methods oxidized ores yield 75% and about 85% of silver. Unoxidized ores are not worked when valuable enough they are smelted. Result is large quantities of ore are left in stopes.

UTAH

Beaver County

THERE IS MUCH ACTIVITY in the Star district near Milford, and more properties are shipping than in several years.

CEDAR-TALISMAN (Milford)—Shipments of zinc ore and of silver-lead ore are being made. Zinc is being mined from 225 and 1000 levels south of shaft. It occurs as bedded deposit lying under lead ore, and is from 18 in. to 4 ft. in thickness.

MAJESTIC (Milford)—Zinc ore has been opened at Harrington-Hickory mine 45 ft. on strike, and up to 10 ft. in thickness. A two-year contract for smelting copper ore from Old Hickory mine has been made.

LEONORA (Milford)—Better progress in development being made since installation of new machinery. Drifting is being done on 400 level, and three fissures between main shaft and limestone-monzonite contact will be prospected.

Juab County

TINTIC ORE SHIPMENTS for week ended Aug. 13 amounted to 171 cars estimated at 8550 tons valued at $210,000. There were 22 shippers.

YANKEE CONSOLIDATED (Eureka)—Discovery of ore made recently at surface in Humbug claim, and favorable reports continue to come in. Ore, which is lead running well in silver, is thought to be on east, or May Day ore zone.

MAY DAY (Eureka)—About 30 leasers are working, and making shipments of zinc ore amounting to 250 tons a month. Eighty tons recently shipped ran 31% zinc. Company is shipping 20 cars of lead-silver ore a month.

SCRANTON-LEHI (Eureka)—This property, which adjoins Scranton in North Tintic, is being developed through two tunnels. Vein material similar to that in Scranton has been cut in lower tunnel. This carries small amounts of zinc. Scranton has produced much high-grade ore from large lenses of zinkite.

Piute County

UTAH FERTILIZER & CHEMICAL CO. (Green River)—This company has been incorporated to work group of 15 alunite claims in Mount Baldy mining district south of Marysvale. Capitalization is $25,000, divided into shares of $5 each. Charles P. Tasker, who has been drilling for oil in southeastern Utah, is president.

Salt Lake County

TAR BABY (Salt Lake)—Twenty feet of low-grade ore has been cut in company's tunnel in Big Cottonwood.

UTAH COPPER (Bingham)—Average daily output during July was 28,000 tons of ore. Of this the D. & R. G. handled 9500 tons and Bingham & Garfield, 18,500 tons.

UTAH-APEX (Bingham)—New smelting contract or renewal has been made with A. S. & R. New flotation plant for treating fines from 250-ton mill is in operation.

WEST TOLEDO (Alta)—Cross-cut which is being driven for Toledo fissure is being advanced 3 ft. daily. Vein is expected to be cut in about 40 ft. Work is being done at two other points.

CARDIFF (Salt Lake)—New 150-hp. Laidlaw-Dunn-Gordon compressor has been ordered, and will be installed as soon as possible. This will be an electrically driven 17 and 10x14 feather-valve compressor, and is rated at 850 cu.ft. of free air per minute.

WASATCH MINES (Alta)—Car of ore has been shipped from No. 5 workings, and further ore is broken and ready for shipment. Silver-lead ore a foot thick has been cut in tunnel on Relief claim. This is under some zinc ore opened at surface. Leasers are making shipments from different parts of property.

COTTONWOOD-KING (Salt Lake)—This property, formerly Giles, in Big Cottonwood has opened 6 ft. of vein matter containing iron and manganese. Work is being done in middle tunnel, which is in 600 ft., and is following limestone-quartzite contact. S. S. Parry is general manager.

SOUTH HECLA (Alta)—Shipment of car a day is being made from Wedge fissure, and shipments will soon be started from Kate Hayes fissure in Quincy tunnel. It is thought that two cars daily will be shipped from this part of the ground. Fields & Claflin, leasers on Quincy tunnel, are opening good body of sand carbonate ore with some galena.

Summit County

PARK CITY ORE SHIPMENTS for week ended Aug. 14 amounted to 1752 tons valued at $76,000 compared with 2342 tons last week.

SILVER KING COALITION (Park City)—Work of installing new flotation section at mill is in progress. Concrete foundations are completed, and part of equipment, including tanks and cells, are on ground.

NEW YORK BONANZA (Park City)—Appraisers are looking over this company's property, now in bankruptcy. Appraisers are M. J. McGill, H. S. Townsend, and J. Fewson Smith.

KEYSTONE (Park City)—Work of cleaning up at this property in Thaynes Canon is being done. It is thought by stockholders that work will be resumed, or that property will be sold to Silver King Coalition.

Tooele County

COMPANIES NOW OPERATING AT OPHIR are Ophir Hill Consolidated, Cliff, Lion Hill Consolidated, Buffalo, Eureka-Ophir, and Montana Consolidated. Production of camp to date is placed at $20,945,000.

OPHIR MINES DEVELOPMENT (Ophir)—Articles of incorporation filed by this company, to develop McKinley group of patented claims adjoining Ophir Hill Consolidated owned by Senator W. A. Clark. Capitalization is $50,000. There are 500,000 shares of which 250,000 remain in treasury. A. K. Tiernan is president. Continuation of Ophir Hill Consolidated ore beds and fissures on south side of canon will be looked for.

WASHINGTON

King County

SEATTLE SMELTING CO. (Seattle)—W. D. Wood, consulting business manager of company, is quoted as stating plans are being made for erection of smelting plant at Anacortes, Wash., for treatment of antimony ore.

Spokane County

MAYFLOWER (Spokane)—Is operating prospect in Nine Mile district of Cœur d'Alenes, Idaho, and plans for installation of compressor and sinking equipment.

SILVERADO (Spokane)—Plans for installation of compressor equipment and electric power plant at its mine near Osborn, Idaho. C. D. Musen, Spokane, is secretary.

EMPIRE MOLYBDENITE MINING & MILLING CO. (Spokane)—First molybdenite mining company organized to operate in the Spokane district, property being in northern Idaho. Thomas A. LePage, president, declares that sufficient ore has been uncovered to warrant erection of mill.

Stevens County

NORTHPORT SMELTERY (Northport)—Men were put to work at Northport smelting plant Aug. 16 and more are to follow. Furnaces 1, 2, 3 and 4 are to be torn down and 5 and 6 are to be retained and used for treatment of copper ore. Lead furnaces are to be installed. Smeltery is to be operated in small way at first and later made as modern as possible, with electric power and mechanical handling devices.

CANADA

British Columbia

GRANBY CONSOLIDATED (Vancouver)—During fiscal year ended June 30 production amounted to 26,705,928 lb. of copper; 415,806 oz. of silver, and 32,126 oz. of gold. Of the total, 10,005,278 lb. came from Grand Forks smeltery and 16,700,650 lb. came from New Hidden Creek smeltery at Anyox. Despite low operating costs at Anyox, three months shutdown at Grand Forks last fall and other facts, made total cost per lb. reach 10½c.

Ontario

PRESTON EAST DOME (Porcupine)—Will be reopened.

VIPOND (Porcupine)—In July treated 3670 tons and recovered $30,000 bullion. Sinking has been started to 550 ft. level.

TOUGH OAKES (Kirkland Lake)—July production was $55,500 from a little over 2300 tons of ore. Mill capacity has been raised to 120 tons a day.

ZENITH ZINC (Nipigon Bay)—As result of the government policy of encouraging zinc refining in Canada this mine will shortly be re-opened.

NIPISSING (Cobalt)—In July produced silver to estimated net value of $180,000 and shipped bullion from Nipissing and custom ores to estimated net value of $262,616. High-grade mill treated 37 tons and the low-grade mill 6960 tons of ore.

HOLLINGER (Timmins)—Usual 4-weekly statement for period ending July 15 shows gross profits of $124,222 from treatment of 25,076 tons of ore of average value of $9.24. Working costs were $3.53 per ton milled.

DOME (Porcupine)—In July treated 28,300 tons and recovered $131,928, an average of $4.67 a ton. This represents a large increase in tonnage and value over preceding month, and constitutes record production since commencement of operations.

McINTYRE (Porcupine)—In July treated 94°6 tons averaging $7.89 and made recovery of 96%; total of $71,600. Total costs were $44,000 or $4.70 a ton. Net profits were $27,600. Owing to favorable developments underground, mill capacity will be increased to 400 tons a day.

STANDARD SMELTING & REFINING CO. (North Bay)—This company will establish plant up Niagara River from Chippawa, Ont., where it has secured works of British Canadian Smelting Co. with 20 acres of land. Large building is being erected. Company will treat nickel and cobalt ores.

DOME LAKE (Porcupine)—Will increase capital of company from $1,000,000 to $2,000,000. Of new capital, 100,000 shares will be offered to shareholders at 40c. to provide funds for equipment of mill with cyanide plant, and to carry on more extensive development. For week ending Aug. 4 mill produced $3100.

MEXICO

Chihuahua

CUSI (Cusihueriachic)—Has just completed experimental mill. Test run promises bright future.

Pachuca

SANTA GERTRUDIS (Pachuca)—In June crushed 14,066 tons of ore. Estimated profit £4860.

Sonora

BELLOTA (Nacozari)—J. V. Fryer and A. Martinet have recently purchased this property from A. Fuller and have been doing considerable work. Shaft 120-ft. has been sunk and 18 in. of $50 ore opened up in the bottom of shaft. Four cars have been shipped to smelters and two more will be shipped as soon as cars can be secured.

SOUTH AMERICA

Chile

ERADEN (Rancagua)—Record production in July, amounting to 1415 tons (2000 lb.) of copper; production for first 7 months of this year, 9064 tons.

CHILE COPPER (Chuquicamata)—By end of October it is expected that full mill equipment will be in operation with nominal daily capacity of 10,000 tons. Third unit of power plant is scheduled to start operations Sept. 1, and fourth unit Oct. 1. Favorable underground developments continuing; one drill hole down 1530 ft. continues in ore averaging 2.11% copper.

The Market Report

Metal Markets

NEW YORK—Aug. 25

During the last week copper, lead and zinc all became emphatically stronger, the price of copper rising about 1c. per lb., and the price for zinc rising nearly 2c. a lb.

Copper, Tin, Lead and Zinc

Copper—Up to Monday the market was very weak, there being sellers all the time at 16c., regular terms, and there were sufficient shadings on some business to bring the net cash price, basis New York, down to 15¾c. At this low level, considerable business was done both with domestic consumers and with foreign governments. It was particularly noteworthy that American consumers bought both for prompt and for September shipment, indicating that they had allowed their supplies to run low. This buying probably absorbed most of the cheap copper offered by the smaller producers, agencies, etc., and on Monday the market started upward. Early in the day about 15.85c., cash, New York, was accepted on some export business, but by the end of the day the market stood at 16.10, or 16¼c., regular terms. On Tuesday there were sales at 16¼c., regular terms, at the opening, but at the close the market stood at 16⅝c., regular terms, for nearby shipments, and 16¾c., regular terms, for futures. On Wednesday there were sellers at 16¾c., regular terms, at the opening, but the tone of the market was decidedly firmer, and before the end of the day 17c., regular terms, was realized.

The principal producers did not figure in the market this week, their price being 17½@18c., regular terms. At the close it looked as if buyers would have to go to them and pay their price, the copper for sale by outside producers having been so completely absorbed, and the upturn in the market having been so sharp.

In the European markets during the last week there was sharp competition from Australian and Japanese sellers who accepted prices that American producers did not care to accept. However, at the beginning of the week a large order was taken by an American producer at a relatively low price.

Our correspondent reports no copper was shipped through the port of Baltimore during the last week.

Copper Sheets are quoted at 23c. base, with the usual advance for cold rolled. Copper-wire market has been unsettled; prices at the mill range from 17⅜@18¼c. per lb.

Tin—The market sagged off a little and then rallied at the close in sympathy with the advances in the other metals. There was a steady demand but in the main the market was featureless.

Lead—The large orders that were accepted at low prices about 10 days ago apparently cleared the atmosphere, for on Aug. 19 there developed an increased demand, and the higher prices that were asked were willingly paid. Following this there was a steady improvement during the week, and a fairly large transaction of business. All of the cheap offerings of lead disappeared and the outside market rose to the level of the A. S. & R. Co. On Aug. 25 that company advanced its price to 4.60c.

Spelter—Late in the afternoon of Aug. 18, and on Aug. 19 there developed a rather important buying demand, in which some very large domestic consumers figured. Their orders were taken, however, at unchanged prices, viz., about 10c. per lb. On Saturday England commenced buying in this market and took a considerable tonnage at about 10½c. per lb. This lifted the market out of the doldrums and a further advance ensued on relatively small business. On Aug. 25 about 13c. was paid for round lots for September-October shipment, and there were some large inquiries in the market for October-November shipment.

The domestic buying in the early part of the week was largely from galvanizers, but it was by no means general, and there was a supposition that certain galvanizers were covering contracts for military purposes. Outside of such work, the galvanizing business sems to be still as nearly paralyzed as it ever was.

The high price for high-grade spelter is said to have been 40c. per lb. The company that produces that grade of spelter, strictly speaking, is now said to be offering it for delivery in 1916 at 20c. per lb.

The American Zinc & Chemical Co., at Langeloth, Penn., is now working on the construction of its second unit which will consist of four furnaces, each of about 900 retorts.

British papers report that the Swansea Vale zinc-smelting works at Llansamlet, Swansea, Wales, have been purchased by London interests, headed by R. Tilden Smith, who intend to enlarge the works and produce spelter at the rate of 25,000 tons per annum, against the present production of 5000 tons per annum.

We hear that the Munitions Ministry of the British Government is contemplating doing some zinc smelting on its own account.

Zinc Sheets have been actively inquired for, but few sales resulted. The base price for carload lots is $16 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Spot, Cts per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis, Cts. per Lb.	Zinc: St. Louis, Cts per Lb.
19	4 6675	47⅛	15 75 @15 85	34	4 40 @4.50	4 25 @4 30	9½ @10½
20	4 6775	47⅛	15.75 @15 85	33⅞	4 45 @4 50	4 30	9½ @10½
21	4 6650	47⅛	15 75 @15 85	33⅞	4 45 @4 50	4 30	10 @11
23	4 6600	47⅛	15 85 @16.10	33½	4 45 @4 50	4.30	10½ @11½
24	4 6550	47	16 10 @16 60	33½	4 50	4 30	11 @12
25	4 65125	46⅞	16 60 @16.85	34⅛	4 60	4 35 @4 45	11½ @13

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Aug.	Silver	Copper: Standard: Spot	Copper: Standard: 3 Mos.	Copper: Electrolytic: £ per Ton	Copper: Electrolytic: Cts. per Lb.	Tin: Spot	Tin: 3 Mos.	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts per Lb.
19	22⅞	65½	67	70½	16.55	148½	149¾	21 3/16	4 41	57	11.87
20	22 1/16	65	66⅛	78½	16 34	148¾	149½	21 3/16	4 44	55	11.45
21	22⅞	..	..	..	..	..	..	..	..	..	..
23	22⅞	64½	65½	77½	16.14	149½	150⅜	21 3/16	4 43	58½	12 08
24	22⅞	65⅜	66½	77	16.03	150¼	151½	21 11/16	4 52	61	12 70
25	22 1/16	68½	69½	78	16 24	153¼	154½	22 1/16	4 59	62½	13 01

The above table gives the closing quotations on London M[illegible] All prices are in pounds sterling per ton of 2240 lb., except silver [illegible] per troy ounce of sterling silver, 0.925 fine. Copper quotat[illegible] copper, spot and three months, and for electrolytic, pric[illegible] subject to 3 per cent. discount. For convenience in comp[illegible] in pounds sterling per 2240 lb., with American prices in cen[illegible] following approximate ratios are given, reckoning exchange a[illegible] 3.21c.; £20 = 4.29c.; £50 = 0.43c.; £40 = 8.57c.; £60 = [illegible] ditions, £1 = 0.21½c.

The Am[illegible]mated Zinc Co. has been granted permission by the Aus[illegible]n authorities to ship the 57,000 tons of blende concentrate[illegible]ld to America and 6000 tons to Marseilles.

Zinc dus[illegible] quoted at 30c. per lb.

Gold, Silver and Platinum

Gold production of the Australian Commonwealth for the half-year ended June 30 is reported at $20,822,890; South Australia being estimated.

Silver—The market has ruled dull and quiet the last week with weaker tendency, closing in london at 22⅛ pence. The New York price has also been depressed by the fall in sterling exchange.

The United States Government bought 500,000 oz. of silver on Aug. 20 and is in the market for 500,000 oz. more on Aug. 27.

Platinum—The market is unsettled but with upward tendency. There were few sales, dealers not being inclined to make concessions. Prices ranged from $38 to $41 per oz. for small lots of refined platinum, and $47 for the 15% iridium alloy.

Other Metals

Aluminum—There is little activity owing to scarcity of the metal. Small lots are quoted nominally at 36@38c. per lb., New York.

Antimony—Notwithstanding that some important inquiries have been received, actual sales are scarce and the market is weak. Outside brands are quoted at 29@31c. per lb., and Cookson's at 45@48c.

Quicksilver—Trade has been quiet but has improved slightly. New York quotations for large orders are $91 per flask of 75 lb. and for smaller lots $90@93. San Francisco quotes $85 with market inactive. London quotations are £18 per flask for both first- and second-hand stocks.

Zinc and Lead Ore Markets

JOPLIN, MO.—Aug. 21

Blende, high price $72.50; base price per ton 60% zinc, premium ore, $70, medium, $65@57, lower grades down to $50; Calamine, base per ton 40% zinc $55@40; average, all grades of zinc, $67.31 per ton.

Lead, high price $53.50, base price $50@45 per ton of 80% metal content; average, all grades of lead, $50.46 per ton.

SHIPMENTS WEEK ENDED AUG. 21

	Blende	Calamine	Lead	Values
Totals this week..	10,221,360	787,300	1,925,970	$419,070
Totals this year..	364,956,730	29,764,560	56,223,510	$15,948,260

Blende value, the week, $351,990; 34 weeks, $13,803,170.

Calamine value, the week, $18,510; 34 weeks, $651,040.

Lead value, the week, $48,570; 34 weeks, $1,494,050.

The decline of $50 per ton for blende in five weeks, as unheard of as its miraculous advance, has engendered a depressing and apathetic feeling in producing circles. Manipulation is charged and dissatisfaction reigns, but so far the production has not been restricted. In fact the high prices failed to produce a marked increase at any time, the average of the year to date being only 5825 tons per week.

PLATTEVILLE, WIS.—Aug. 21

The base price paid this week for 60% zinc ore was $60-65 per ton. No sales of lead ore were reported.

SHIPMENTS, WEEK ENDED AUG. 21, 1915

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,067,870	.....	707,440
Year	121,522,210	4,083,160	18,100,210

Shipped during week to separating plants, 4,297,140 lb. zinc ore.

Iron Trade Review

NEW YORK—Aug. 25

The steel market is undoubtedly quieter than it was a week ago, and considerably quieter than it was in July. There is really very little strictly new buying, while specifications on contracts, although at a very good rate, are not on the whole coming in as rapidly as in June and July. There are exceptions, wire products and sheets showing decidedly greater activity, both in new business and in specifications against contracts.

PITTSBURGH—Aug. 24

The slackening in general market activity is causing a little concern in some quarters as to the future of the steel market, particularly in view of the fact that the steel mills will be working better in September and October and will be able to turn out a larger tonnage, by 10 or 20%, than in July and August. There is decided encouragement in the fact that export demand has continued to grow uninterruptedly to date, while September normally shows a great deal more steel buying than August.

Steel prices continue to stiffen. The 1.35c. price on bars, plates and shapes, announced last week by the Carnegie and Illinois steel companies, is being more frequently quoted by other interests. Blue annealed sheets were advanced last Thursday from 1.35c. to 1.40c. by the American Sheet & Tin Plate Co., which today announced an advance in black sheets also, from 1.85c. to 1.90c., the advanced price in blue annealed having since become the market while the black-sheet advance is practically certain to be similarly effective.

Effective yesterday the American Steel & Wire Co. announced new prices on wire products, involving advances of $1 a ton in nails and $2 a ton in plain wire and painted barb wire, and reductions of $2 a ton in galvanized wire and galvanized barb wire, the extra for galvanizing being reduced from 80c. to 60c. per 100 lb. consequent upon the decline in spelter. The new prices are: Plain wire, 1.50c.; wire nails, $1.65; galvanized wire, 2.10c.; painted barb wire, 1.80c.; galvanized barb wire, 2.40c.

Pig Iron—Bessemer and basic pig iron have advanced 25c. and foundry and forge 50c. in the week. The sales have not been heavy but the furnaces were already well sold up and further advances are expected. The Valley Mold & Iron Co. announces it will blow in its Alice furnace at Sharpsville shortly, while Ella furnace of Pickands, Mather & Co., and Fannie and Claire of M. A. Hanna & Co., also in the Shenango valley, are being gotten ready for blast and the Shenango Furnace Co.'s No. 4 stack at Sharpsville has been blown in. With additional furnaces seeking orders prices may not rise as rapidly in the next two or three months as they have been rising in the past four or five weeks. We quote: Bessemer, $15.50; basic, $14.25@14.50; No. 2 foundry and malleable, $14@14.50, forge, $13.75@14.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market is quite unsettled. There is no regular quotation on imported ferromanganese, while domestic is offered on contract at $115, this price however being occasionally shaded, and the quotable market for spot and contract lies within the limits of $100 and $115, with not much activity.

Steel—There is considerable negotiating for billets and sheet bars in small lots, with few offerings and prices not well settled. A steel mill in this district has taken a contract to reduce 3000 tons of ingots to billets, a kind of business done only when steel is very scarce. The market is approximately $23 for billets and $24 for sheet bars, f.o.b. maker's mill, Youngstown, and about $1 higher delivered Pittsburgh. Rods are decidely stronger at $28, Pittsburgh.

Imports of ferromanganese at Baltimore for the week from Liverpool were 1079 tons.

Imports of manganese ore at Baltimore for the week from Brazil were 12,300 tons.

IRON ORE

Of the Lake ore shipped in July 6,161,730 tons, or 85.5%, went to Lake Erie ports.

Ore on Lake Erie docks Aug. 1 was 6,539,933 tons, or 89,720 tons less than on Aug. 1, 1914. As the receipts this year were greater by 3,616,673 tons than in 1914, this indicates an increase of over 3,700,000 tons in the movement from docks to furnaces.

Imports of iron ore at Baltimore for the week from Cuba amounted to 13,490 tons.

Chemicals

NEW YORK—Aug. 25

The market is firm though not active. Futures are stronger, especially in nitrate, and the position of some other chemicals is improving owing to conditions arising out of the constricted war market.

Arsenic—Prices are a little firmer, though not much business is being done. Carload lots are quoted 3⅜@3½c., and smaller orders 4c. per lb.

Copper Sulphate—Trade is fair but without change in prices, $7.25 per 100 lb. being asked for large lots and $7.50 for smaller parcels.

Nitrate of Soda—This market is stiffening, owing to buying of the Allies on the West Coast. Spot nitrate is 2.40c. per lb.; September forward, 2.42½c., and 1916 quotations have advanced to 2.45c.

Pyrites—Imports from Spain at Baltimore for the week ended Aug. 23 amounted to 17,076 tons.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt
Acacia, g	Colo	1,454,304	$ 1	$ 122,004	Jan '11	$0 01
Adams, s.l.c	Colo	1,138,989	10	778,000	Dec. '09	0 04
Ahmeek, c	Mich	80,000	25	3,050,000	July '15	5.00
Alaska Mexican, g	Alas	50,000	5	3,489,381	May '15	0.20
Alaska Treadwell, g	Alas	180,000	25	15,285,000	May '15	1 00
Alaska United, g	Alas	200,000	5	1,865,070	May '15	0.40
Am. Zinc, Lead & Sm	U. S.	180,200	25	983,320	Jan. '14	0 50
Anaconda, c	Mont	168,640	25	97,741,875	July '15	0.50
Argonaut, g	Calif	4,992,500	5	1,660,000	June '15	0 10
Arizona Copper, pf.	Ariz	200,000	1 20	2,121,274	May '15	
Arizona Copper, com	Ariz	1,426,120	1 20	18,461,338	July '15	0.24
Bagdad-Chase, g., pf.	Calif	1,519,896	5	202,394	Jan. '09	0 10
Baltic, c	Mich.	84,819	25	7,950,000	Dec. '13	2 00
Bingham N. H., c.	Utah	100,000	5	408,564	Mar. '15	0.10
Bonanza Dev., g	Colo	228,690	1	1,425,000	Oct '11	0 20
Brunswick, g	Calif	395,287	1	179,597	June '15	0.06
Bunker Hill Con., g.	Calif	300,000	1	845,000	July '15	0 02½
Bunker Hill & Sul., l.s.	Ida	200,000	10	16,282,500	July '15	0.25
Butte-Alex Scott, c.	Mont	327,000	10	148,000	Oct. '13	0 50
Butte & Ballaklava, c.	Mont	74,000	10	125,000	Aug. '10	0 50
Butte & Superior, z.	Mont	271,136	10	1,700,348	June '15	3.25
Caledonia, l.s.c	Ida	250,000	1	572,150	July '15	0.03
Calumet & Arizona, c.	Ariz	617,385	10	21,559,443	June '15	0 50
Calumet & Hecla, c	Mich	616,758	25	126,250,000	June '15	5.00
Camp Bird, g.s	Colo.	100,000	5	10,428,674	July '15	0.08½
Centen'l-Eur., l.s.g.c	Utah	1,100,051	5	4,050,000	Apr. '14	1.50
Center Creek, l.z	Mo	100,000	10	535,000	July '15	0.15
Champion, c.	Mich	100,000	25	10,000,000	July '15	1.00
Chief Consolidated, s.g.l.	Utah	871,384	1	262,983	Aug. '14	0.05
Chino, c	New Mex.	777,458	5	5,175,560	June '15	0.75
Cliff, g	Utah	864,820	1	90,000	Jan. '13	0.10
Cliff, g	Alas	300,000	1	210,000	Oct. '13	0.01
Colo. Gold Dredging	Colo	100,000	10	650,000	Sept. '14	1.00
Colorado, l.s.g.	Utah.	100,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s.	Utah.	1,000,000	5	226,832	Oct. '07	0.20
Commercial Gold	Ore.	285,540	1	43,750	Dec. '10	0.00½
Con. Mercur, g	Utah.	1,000,000	1	3,445,313	July '13	0.03
Continental, z.l.	Mo	22,000	25	341,000	July '15	0.50
Copper Range Con., c	Mich	393,692	100	13,986,746	Oct. '13	0.75
Daly Judge, s.l	Utah.	300,000	1	1,020,000	July '15	0.25
Daly West, s.l	Utah	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo	3,000,000	0 10	45,000	Mar. '11	0.00½
Doe Run, l	Mo	65,783	100	3,550,969	Dec. '13	0.76
Eagle & Blue Bell, g.s.l.	Utah	893,146	1	312,601	Oct. '14	0.05
Elkton Con., g	Colo	2,500,000	1	3,579,460	May '15	0.02
El Paso, g	Colo	490,000	5	1,707,545	Feb. '14	0.10
Ernestine, g.s	N.M.	300,000	5	150,000	July '15	0.10
Fed. M. & S., com	Idaho.	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf	Idaho	120,000	100	9,856,503	June '15	1.00
Florence, g	Nev	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g	Nev	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g	Colo	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g	Calif	200,000	2.50	258,000	Oct. '14	0.02
Frontier, z	Wis	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s	Utah	5,000	100	2,305,000	Dec. '14	10.00
Gold Chain, g	Utah.	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor.	Colo	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con	Colo	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g	Colo.	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g	Colo	1,500,000	5	4,020,000	July '15	0.02
Golden Star, g	Ariz	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g	Nev	3,559,148	10	28,288,001	July '15	0.10
Grand Central, g	Utah	500,000	1	1,620,750	Sept. '14	0.05
Granite, g	Colo	1,650,000	1	270,000	Nov. '12	0.01
Hazel, g	Cal	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s	Idaho.	1,000,000	0 25	3,300,000	July '15	0.02
Hercules, l.s	Idaho.	1,000,000	1	5,725,000	June 15	....
Homestake, g	S. D	251,160	100	37,824,478	July 15	0.65
Horn Silver, l.s.z	Utah	400,000	25	5,642,000	Sept. '07	0.05
Iowa, g.s.l	Colo	1,666,667	1	233,499	Aug. '1[illegible]	0.00½
Iowa-Tiger Leasing g s	Colo	12,655	1	9,250	Dec. '14	1.00
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	2,420,000	July '15	0.05
Iron Silver, s.l.g	Colo	500,000	20	4,950,000	Dec. '14	0.10
Jamison, g	Cal	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g	Colo	2,500,000	0 10	187,500	Nov. '14	0.01
Kendall, g	Mont	500,000	5	1,505,000	July '14	0.06
Kennedy, g	Cal	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g	Ariz	200,000	1	396,000	Aug '09	0.12
Klar Piquette, z.l	Wis	20,000	1	259,000	Apr. '13	0.50
Knob Hill, g	Wash	1,006,000	1	70,000	Oct. '13	0.00½
Liberty Bell, g	Colo	133,552	5	1,559,179	Sept. '13	...
Little Bell, l.s	Utah	300,000	1	75,000	Mar. '11	0.05
Little Florence, g	Nev	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c	Utah	100,000	25	2,300,000	July '13	0.05
Mary McKinney, g	Colo	1,309,252	1	1,169,308	July '14	0.02
May Day, g.s.l	Utah	800,000	0 25	196,000	May '15	0.02
Mexican, g.s	Nev	201,600	2.50	161,910	June '14	0.75
Miami, c	Ariz	747,112	5	4,085,629	May '15	0.50
Modoc, g.s	Colo	500,000	1	275,000	Dec. '11	0.01
Mohawk, c	Mich	100,000	25	3,375,000	Feb. '15	1.00
Monarch-Mad'a, g.s.l.	Colo	1,000,000	1	40,000	May '11	0 01
Montana-Tonop., s.g.	Nev	921,865	1	488,588	Dec. '12	0.10
Mountain, c	Cal	250,000	25	4,216,250	May '08	0.44
National, g	Nev	750,000	1	570,000	May '11	0 10
Nevada Con., c	Nev	1,999,457	5	18,226,345	June '15	0.37½
New Century, z.l	Mo	330,000	1	237,600	Oct. '09	0.01
New Idria, q	Cal	100,000	5	1,680,000	Apr. '14	0.10
North Butte, c	Mont	410,000	15	11,890,000	July '14	0.50
North Star, g.	Cal	250,000	10	4,637,040	June '15	0 20
Old Domin'n, M. & Sm.	Ariz	162,000	25	7,290,000	June '15	0.50
Ophir, s.g	Nev	201,600	3	2,068,360	Jan. '12	0 10
Opohongo, g.s.l.	Utah.	898,978	0.25	80,907	Jan. '13	0 02
Oroville Dredging	Cal	700,000	5	1,692,568	June '15	0.12
Osceola, c	Mich	96,150	25	12,660,448	July '15	3.00
Parrot, c	Mont.	229,850	10	7,871,839	July '15	1.63
Pearl Con., g	Wash	1,009,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g	Colo	1,500,000	1	7,500	Feb. '10	0.00½
Pioneer, g	Alas	5,000,000	1	2,041,526	Oct. '11	0 03
Pittsburgh-Idaho, l.	Iad	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g	Nev	2,790,000	1	771,200	July '14	0.02
Portland, g	Colo	3,000,000	1	9,993,080	July '15	0.02
Quilp	Wash.	1,500,000	1	67,500	Feb '12	0 01

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Quincy, c	Mich	110,000	$ 25	$21,227,500	June '15	$2 00
Ray, c	Ariz	1,482,436	10	3,814,995	June '15	0.37½
Republic, g	Wash.	1,000,000	1	170,000	Nov. '12	0 01½
Rochester, l z	Mo	4,900	100	190,846	July '12	0.50
Round Mountain, g	Nev	866,126	1	363,365	Aug. '13	0 04
Seven Troughs Coal, g.	Nev	1,500,000	1	108,226	June '15	0 02½
St Joseph, l	Mo	1,472,252	10	9,573,180	June '15	0 05
Shannon, c	Ariz	300,000	10	750,000	Jan. '13	0 50
Shattuck-Arizona, c	Ariz	350,000	10	2,450,000	May '15	0 50
Silver King Coal, l s	Utah	1,250,000	5	2,909,885	July '15	0 15
Silver King Con., l.s.	Utah.	637,582	1	685,338	July '15	0 10
Sioux Con, s l g	Utah.	745,389	1	872,097	July '11	0 04
Skidoo, g	Cal	1,000,000	5	365,000	Oct. '14	0 01
Snowstorm, c g	Ida	1,500,000	1	1,192,103	Oct '13	0 02
South Eureka, g	Calif	299,981	1	411,680	July '15	0 03
Standard Con., g s	Cal	178,394	10	5,274,407	Nov. '13	0 25
Stewart, s.l	Ida	1,238,262	1	1,826,417	July '15	0 25
Stratton's Ind., g	Colo	1,000,000	0 60	456,625	Dec '14	0 03
Success, z	Ida	1,500,000	1	660,000	July '15	0 04
Superior & Pitts, c	Ariz	1,499,792	10	9,178,736	June '15	0 26
Tamarack, c	Mich	60,000	25	9,420,000	July '07	4 00
Tennessee, c.	Tenn	200,000	25	4,756,250	July '15	0 75
Tomboy, g s	Colo	310,000	4 85	3,709,395	June '15	0 24
Tom Reed, g	Ariz	909,555	1	2,443,757	Apr '15	0 06
Tonopah Belm't, s g.	Nev	1,500,000	1	7,455,510	July '15	0 12½
Tonopah Ext, g s	Nev	943,433	1	896,259	July '15	0.10
Tonopah of Nev, s g	Nev	1,000,000	1	12,850,000	July '15	0 25
Tri-Mountain, c	Mich	100,000	25	1,450,000	Dec. '13	2 00
Tuolumne, c	Mont	800,000	1	520,000	May '13	0 10
Uncle Sam, g s l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov. '12	0 01
United (Crip Ck) g	Colo	4,000,100	1	440,435	Jan. '10	0 04
United Globe, c	Ariz	23,000	10	2,265,500	June '15	6.00
United Verde, c.	Ariz.	300,000	10	35,272,000	Feb. '15	0 75
Utah, s l	Utah.	100,000	10	281,860	Dec. '10	0 02
Utah, c	Utah.	1,624,290	10	28,650,671	June '15	1.00
Utah Con, c	Utah.	300,000	5	8,850,000	July '15	0 50
Valley View, g	Colo	1,000,000	1	210,000	Dec. '10	0 04
Victoria, g s l	Utah.	250,000	1	207,500	Mar '10	0 04
Vindicator Con, g	Colo	1,500,000	1	3,217,000	July '15	0 03
Wasp No 2, g	S. D	500,000	1	479,466	July '15	0 01
Wellington Mines, g	Colo	10,000,000	1	350,000	July '13	0.00½
Wolverine, c	Mich	60,000	25	8,220,000	Apr '14	2 00
Yak, s l	Colo	1,000,000	1	1,907,685	June '14	0 03
Yankee Con., g s	Utah.	1,000,000	1	167,500	Jan. '13	0 01
Yellow Aster, g	Cal	100,000	10	1,163,789	May '15	0 02
Yellow Pine, l z s	Nev	1,000,000	1	533,008	June '15	0.07
Yukon Gold, g	Alas	3,500,000	5	7,087,500	June '15	0 07½

Iron, Industrial and Holding Companies

Amalgamated, c	Mont	1,538,879	$100	$92,484,306	May '15	$0.50
Am. Sm. & Ref, com	U. S.	500,000	100	28,333,333	June '15	1 00
Am. Sm. & Ref., pf	U. S.	500,000	100	52,208,333	June '15	1 75
Am. Smelters, pf. A.	U. S.	170,000	100	10,274,800	July '15	1.50
Am. Smelters, pf B.	U. S.	300,000	100	15,125,000	July '15	1.25
Greene Cananea	U. S.	450,642	100	4,371,646	June '14	1.00
Guggenheim Expl	U. S.	831,732	25	22,489,595	July '15	1 00
Inter'l Nickel, com	U. S.	380,315	100	17,704,109	June '15	5 00
Inter'l Nickel, pfd	U. S.	89,126	100	8,492,180	May '15	1.50
National Lead, com.	N. Y.	206,554	100	8,735,716	June '15	0.75
National Lead, pf	N. Y.	243,676	100	30,119,526	June '15	1.75
Old Dominion, c	Ariz	293,245	25	6,393,744	June '15	1.00
Phelps, Dodge & Co	U. S.	450,000	100	41,709,304	June '15	5.50
U. S. Steel Corp, com.	U. S.	5,083,025	100	222,360,438	Dec. '14	0.50
U. S. Steel Corp, pf	U. S.	3,602,811	100	376,903,174	May '15	1.75
U. S. S., R & M, com	U.S.-Mex	486,348	50	6,362,188	July '14	0.75
U. S. S., R & M, pf.	U.S.-Mex.	351,114	50	15,944,131	July '15	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g s	Mex	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g s	Mex	2,000,000	1	1,580,884	Feb. '15	0.03
B. C. Copper.	B. C.	591,709	5	615,198	Jan. '13	0.15
Beaver Con, s.	Ont	1,996,490	1	529,857	Apr. '15	0.03
Buffalo, s	Ont	1,000,000	1	2,757,000	July '14	0 03
Canadian Goldfields, g	B. C.	600,000	0 10	290,000	July '14	0.001½
Chontalpan, g s l z.	Mex	7,000	25	59,500	May '14	0.75
Cobalt Townsite, s.	Ont	45,000	1	1,042,259	May '14	0.10
Coniagas, s	Ont	800,000	5	7,480,000	May '15	0.30
Con. M & S Co. of Can	B. C.	58,052	100	2,058,907	July '15	2.00
Crown Reserve, s	Ont	1,768,814	1	6,067,030	July '15	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar '11	0.25
Dos Estrellas, g.s.	Mex	300,000	0 50	10,335,000	Dec. '13	1.50
El Oro, g s.	Mex.	1,147,500	4 85	8,668,418	July '13	0.24
Esperanza, s g.	Mex.	455,000	4.85	13,327,999	July '15	0.24
Granby, s l.c	B C.	148,496	100	5,533,457	June '14	1.50
Greene Con, c	Mex.	1,000,000	10	9,544,400	May '14	0.50
Guanajuato D, pf., s	Mex.	10,000	1000	274,356	Jan '11	3.00
Hedley Gold.	B C.	120,000	10	1,644,000	June '15	0 50
Hollinger, g	Ont	600,000	5	3,453,000	July '15	0.20
Kerr Lake s.	Ont	600,000	5	5,670,000	Mar '15	0.25
La Rose Con, s	Ont	1,498,627	5	5,387,122	July '15	0.25
Le Roi No. 2, g.	B. C.	120,000	24.30	1,501,740	May '15	0 24
Lucky Tiger Com., g.	Mex.	715,337	10	3,134,340	July '15	0.09
McK-Dar. Sav. s	Ont	2,247,692	1	4,540,333	July '15	0.03
Mines Co. of Am. (new)	Mex.	1,700,000	10	1,215,000	July '13	0 12½
N. Y. & Hond Ros., g	C. A.	200,000	10	3,730,000	July '15	0 30
Nipissing, s.	Ont	1,200,000	5	13,290,000	July '15	0.25
Peñoles, s l g	Mex	80,000	25	6,361,688	June '13	1 25
Pinguico, pf, s.	Mex	20,000	100	840,000	Oct. '13	3 00
Right of Way Mns†s.	Ont	1,685,500	1	219,115	Nov '14	[illegible]
Rio Plata, s.	Mex.	374,518	5	345,745	Feb. '13	0 05
San Rafael, g s	Mex.	2,400	25	1,442,380	Jan '1[illegible]	0 50
San Toy, g s	Mex.	5,750,000	1	530,000	July '13	0 01
Sorpresa, g.s	Mex	19,200	20	3,979,24[illegible]	Jan '11	34 00
Stand'd Silver-Lead.	B. C.	2,000,000	1	1,550[illegible]	Sept '14	0 02½
Temiskaming, s.	Ont	2,500,000	1	1,38[illegible]	Apr. '13	0 06
Tem & Hud. Bay, s	Ont	7,761	1	1,94[illegible]	[illegible]	3 00
Trethewey, s	Ont	1,000,000	1	1,0[illegible]	[illegible] '14	0 05
Wettlaufer-Lorrain, s	Ont.	1,416,590	1	[illegible]	[illegible] '13	0 05

Assessments

Company	Delinq.	Sale	Amt.
Ameri[illegible]	Aug. 7	Sept. 2	$0.001
Belmon[illegible]	Aug. 10	Sept. 10	0.003
Blue [illegible] (post.)		Aug. 30	0.003
Bu[illegible]	July 22	Sept. 10	0.003
[illegible]	Aug. 30	Sept. 25	0.005
[illegible], Ida	Aug. 28	Sept. 29	0.005
[illegible], Ida	Aug. 30	Sept. 30	0.0005
[illegible] Chief, Ida	Aug. 30	Sept. 25	0.005
East Coeur d'Alene, Ida.	Aug. 9	Sept. 9	0.001
East Hercules Ext., Wash.	Aug. 10	Sept. 10	0.0015
Great Bend, Nev.	Sept. 10	Oct. 10	0.01
Hancock Cons., Mich.	Sept. 1		1.00
Hancock Cons., Mich.	Jan. 3		1.00
Happy Day, Ida	Aug. 26	Sept. 30	0.0025
Hector, Ida	Sept. 4	Oct. 4	0.005
Hennessy-Burns, Ida	Aug. 20	Sept. 24	0.005
Honolulu, Ida	Aug. 24	Sept. 13	0.0035
Idaho Los Angeles, Ida	Sept. 3	Sept. 25	0.005
Idaho Montana, Ida	Sept. 3	Sept. 25	0.001
Idaho Nevada, Ida	Sept. 7	Oct. 1	0.002
Imperial, Ida	Aug. 31	Oct. 1	0.005
Keweenaw, Mich.	Sept. 1	...	1.00
Laclede, Ida	Sept. 3	Sept. 27	0.003
Lake Superior & West., Ariz.			0.02
Liquidator, Ida	Aug. 28	Sept. 28	0.003
Lucky-Calumet, Ida	Aug. 27	Sept. 27	0.005
MacNamara, Nev	Aug. 23	Sept. 13	0.02
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0.50
New Quincy, Utah	Sept. 2	Sept. 23	0.01
Old Veteran, Ida	Sept. 2	Sept. 30	0.002
Oom Paul, Ida	Aug. 28	Sept. 28	0.01
Oom Paul Con, Ida	Aug. 30	Oct. 4	0.01
Oreano, Ida	Aug. 2	Sept. 2	0.0015
Phoenix, Mich	Sept. 1		1.00
Phoenix, Mich	Jan. 1		1.00
Revelator, Utah	Aug. 17	Sept. 3	0.00½
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Royal, Ida	Sept. 1	Oct. 1	0.001
Sandstorm Kendall, Nev	Aug. 23	Sept. 27	0.01
Selma Utah	Sept. 8	Sept. 25	0.005
Smuggler, Utah	Aug. 17	Sept. 10	0.005
Snowshoe, Ida	Aug. 26	Sept. 27	0.005
Sonora, Ida.	July 23	Aug. 31	0.004
Springfield, Ida	July 30	Aug. 30	0.002
Sunset Dev., Wash	Aug. 25	Sept. 18	0.002
Syndicate, Utah	Sept. 11	Oct. 2	0.001
Tarbox, Ida., (post.)		Sept. 4	0.0025
Tonopah Bonanza, Nev	Sept. 13	Oct. 11	0.01
Tonopah Midway, Nev	Aug. 18	Sept. 18	0.01
Union Cons., Nev	Aug. 24	Sept. 14	0.05
White Caps, Nev	Aug. 14	Sept. 18	0.015

Stock Quotations

There was no sale of mining stocks at auction in New York or Philadelphia during the last week.

COLO SPRINGS Aug. 23 Name of Comp.	Bid.	SALT LAKE Aug. 23 Name of Comp.	Bid.
Acacia	03	Beck Tunnel	05¼
Cripple Cr'k Con	.007	Black Jack	.10
C. K. & N.	.03	Colorado Mining	10
Doctor Jack Pot	09½	Crown Point	01½
Elkton Con	.22	Daly-Judge	7 00
El Paso	.76	Gold Chain	19
Findlay	03½	Grand Central	55
Gold Dollar	01	Iron Blossom	69
Gold Sovereign	03	Little Bell	‡ 10
Golden Cycle	1.76	Lower Mammoth	03⅜
Isabella	13¼	Mason Valley	1 00
Jack Pot	06½	May Day	18
Jennie Sample	‡ 02	Opohongo	‡ 00½
Jerry Johnson	.04¼	Prince Con	67
Lexington	005	Seven Troughs	01
Mary McKinney	37	Silver King Coal'n	3 17½
Pharmacist	008	Silver King Con	2 00
Portland	1 45	Sioux Con	01½
Raven B. H	02	Uncle Sam	06½
Vindicator	1 50	Yankee	.19

TORONTO Aug 23			
Bailey	02	Dome Exten	18
Coniagas	4 00	Foley O'Brien	25
Peterson Lake	19	Hollinger	23 50
Right of Way	‡ 02	Imperial	06
Seneca Superior	.75	Jupiter	11
Silver Queen	01	McIntyre	50
T. & Hudson Bay	20 00	Pearl Lake	‡ 00½
Timiskaming	31	Porcu Crown	70
Wettlaufer-Lor	02	Preston E. D	04¼
Dome Mines	21 25	Rea	‡ 10

SAN FRANCISCO Aug 23 Comstock Stocks		Misc. Nev. & Cal	
Alta	‡ 07	Belmont	3 87½
Andes	08	Jim Butler	80
Best & Belcher	07	Lone Star	03
Caledonia	.54	MacNamara	02
Challenge Con	08	Midway	10
Chollar	03	Mont.-Tonopah	29
Confidence	.15	North Star	11
Con. Virginia	.12	Rescue Eula	06
Gould & Curry	.04	West End Con	59
Hale & Norcross	.05	Atlanta	28
Julia	.02	Booth	12
Mexican	.49	C.O.D. Con	04
Occidental	.79	Comb. Frac	09
Ophir	.34	D'field Daisy	03
Overman	‡.08	Jumbo Extension	1 45
Potosi	.02	Pitts.-Silver Peak	06
Savage	.06	Round Mountain	42
Sierra Nevada	.16	Sandstorm Kendall	06
Union Con	.40	Silver Pick	08
Yellow Jacket	.14	Central Eureka	16

N. Y. EXCH. Aug. 23 Name of Comp.	Clg.
Am.Sm.&Ref.,com	77¾
Am. Sm. & Ref., pf.	105½
Am. Sm. Sec., pf. B.	80
Anaconda	68½
Batopilas Min.	1¼
Bethlehem Steel	269½
Bethlehem Steel, pf.	150
Chino	44
Colo. Fuel & Iron	38⅝
Crucible Steel	67½
Federal M. & S., pf.	41
Great Nor., ore., ctf.	40¼
Guggen. Exp.	61⅜
Homestake	117¼
Inspiration Con.	32⅝
Mex. Petroleum	79½
Miami Copper	25
Nat'l Lead, com.	61
National Lead, pf.	108¼
Nev. Consol.	14
Ontario Min	3
Quicksilver, pf.	3½
Ray Con.	21½
Republic I&S, com.	39⅜
Republic I&S, pf.	100
SlossSheff'd, com.	51
Tennessee Copper	51
Utah Copper	64⅜
U. S. Steel, com.	70⅝
U. S. Steel, pf.	110

N. Y. CURB Aug. 23	
Alaska Juneau	11¼
Alta Con	.86
Beaver Con	28
Big Four	05
Blue Bell	02
Braden Copper	7½
Buffalo Mines	.43¾
Can. Cop. Corpn.	‡⅜
Can. G. & S.	‡ 05
Cashboy	.03
Chambers Ferland	.13
Chile Cop.	18½
Con. Ariz. Sm.	11/16
Con. Coppermines	1½
Con. Nev.-Utah	5/16
Dia. Black B	03
Florence	46
Goldfield Con.	1 5/16
Goldfield Merger	20
Greene Cananea	37
International Nickel	162
Kennecott Cop.	44½
Kerr Lake	3⅜
La Rose	7/16
Magma	13
McKinley-Dar-Sa	24
Mines of Am.	2⅜
Nevada Hills	18
New Utah Bingham	2⅜
Nipissing Mines	6
Oro	07
St. Joseph Lead	12
South Utah	.10
Stand'd Oil of N.J.	432
Standard S. L.	1 9/16
Stewart	1 1/16
Tonopah	5¼
Tonopah Ex.	2 7/16
Tonopah Merger	.35
Tribullion	⅜
Tularosa	‡ 3/16
Yukon Gold	2¼

LONDON Aug. 10	
Alaska Tre'dwell	£7 0s 0d
Burma Corp.	1 13 9
Cam & Motor	0 12 6
Camp Bird	0 4 0
El Oro	0 7 0
Esperanza	0 7 9
Mexico Mines	3 7 6
Nechi, pfd.	0 12 0
Oroville	0 14 10½
Santa Gert'dis	0 7 6
Tomboy	1 0 3
Tough Oakes	0 6 6

BOSTON EXCH Aug. 23 Name of Comp.	Clg.
Adventure	2
Ahmeek	397
Alaska Gold M.	32⅜
Algomah	2
Allouez	52¾
Am. Zinc	50¼
Ariz. Com., ctfs.	8¼
Bonanza	.35
Butte-Ballaklava	4
Butte & Superior	60¼
Calumet & Ariz.	60
Calumet & Hecla	550
Centennial	18
Cliff	‡ 90
Copper Range	52¼
Daly West	2⅜
East Butte	11½
Franklin	8¼
Granby	77½
Hancock	15¼
Hedley	27¼
Helvetia	25
Indiana	4¼
Island Cr'k, com.	48
Island Cr'k, pfd.	89½
Isle Royale	26¼
Keweenaw	1⅜
Lake	13
La Salle	5½
Mass	10¼
Mayflower	3½
Michigan	2½
Mohawk	69½
New Arcadian	9¼
North Butte	28
North Lake	1½
Ojibway	1½
Old Colony	2¼
Old Dominion	50
Osceola	79
Quincy	83
Santa Fe	2¾
Shannon	7
Shattuck-Ariz.	25½
Superior	25½
Superior & Bost.	2½
Tamarack	53
Trinity	4
Tuolumne	.45
U. S. Smelting	39
U. S. Smelt'g, pf.	46⅜
Utah Apex	3⅜
Utah Con	11½
Victoria	2
Winona	3¼
Wolverine	58¼
Wyandot	1⅜

BOSTON CURB Aug 23	
Alvarado	.50
Bingham Mines	7½
Boston Ely	.22
Butte & Lon'n Dev.	.34
Calaveras	1¾
Calumet-Corbin	.04
Chief Con	.90
Corbin	‡.50
Cortez	.45
Crown Reserve	.40
Davis-Daly	1
Eagle & Blue Bell	1⅜
First Nat. Cop	2⅜
Houghton Copper	3½
Iron Cap Cop., pf.	5
Majestic	50
Mexican Metals	.24
Nevada-Douglas	.64
New Baltic	3
Ohio Copper	.10
Oneco	1
Raven Copper	.12
Smokey Dev.	.15
So. Lake	5½
Tonopah Victor	28
Trethewey	10
United Verde Ext.	5½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62 938	57.572	48.855	28 983	26 553	22 731
February	61 642	57 506	48.477	28.357	26 573	22 753
March	57 870	58 067	50.241	26.669	26 788	23.708
April	59 490	58.519	50.250	27.416	26 958	23 709
May	60 361	58.175	49.915	27.825	26 704	23 570
June	58 990	56.471	49.034	27.199	25 948	23 267
July	58 721	54 678	47.519	27 074	25 219	22 597
August	59 293	54 344	.	27 335	25 979	
September	60 640	53.290		27.986	24 260	
October	60 793	50.654	.	28 083	23 199	.
November	58 995	49.082	....	27 263	22 703	
December	57 760	49.375	....	26.720	22 900	..
Year	59 791	54 811	....	27 576	25 314	..

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14 491	14.394	65.259	63 494	70.188	*
March	14.131	14.787	64.276	66.152	69 170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.996	18.506	63.182	77 600	67.786	*
June	13.603	19.477	61.336	82.574	66 274	95.333
July	13.223	18.796	60.540	76.011	64 955	91.409
August	*	.	‡		‡	
September	*		‡		‡	.
October	*	.	‡		‡	. .
November	11.739		53.227			.
December	12.801		56.841	.	*	. .
Year	..	.		.	......	......

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37 779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31 707	37.423	142 517	167.080
August	*		‡	.
September	32.675		‡	.
October	30 284	..	‡	
November	33.304		1 9.390	.
December	33.601	.	147.102	. . .
Av. year	34 301		....	.

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4 011	3.548	19.665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18 225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3 738	5.531	19.051	24.611
August	3.87[illegible]	.	3 715		‡	.....
September	3.828	...	3 658	..	‡	.....
October	3.528	...	3 384	.	‡	.....
November	3.683	...	3.585	.	18.500	......
December	3.800	.....	3.662	. .	19 097	......
Year	3.862	.....	3.737	....	......	.....

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5 262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5 113	10.012	4.963	9.837	21 569	49.888
May	5 074	14.781	4 924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21 345	100.614
July	4 920	19.026	4.770	18 856	21 568	97.250
August	5 568	..	5 418		‡	. . .
September	5.380	..	5.230		‡	. .
October	4'909		4.750	.	‡	.
November	5.112	.	4.962	. .	25 016	.
December	5.592	. ...	5.430	. .	27.369	. . .
Year	5.213	.....	5.061	. . .	......	. . .

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14 90	14.94	13.90	13.91	13,90	13.68
August	14.90		13.90		14.08	
September	14 90	. ..	13.90		14.03	
October	14.84	...	13 75		13.97	
November	14.59	.	13.43		13.83	
December	14 70	....	13.45	.....	13 83	...
Year	$14 88	.....	$13 78	.....	$14 01	.. .

The Engineering and Mining Journal

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The Steel Headframe at No. 9 Shaft, Republic Mine, Vulcan, Mich.

By Floyd L. Burr*

SYNOPSIS—Old wooden headframe demolished and new steel headframe constructed and shaft kept from operation only seven weeks. New 100-ft. headframe designed for sheaves in tandem instead of parallel as usual; for unusual structure stresses; and uncommon method of hoisting and balancing. Total weight of steel 142,000 lb.; that cost erected, $8400.

In the earlier days of the Lake Superior mining region, when timber was a plentiful local product, almost all mine structures above and below the surface were of wood. Many of these structures have given excellent service but have now reached a state of advanced decay and must be replaced. In making replacement, attention is now usually directed toward a more durable material than wood, and this is especially true when a headframe is under consideration. The structure described in this article was erected for the Republic Iron Co., which at the time of construction was the owner of the property. It was operated under the same general management as the Penn Iron Mining Co.'s mines at Vulcan. The Republic mine has since been transferred to the Cleveland Cliffs Iron Co. No. 9 shaft of the Republic Mine is a rectangular timber-lined vertical shaft 6 ft. by 17 ft. 4 in. inside the timbers, having three compartments comprising a cageway at the north end, a skipway at the south end and a middle compartment used for pipeway, ladderway and balanceways—a very common type of shaft in this district.

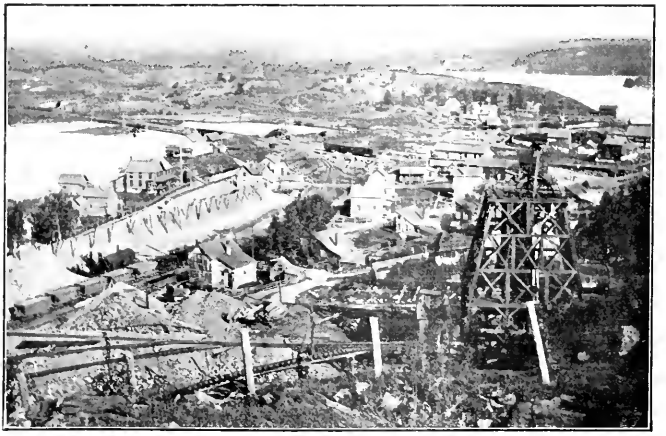


FIG. 8. VIEW AT REPUBLIC MINE, VULCAN, MICH., SHOWING OLD TIMBER HEADFRAME

This shaft had for 25 years been surmounted by a timber headframe having the form of a truncated pyramid 36 ft. square at the base, set upon a prismatic section; altogether about 60 ft. high. The long axis of the shaft has a general north-south direction. The headsheaves for the cage rope and skip rope lay in east-west vertical planes, the ropes leading from them down toward the east to an angle-sheave frame where the ropes were turned nearly at right angles, running thence in a southerly direction for about 1800 ft. to a second angle-sheave frame, from which they emerged in an easterly direction and entered the hoisting house.

This long and indirect route for the hoisting cables came about by reason of the use of the old No. 5 shaft hoisting drums for the then new No. 9 shaft. This solution of the problem of equipment for a new shaft is not unusual in the Lake Superior district. In addition to the two horizontal angles in the ropes, there were several slight vertical angles due to the profile of the ground over which the ropes ran. In the discussion preliminary to the design of a new headframe it was thought best to eliminate one of the two principal angle-sheave frames by letting the ropes run the 1800 ft. in a southerly direction directly from the headsheaves to the southernmost one of the two old frames. There were various other matters of rearrangement planned as an improvement over the original layout.

Regular Practice in Operation of Headgear

The common practice at the Vulcan and Republic mines is to dump the ore from the skip into a hopper or chute through which it slides by gravity into a transfer car operated by some form of rope haulage. This car carries

*Vulcan, Mich. Formerly structural engineer, Republic Iron Co.

the ore out to its destination, which may be either the stockpile or the shipping pocket where it is automatically dumped. The floor or platform upon which this car stands in the headframe is known as the landing floor. Where the neighboring ground surface is at about the same elevation as the shaft mouth, it is necessary in modern installations to have this landing floor about 40 ft. above the shaft collar in order to provide ample headroom for shipping pockets and stockpile trestles.

In the case of this shaft, a form of gravity haulage has been in use for some years. The tram tracks are placed on a strong down grade, varying from 2½ to 5%, leading out on the trestles to the stockpile dump, the wasterock dump, or the crushing plant dump, and the loaded transfer car is allowed to run out and be automatically emptied. On the way out, it is controlled by a rope attached to the car and to a drum at the headframe, and the empty car is pulled back up the slope to the headframe by this drum, actuated by the skip hoist through the medium of a driver pulley keyed to the shaft of the headsheave and a rope drive delivering power to a follower pulley on the same shaft with the drum. This drum may be clutched to the shaft at pleasure. One man attends to the landing of the skip and operation of the machinery and car.

On account of the elevation of the shaft above the railroad tracks, a height, for the landing level, of about 12 ft. above the collar is sufficient to furnish the down grade referred to and still leave sufficient headroom for the various dumps.

Besides the cage and skip there was a skip counter-balance running in the shaft and requiring provision in the headframe.

In order to make certain references farther along intelligible, it will be necessary to give here a little explanation about the system of skip counterbalancing[1] in use at this shaft. By this system an auxiliary rope runs from the bottom of the hoisting drum to an auxiliary drum, called the balance drum (see Fig. 3). From the other end of this balance drum another rope runs to and over the headsheave and down into the shaft, where it is attached to the balance weight that travels up and down the shaft between ordinary guides. This balance drum is made with varying radii, thus giving a varying-moment arm for the pull of the ropes. These radii are proportioned so that the dead weight of the skip and that portion of its rope which hangs in the shaft is, at all points in its downward and upward travel, very closely in balance with the weight of the counterbalance and that portion of its rope which hangs in the shaft. The balance drum usually takes the general form of a double cone. In this case, however, the shaft end of the drum is a spool, upon which a flat rope runs to the headsheave and counter-weight. Of course the varying diameter of the coil as the rope winds on or off furnishes the varying moment arm needed for the system. The other, or hoist portion of the drum, is of the usual form with sloping face.

When the skip (Kimberly type) goes into the dump in the headframe, it of course exerts less pull on its rope or "loses weight" by reason of its resting partly on the dump members of the headframe. With the perfect

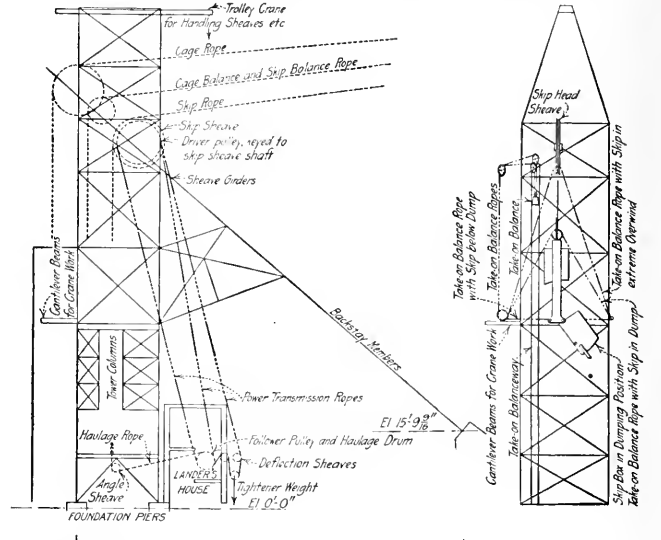


FIG. 2. GENERAL LAYOUT OF HEADFRAME, HOISTING ROPES AND BALANCING SYSTEM

counterbalancing just explained, this loss of weight is sufficient to prevent the emptied skip from moving out of the dump when it is started downward again into the shaft. It is therefore necessary to compensate for this loss of weight by taking on weight from another source—hence the "take-on balance."

This take-on balance is a weight of about 1500 lb. traveling in a balanceway built from the ground up into the headframe. It is attached to a rope, or a pair of ropes which are led over small headsheaves and around various deflecting sheaves and attached to a fixed support in such a way and at such an elevation as to lie horizontally across the center of the skipway ready to be engaged by wheels on the top of the skip frame just when the skip box begins to lose weight in entering the dump. It will be readily seen that by having the horizontal portion of these ropes of some length, the effect of the take-on

[1] A complete description of this system may be found in the "Proceedings of the American Institute of Mining Engineers," meeting of February, 1914, as part of a paper entitled "Use of Electricity at the Penn and Republic Iron Mines, Michigan," by William Kelly and E. H. Armstrong.

balance is gradually increased to correspond approximately with the gradually decreasing weight of the skip.

General Design of the Headframe

A survey disclosed the fact that the long or north-south center line of the shaft lay at an angle of only 11¼° from a straight line joining the shaft with the distant angle-sheave frame mentioned. Therefore it was decided that the center line of the headframe should be aligned parallel with the shaft, thus avoiding a slight obliqueness in the alignment of support of guides, dump, etc. The center of the two principal compartments lying thus so nearly in a common line to the distant angle-sheave frame, the two main sheaves would be very nearly in the same vertical plane and of course would be in tandem (see Fig. 4), instead of parallel arrangement as they had been in the old headframe and as they are in the majority of headframes. This tandem arrangement generally introduces a good deal of complication to the design of a headframe, and this case was no exception to the rule.

The site of the shaft is at the foot of a steep rocky slope which forms the north end of the bold and extensive jasper outcrop, so prominent a part of the distinctive geology and the remarkable scenery at Republic. The hoisting ropes were to lead directly to the brow of the bluff and, with the height of headframe required, this a long distance from the shaft, making it necessary to adopt the six-post type of headframe in which there are four vertical columns in the immediate region of the shaft, forming by themselves a complete tower against which is leaned, so to speak, the backstay portion of the frame. The backstay portion is to a large extent independent, being braced to the tower only in the upper portion of its height.

As a matter of fact these objects have not been attained with absolute perfection, since the pillow blocks for the sheaves are placed on the top flange of the girder struts, thus putting the center of the sheave about a foot from the plane of the center lines of the backstays instead of exactly in that plane.

Also the resultants from the four hoisting ropes do not all fall exactly in the same plane, since it was not convenient so to arrange matters on the hill that all the ropes from headsheaves to hill should be exactly in parallel planes. As a result of this lack of perfection the vertical tower portion of the frame does carry a slight compressive stress from the hoisting.

Detail Description of Design

The details of the design are shown in Figs. 5 and 6. It was thought best to gain the advantage of short girts, beams and diagonals by making the headframe narrow

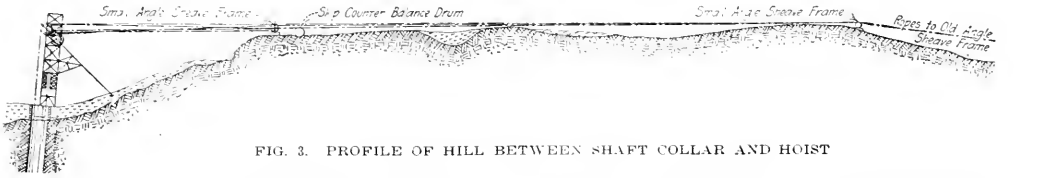


FIG. 3. PROFILE OF HILL BETWEEN SHAFT COLLAR AND HOIST

topographical relation made the ropes actually slope upward in leading away from the headsheaves—an unusual condition. This of course made the resultant of the rope stresses lie very flat. A glance at the profile sketch (Fig. 3) will make these features clear.

The shaft being a deep, important and permanent one, structural steel was chosen almost as a matter of course as the material for the headframe. In deciding upon the general form of the headframe and the location of its members, it was necessary to keep in mind the matters of support and clearance for four headsheaves with their hoisting cables; the take-on balanceway and its sheaves and ropes and fixed support for rope ends; the dump plates, hopper, platform, car, and track; the large rope drive, driver-pulley on the skip-sheave shaft and the rope-drive ropes; means for convenient handling of the headsheaves; suitable provision for handling miscellaneous loads on two sides of the headframe; and convenient floors, stairways, ladders and railings as means of reaching all vital parts.

In working out the design, it was considered desirable to have a structure wherein the principal stresses produced by the hoisting should be perfectly determinate and as far as practicable be confined to a few members through which they would be transmitted directly to the earth. These objects required the backstays to lie in the plane of the resultant for each and every rope, and called for the peculiar arrangement of sheaves whereby all four of them are located in the plane of backstays. Placing the backstays at such a flat slope forced their bases out and the tower portion short. This narrowness also allows teaming of supplies close to the east side of the shaft. To allow for plenty of clearance for the skip throughout its dumping operation and a possible overwind, and to provide clearance for the travel of the take-on ropes the west columns were placed 10 ft. from center line of shaft. This position was also found to furnish a good central support for the hopper, which is a heavy affair and subject to much stress by the impact due to the dumping of ore. The east columns were placed 7 ft. from the center line of the shaft to allow of suitable bearing for the column piers. This made a total width of 17 ft., which is little enough for the general stability of a structure of 100 ft. total height.

For a similar reason, the length of the tower portion was reduced to a minimum (16 ft.) that would still provide for stairways, landings and other minor but necessary features. To attain this object, the front of the tower was placed across the center compartment of the shaft, and the cageway was thus left outside the main structure. The near or south guide of the cageway was easily bracketed out from the north girts of the tower. The outer or north guide was not so readily supported since there must be clear space for the travel of the cage. Believing that about 50 ft. of clear cageway would be sufficient for safety, overwind possibilities and all traffic of handling long materials on or under the cage, its travel was stopped off at elevation 51 ft. by a triangular horizontal bracket reaching out to the north side of that compartment to furnish horizontal support for the

upper end of a vertical backing-beam to which the north guide is bolted. This beam was built up by riveting a 10-in. channel to one flange of a 10-in. I-beam.

The tower proper is surmounted by a trolley-beam crane from which all the sheaves can be readily handled. A trolley is provided and the web of the beam is also perforated at short intervals for the ready attachment of

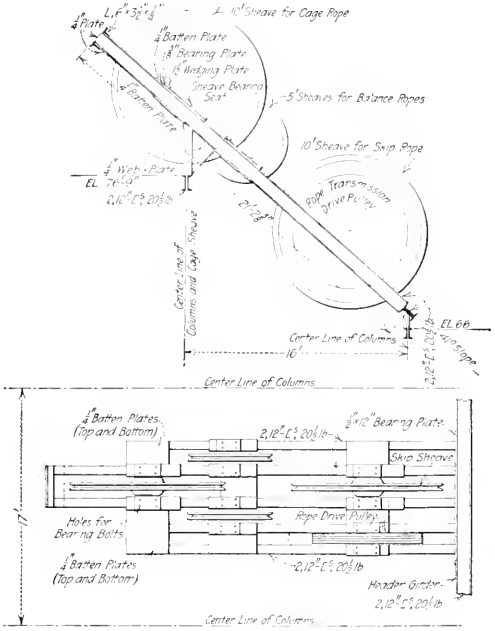


FIG. 4. DETAILS OF SHEAVE SUPPORTS

a clevis at any desired point along its length. This trolley-beam cantilevers out both to the north and to the south. The south end—extending over the backstays—is intended for a support for hoisting the sheaves from the ground. An open space is provided in the upper panel of the backstays through which the sheaves may pass while being hoisted. The north end, extending over the cageway, could with less facility be used in the same manner, but is intended only for general convenience in handling and temporarily storing sheaves or their bearings; thus one sheave could hang suspended from this north end while other sheaves are being handled on the main portion of the beam. The trolley beam is readily reached by means of two ladders, one on each side.

A comfortable stairway leads up from the ground to the top of the tower proper, the maximum slope of the stairs being about 50°. All floors or landings are of reinforced concrete built on "Multiplex Plates." All stairways and landings are well inclosed by riveted angle-steel railings. At several points these landings and stairways extend outside of the tower frame. Such an extension of the floor occurs at the base of each trolley ladder and provides a safe and convenient platform for entering or leaving the ladders.

No swinging jib crane is provided for general handling purposes. Instead there are at an elevation of 36 ft. 6 in. on the north and east sides of the structure, cantilevered beams provided with clevis holes from which tackle can be suspended to handle any material desired. One pair of these beams extends out from the skipway, while the others extend in front of the cageway on either side.

Provision is made for four headsheaves, but only three are installed—a 5-ft. sheave for the skip balance, a 10-ft. sheave for the cage, and a 10-ft. sheave for the skip. The fourth sheave will some time be put in to carry the cage-balance rope. Up to the present the cage has never been counterbalanced. The bearings of these sheaves all rest on a series of sheave girders set in the plane of the

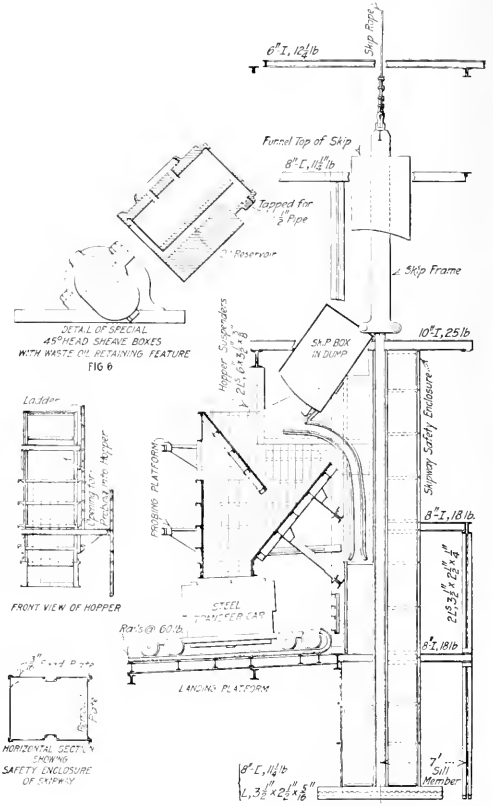


FIG. 5. SECTION THROUGH SKIPWAY AND DUMP
FIG. 6. DETAIL OF 45-DEG. HEAD-SHEAVE BOXES

backstays. These girders are of built-up eye-section, each being formed of two 12-in. 20½-lb. channels set ¼ in., back to back. The lower ends of these girders or girder-struts bear upon a cross girder of similar section which receives the hoisting stresses and through the medium of certain trusslike bracing delivers them to the backstay columns.

(To be concluded)

1914 Mineral Production of Western Australia

The mineral production of Western Australia in 1914 has been officially reported as follows, the items being given in long tons, except when otherwise stated, and in order of descending value: Gold, 1,232,977 oz.; coal, 319,210; lead ore, 3554; tin, ore and ingot, 363; copper ore, 3913; silver, 189,837 oz.; copper ingot, matte, etc., 183; pyritic ore, 9759; bismuth, 9; zinc, spelter, etc., 22; mica, 4. The total value of the mineral output for 1914 was £5,533,990, or $502,125 less than that of 1913.

Regulation of Oil and Gas Wells in California

By Lewis H. Eddy*

Protection of the natural resources of petroleum and gas in California against improper operation by producers is provided for in an act passed by the last Legislature and approved by the governor, known as Senate Bill No. 916, introduced by Senator Maddux. This act provides for state control under direction of the state mineralogist, creating a special branch of the State Mining Bureau known as the Department of Petroleum and Gas.

The work of the department will be performed by a state oil and gas supervisor appointed by the state mineralogist. The compensation of the state mineralogist for supervising the new department is $1100 per annum, in addition to his compensation of $3600 as state mineralogist. The compensation of the supervisor is $4500 per annum. The supervisor will appoint not more than four deputies, also clerical assistants, and he may employ an attorney. The deputy supervisors shall be competent engineers or geologists experienced in the development and production of petroleum. It shall be their duty to collect all necessary information regarding oil wells with a view of advising operators in the protection of wells from infiltration of water. Records and data shall be kept on file in the offices of the deputies and open to inspection of persons authorized by operators and the state officers and the board of arbitration. The records are not to be used as evidence except in such proceedings as are provided for.

The supervisor shall order such experimental or remedial work to protect wells as his judgment dictates. The well owner may within 10 days from service of the order file a statement and demand arbitration by a board of three members. Two members of the board shall be selected by owners of wells and they shall select the other member. They shall be paid for actual services at the rate of $10 for each day, not to exceed $30 each in the arbitration of any one case.

One-third of the owners or operators of wells within a radius of one mile may make written complaint, upon which the supervisor or deputy must make investigation of the well or wells complained of and order the work required to repair the damage. If the supervisor holds that such repair is not necessary, the complainants may demand arbitration.

In obedience to the order of the supervisor or the arbitration board, the owner of the well shall commence work in good faith within 30 days. If the work be not commenced within the time limit, the supervisor shall appoint agents to perform the work and the amount expended shall be a lien against the well or the land. The decision of the board of arbitration or supervisor may be reviewed by the Superior Court within 30 days.

It should be the duty of the owners of wells now drilled or that may be drilled to case such wells properly with metal casings, and to use every effort for protection in accordance with the most approved methods.

Before abandoning a petroleum or gas well the owner shall give written notice to the deputy supervisor of intention to abandon, 15 days before such proposed abandonment and shall furnish information of the condition of the well and proposed method of abandonment. The supervisor or deputy shall either approve or order such work as may be necessary before approval.

The owner of any well before commencing the work of drilling shall file with the supervisor or deputy written notice of intention, stating location, elevation and designation of the well, and estimates of depth at which oil or gas sands of formation should be encountered, and the point where water should be shut off. The owner shall keep a careful and accurate log of drilling, to be subject to inspection of the supervisor and his deputies, and the copy filed with the deputy, including additional work. Five days in advance of a test to shut off water in a well, a deputy supervisor shall be notified and be present at such test and record the result. If any test should be unsatisfactory, he shall so notify the owner. Producers of oil shall file with the supervisor once a month a sworn statement of the amount and gravity of the oil produced, and the number of wells being drilled, the number producing, idle or abandoned. Refusing to permit inspection or hindrance of such inspection will be deemed a misdemeanor. Operators of petroleum and gas wells shall pay annually to the state treasurer a charge at uniform rate per barrel of oil produced and amount of gas sold in the preceding calendar year. Owners of oil lands shall pay to the state treasurer an annual charge at a uniform rate per acre.

Estimates of amounts necessary to be assessed and collected from the owners of wells and land, for the maintenance of the department, shall be determined by the state mineralogist in conjunction with the state board of control. Notice of such assessment shall be published annually in newspapers in Fresno, Kern, Los Angeles, Orange, Ventura and Santa Barbara Counties. Assessments and charges constitute a lien upon all property of owners of wells or lands so assessed or charged. Action against the state treasurer may be brought by persons so assessed upon claims that the assessment is void. Collection of delinquent assessments will be prosecuted by the attorney-general.

The fir assessments under this law shall be levied on the first Monday in March of 1916 and based on the production of 1915, and are due and payable upon the first Monday in July following, and delinquent in six weeks thereafter. Action for delinquency shall be brought in the following May. The moneys will be expended under direction of the state mineralogist; $45,000 annually to be allowed for maintenance of the department; and all moneys in excess of this amount shall be available for repairs of wells made by the supervisor upon failure of the owner, and for costs of publication and its defense

*Associate editor, "Engineering and Mining Journal," San Francisco, Calif

of actions in court. Appropriation of $20,000 from the general fund of the state is made available for the immediate use of the department, to be returned to the general fund when collections equal $30,000. The act of Mar. 20, 1909, which had become practically obsolete, is repealed.

Iron and Steel Production of Canada in 1914

The iron and steel production of Canada in 1914, as collected and reported by the statistical bureau of the American Iron and Steel Association is given in Bulletin No. 5 of the association. The production of pig iron shows a heavy decrease, 30.5%, as compared with 1913, and is the smallest reported since 1909. The make for three years has been as follows:

	1912		1913		1914	
	Tons	%	Tons	%	Tons	%
Basic	489,799	53.6	558,524	55.0	331,456	46.9
Bessemer	228,742	25.2	227,662	22.4	184,053	26.1
Foundry	194,208	21.2	225,231	22.2	174,546	24.7
Other	129	...	3,701	0.4	16,117	2.3
Totals	912,878	100.0	1,015,118	100.0	705,972	100.0

The total production in 1914 included 690,880 tons made with coke as fuel and 15,092 tons with charcoal. Ontario furnished 503,214 and Nova Scotia 202,758 tons. Of the total for the year 515,527 tons were used by the makers for conversion into steel, and 190,445 tons were merchant iron, for sale. Deliveries from furnace were: Molten, 449,713; sand-cast pigs, 188,135; machine-cast, 68,106; direct castings, 18 tons.

The raw material used in 1914 was 1,358,184 tons of iron ore, cinder, etc.; 419,864 tons limestone; 910,887 tons coke; 883,625 bu. charcoal. The average consumption per long ton of iron made was 4309.4 lb. ore and 1332.2 lb. limestone. The coke furnaces consumed 2,611.4 lb. coke per ton of iron; the charcoal furnaces 105.5 bu. charcoal.

There are 22 blast furnaces in the Dominion, 11 being in Ontario, 8 in Nova Scotia and 3 in Quebec. Their total estimated capacity is 1,564,800 tons yearly. Five furnaces use charcoal as fuel, their average yearly capacity being 14,560 tons; 17 use coke, having a yearly capacity of 81,150 tons each.

Steel Production

The steel production of Canada for 15 years past has been as follows, in long tons:

1900	[illegible]	1905	403,449	1910	741,924
1901	[illegible]	1906	570,889	1911	790,871
1902	[illegible]	1907	616,754	1912	853,031
1903	181,514	1908	509,957	1913	1,042,503
1904	148,744	1909	678,751	1914	694,447

The sudden increases in 1902 and 1905 were due to the completion of new works. The make in 1914 was less than that of 1913 by 348,056 tons, or 33.4%; and was the smallest reported since 1909, five years previously.

Magnesite Discovered in British Columbia

Magnesite has been found in large quantities along the shore of Lake Atlin, in the northwestern part of British Columbia. Seven claims have been located by Vancouver parties, and plans are being made for working the deposits. This ore is shown by analysis to run as high as 98% in magnesium carbonate. The world's supply has so far come from California, Greece and Austria. On account of the war the latter source is cut off, and since this was the most important there is an extraordinary demand for the mineral which British Columbia will soon be in a position to supply. Magnesium salts are used in the arts, in medicines and in connection with the pulp industry of this province. This new discovery may prove to be of special importance, since the chief value of the spruce forests in British Columbia is in their paper-making possibilities, and the fact that magnesia necessary to the manufacture of a finished product is right at hand may result in greatly increasing the importance of the two industries.

Interstate-Callahan Zinc Makes Record Profits

Special Correspondence

Cœur d'Alene mine-earning records have been eclipsed by the Interstate-Callahan company, which owns and operates the Consolidated Interstate-Callahan mines, in the Nine Mile district. The net profit for the quarter ended June 30, 1915, was $1,126,114, according to the report of John A. Percival, secretary-treasurer.

The total ore extracted was 30,595 tons and the concentrates and shipping ore produced was 14,872 tons. Of the crude-ore shipments there were 68 tons averaging 21.05 oz. in silver and 44.60% lead, and 2834 tons averaging 19.74% zinc. The milling ore treated amounted to 27,235 tons, averaging 27.8% zinc, and the concentrates produced were 851 tons averaging 26.72 oz. in silver and 59.49% lead and 11,399 tons averaging 48.24% zinc.

The recovery of zinc values by sorting and milling was 78.28%, and the ratio of milling ore to total concentrates was 2.2:1. The mining costs were $3.07 per ton; milling costs were 67.2c.; and loading and shipping costs were $1.267, making the total cost of the ore mined $4.285 per ton.

The Interstate-Callahan company, of which John H. Robbers, Spokane, is president and general manager, inaugurated dividend payments last April, and $1,610,000 have since been disbursed to stockholders.

Gems and Precious Stones in the United States in 1914

The total value of the output of precious and semi-precious stones in the United States in 1914 is reported by the Geological Survey at $124,651. The demand for gems at the Panama-Pacific Exposition resulted in an increased production of turquoise and turquoise matrix, the production in 1914 being $13,370, as compared with $8075 in 1913. These gems have long been popular with the tourist trade in the West.

No discoveries of unusually fine deposits of gem minerals were made in 1914, but a few prospects for the less valuable gems were found. Among these were pink beryl in the quarry of the Maine Feldspar Co., on Mount Apatite, near Auburn, Me.; amazon stone, a variety of feldspar, near Lone Pine, Calif., White Plains, N. Y., and on the coast of Maine; sunstone in the Apache Indian Reservation of Arizona; and turquoise deposits in Lander and Eureka Counties, Nevada.

The Wisconsin Zinc District—III

By H. C. George*

SYNOPSIS—Milling practice of the Wisconsin zinc district is much like that of Joplin, Mo. The difference is in detail; but the Wisconsin mines do not concentrate on tables following the jigs. Jigs are usually of the Cooley type. Roasting and magnetic separation are practiced. Descriptions of all processes are given.

The milling practice of the Wisconsin zinc district is in a general way similar to that of the Joplin, Mo., lead and zinc district: that is, the ore is crushed and jigged. In details, however, the process is different. None of the average Wisconsin mines supplements jigging with the concentration of sands on tables. The usual mill consists of crusher, rolls, one or two jigs and the necessary trommels and elevators. Figs. 29 and 29A show a plan and flow sheet, and Fig. 30 an elevation of a typical Wisconsin zinc mill with steam power-plant, except for the use of a Wilfley table for sands.

The mills of the district are housed in frame buildings on concrete foundations. The cost of a mill with all machinery varies from $10,000 to $30,000, depending on its capacity and equipment. The usual practice of the district is to build the concentrating plant or mill adjoining the hoisting derrick and hopper, but frequently the ore is conveyed on the surface as much as half a mile from the shaft to the mill. In this case the hopper at the shaft feeds onto a belt conveyor, or into surface tram cars or aerial tram buckets or cars, which deliver the ore at the mill hopper.

After the ore is hoisted, it is delivered onto a grizzly above the hopper. The grizzly has the bars spaced from 4 to 6 in. apart. The oversize is either sorted by hand (the pieces containing ore being broken by sledge hammers to pass through the grizzly bars, and the waste rock loaded into cars and dumped on the surface outside the hopper) or it is all fed to a large crusher, which breaks all of the large pieces of rock and ore and discharges them into the hopper with the undersize. From the hopper, which usually has a capacity of 100 to 200 tons, the ore is fed directly into a 14-, 18- or 24-in. crusher of the Blake type, or onto a shaking screen. In the latter case the fine material passes through the shaking screen and goes direct to the dirt elevator, and the coarse material or oversize is fed to the crusher.

Material from the crusher runs down an inclined trough to the first roll crusher,

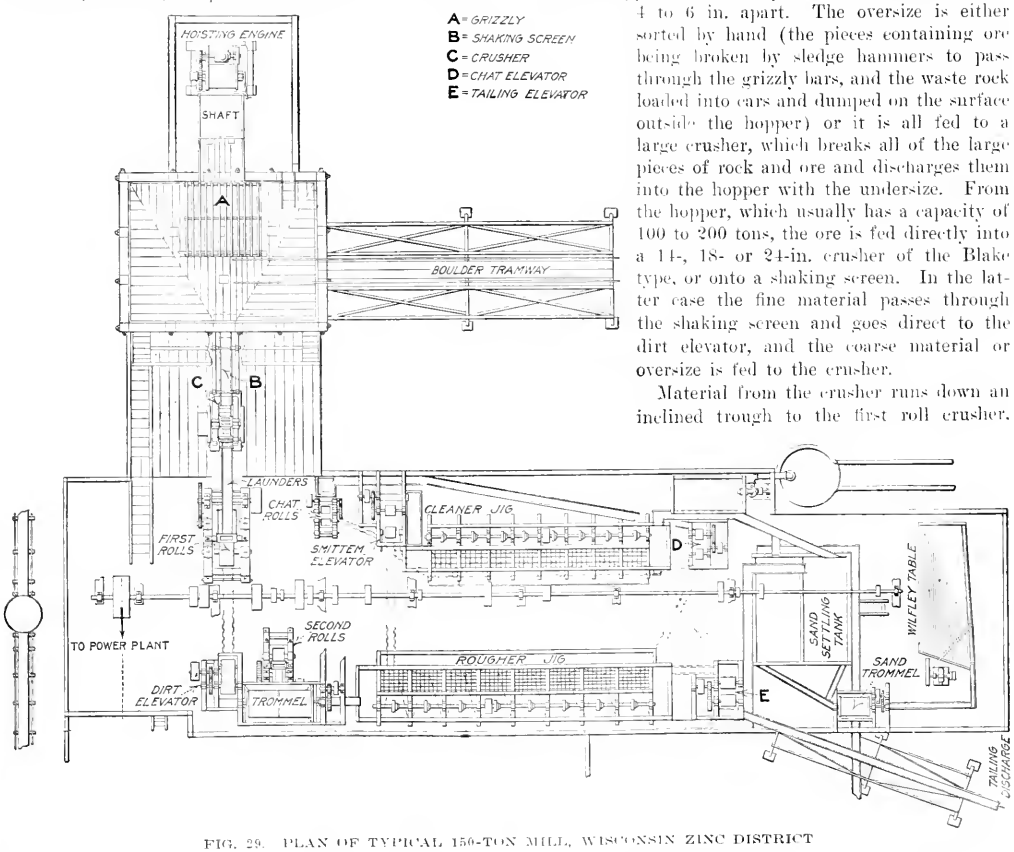


FIG. 29. PLAN OF TYPICAL 150-TON MILL, WISCONSIN ZINC DISTRICT

which is usually a 24-, 30-, 36- or 48-in. machine of the Cornish type. The crushed material from these rolls is carried in an inclined trough to the dirt elevator. The first elevator feeds into a trommel with ⅜-, ¼- or ⅝-in. perforations. The oversize from the trommel is fed to the second rolls, usually 24 or 30 in., of the Cornish type, and from these rolls it is returned to the dirt elevator and thence again to the crushers.

*Chief engineer, Wisconsin Zinc Co., Platteville, Wis.

The undersize product from the trommel is fed onto the rougher jig in a two-jig mill or onto the combined rougher and cleaner jig in a one-jig mill. Up to this point the process is the same in the one- and two-jig mills, but from this point the processes are different and will be treated separately.

One-Jig Mills

The jig, usually of the Cooley type, consists of 7, 8 or 9 cells, each cell generally having a 30x36-in. jigging surface. A common pitch from cell to cell in a jig having

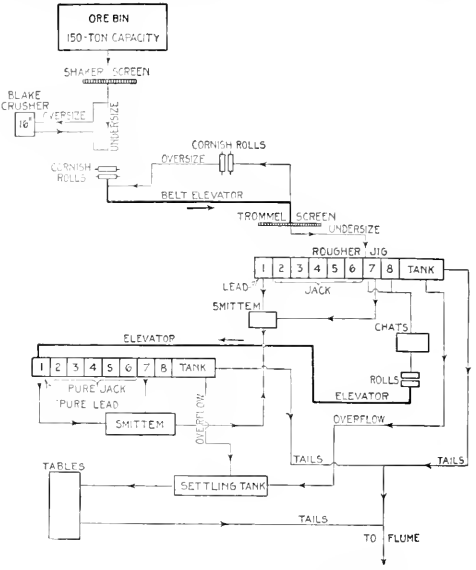


FIG. 29A. FLOW SHEET OF 150-TON MILL

30x36-in. cells is $1\frac{3}{4}$ in. per cell. The amount of water used in milling varies from 800 to 1200 gal. per min. The first cell is used for cleaning lead, and cells 3, 4 and 5 are used for cleaning zinc in the 7-cell jig, and cells 3, 4, 5, 6 and 7 are used for cleaning zinc in the 9-cell jig.

Mixed lead and zinc product from the second cell is either returned to the dirt elevator or the chat elevator. The product from the eighth and ninth cells in a 9-cell jig and from the sixth and seventh cells in a 7-cell jig is sent to the chat elevator. From the chat elevator the material is sent to the chat rolls, usually of the 24-in. Cornish type. The crushed material from the chat rolls is returned to the dirt elevator. In some one-jig mills there are no chat rolls, and in this case the chat material is fed to the second rolls with the oversize from the trommel.

Recrushing is necessary for this material in order to free the zinc and iron sulphides from the lead sulphides and from limestone. The material that passes over the lower end of the jig to the dewaterer carries from 4% to 6% metallic iron as iron sulphide and from 1% to 2% metallic zinc as zinc sulphide. This material is carried from the dewaterer at the end of the jig to the tailings elevator, from which it is discharged through a trough to the ground at some point near the mill. A common size for the sieves or grates on the first, second and third cells is usually a $\frac{1}{4}$-in. perforation; on the fourth and fifth cells, $\frac{1}{4}$-in. perforation, and on the sixth seventh, eighth and ninth cells, $\frac{3}{16}$-in. perforation. Fig. 29 shows the plan of a rougher and cleaner jig in a mill and Fig. 31 shows a vertical cross-section of a jig cell. In Fig. 31 *K* shows the sieve or grates, *L* is the hutch or part of the cell below the sieve; *M*, the spigot for drawing from the hutch; *N*, the spigot for drawing from the bed or the part above the sieve, and *P*, the jig-plunger compartment. In the one-jig mill, concentrates are drawn from the spigots *M* and *N* in the cells used for cleaning ore.

Two-Jig Mills

The two-jig mill process is practically the same as the one-jig mill process up to the point of the delivery of the undersize product to the jig. The two-jig mill has a rougher jig, with from 5 to 9 cells, usually with a 30x36-in. jigging surface on each cell, and the cleaner has from 5 to 7 cells of the same size. For convenience of description I will take the case where the rougher and the cleaner each has 7 cells. A common construction in the jigs of a two-jig mill of this type is for the sieves or grates in the first 5 cells of the rougher to have $\frac{1}{8}$-in. perforations and the sixth and seventh cells to have $\frac{1}{12}$-in. perforations, and the first three cells of the cleaner have $\frac{1}{16}$-in. perforations, and the last 4 cells $\frac{1}{12}$-in. perforations.

In the two-jig mill process, this product is fed to the rougher, which has from 5 to 9 cells, usually with a 30x36-in. jigging surface. The oversize or sieve product on the middle cells of the rougher is cleaned and drawn

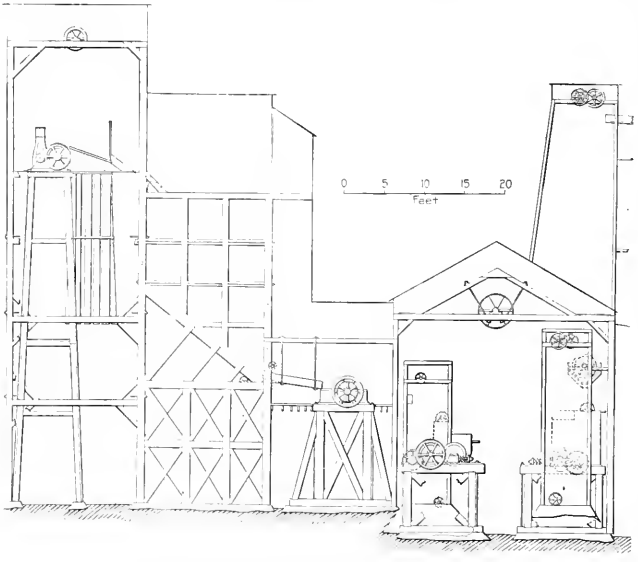


FIG. 30. END ELEVATION OF ZINC MILL

from the spigot *N* when the product is not chatty. When the ore is chatty it is drawn and taken to the chat elevator, and from there to the chat rolls, whence it is returned to the dirt elevator. Fig. 32 shows a flow sheet of a typical two-jig mill. In case the sands are not treated this product is run into the tailings elevator instead of to the sands elevator, as shown in Fig. 32.

The hutch product from the rougher, the "smittem," is carried to the "smittem" elevator and from there to the cleaner jig, where it is cleaned. The finished lead concentrate is drawn from the hutch of the first cell of the cleaner. The hutch or middling product from the hutch of the second cell is returned to the "smittem" elevator. The hutch product from the third, fourth, fifth and sixth cells is finished zinc concentrates. The hutch product from the seventh cell when not chatty is returned to the smittem elevator, but when chatty it is returned to the chats elevator. The material passing over the tailboard of the cleaner jig is sent to the tailings elevator, unless the sands are to be treated on a sands jig, and in that case it is taken to the same elevator, as shown in Fig. 32, or when the cleaner tailings contain much zinc they are returned to the dirt elevator or to the chats elevator. Jigging is done on three materials in the district—perforated sheet steel, jig grates and woven-wire screen cloth. The first of these is most commonly used, it being claimed that it has the advantage over grates in that no "dead beds" exist, because of the greater perforation area, which produces better and more uniform pulsations on the beds. This enables the ore to be cleaned better, and is especially advantageous in keeping down the lime and lead content of the zinc concentrates. It is also claimed that perforated metal (sheet steel) adapts itself better to a variable feed to the jig. Grates have the advantage over perforated sheet steel and woven-wire screens because the bed does not have to be cleaned so often with the grates.

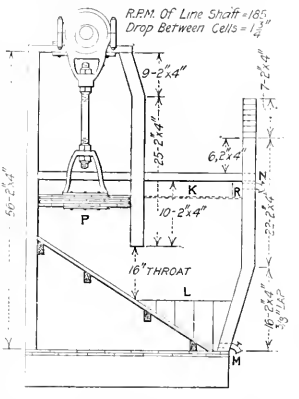


FIG. 31. CROSS-SECTION OF JIG

Concentrating Tables

Concentrating tables have been very little used in the Wisconsin zinc district. The Vinegar Hill Zinc Co. uses two Overstrom tables and one Ford table at the Wilkinson mine for concentrating marcasite sands. The Wilfley table has been successfully used at the Wallace mine at Highland, the Board of Trade mine at Cuba City, and the Avenue Top mine at Dubuque, Iowa. All of these mines have produced zinc concentrates from the jigs assaying better than 50% Zn.

The Wilfley table has been tried at a number of mines where the zinc concentrates from the jigs assayed from 30 to 45%; but because of the greater sliming of the marcasite much lower-grade zinc concentrates have been produced, and they have been difficult to market. On account of their fineness and the resulting dust losses they are not suitable to roast in the local calcining plants.

The classification of sands and the handling of the different products over different tables have been difficult on account of the small amount of ore handled daily in a Wisconsin mill, but this difficulty may be overcome with the larger mills being built in the district at the present time and the greater attention being given to the question of mill recovery.

Roasting or Calcining

A feature of the district is the roasting or calcining and magnetic separation of low-grade zinc ores. The Mineral Point Zinc Co. at Mineral Point, Wis., has a plant with five roasting kilns of the Mathey type. This plant uses Wetherill magnetic separators and has a capacity of about 300 tons of green or unroasted ore per week. The Wisconsin Zinc Co. has a plant with two roasting kilns of the Mathey type located at Platteville, Wis. This plant is equipped with Dings magnetic separators and has a capacity of about 250 tons of green ore per week.

The National Separating Co. has a plant with two roasting kilns of the Mathey type at Cuba City, Wis. This plant is equipped with Dings magnetic separators and has a capacity of about 300 tons of green ore per week. The

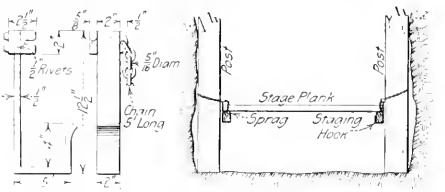


FIG. 32. FLOW SHEET OF ZINC TREATMENT

Campbell Magnetic Separating Co. has a plant with four roasting kilns of the Campbell type at Cuba City, Wis. This plant is equipped with Campbell separators and has a capacity of about 300 tons of green ore per week. During the past year this plant was leased by the Wisconsin Zinc Co. The Linden Zinc Co. has a plant with two roasting kilns of the Campbell type at Linden, Wis. This plant is equipped with Campbell magnetic separators and has a capacity of 150 tons of green ore per week. There are also several roasting plants of the Mathey type at different mines in the district and one custom roasting plant of this type near Galena, Ill., not operating.

The roasting or calcining process consists of heating the ore in the kiln by coal or oil fuel in an adjoining fire box. Coal is used in the Mathey roaster and oil is used in the Campbell roaster. The sulphur in the ore aids in the combustion. Only the outer crust of the fragments or particles of marcasite or pyrite are changed by the heat to a magnetic sulphide, which, after the ore is discharged from the kiln, cooled and fed to the magnetic-separating machines, is picked out of the feed of mixed zinc and iron sulphides by the magnets of the separating machines and discharged as a tailing product.

The feed to the roasting kiln usually assays from 20% to 40% metallic zinc. The finished ore from the magnetic separators assays from 58% to 61% metallic zinc. The tailings from the magnetic separators assay from 3% to 8% metallic zinc.

All of the companies named in the preceding page as operators of magnetic-separating plants buy ore running from 20% to 40% metallic zinc for their roasting plants, besides treating that from their own mines. In addition to these companies, a number of the zinc-smelting companies have buyers in the district. These buyers purchase high-grade ores from the mines and the roasted ore product from the separating plants.

The smelting companies that have ore buyers in the district are the Mineral Point Zinc Co., with a smeltery at DePue, Ill.; the Grasselli Chemical Co. with smelteries at Clarksburg, W. Va., and Meadow Brook, W. Va.; the Matthiessen & Hegeler Zinc Co., with a smeltery at La Salle, Ill.; the Illinois Zinc Co., with a smeltery at Peru, Ill.; the American Zinc & Chemical Co., with a smeltery at Langeloth, Penn., and the American Zinc Co. of Illinois, with a smeltery at Hillsboro, Ill. The Illinois Zinc Co. and Matthiessen & Hegeler Zinc Co. buy zinc concentrates low in lead, because much of their spelter product is rolled into sheet zinc. The Grasselli Chemical Co. buys zinc concentrates low in lead because it makes a high-grade spelter for the brass and bronze trade. The other smelting companies are not so particular about the lead content of the zinc concentrates because they make prime Western spelter for galvanizing purposes.

The buyers for the smelting companies purchase on a base of 60% metallic zinc contents in the zinc concentrates. They penalize $1 per unit of zinc below 60% and pay a premium of $1 per unit above 60%. Iron is penalized at the rate of $1 per unit over 1%; lime at 50c. per unit over 2%; and lead at $1 per unit over 1%. This scale of penalties and premiums usually applies to concentrates containing from 50% to 63% metallic zinc. For ores of a lower grade a different scale is used. Some ores are purchased on contract, based on the spelter market, a fixed or given smelting charge, and the metallic zinc content of the concentrates.

Three-fourths of the production of the district is made by five companies. The following list gives the principal operating mines of the district, their location and the name of the operating company:

The foregoing list contains only about half of the properties that have produced ore during the past year, and does not contain the names of any properties not equipped with a milling plant, but it does include the names of all of the big producers of the present time in the zinc district.

The mines of the district are widely scattered, few of them being nearer than a mile to any other mine. Prospecting is being carried on largely by the big companies, with good results. The production of the district grew from 19,000 tons of concentrates in 1904 to 130,000 tons in 1914. Taking into consideration the scattered nature of the ore deposits, the size of the district and the number of mines that have been found with a small amount of prospecting, it is safe to predict a steady growth, a long life, and a bright future for the Wisconsin zinc district.

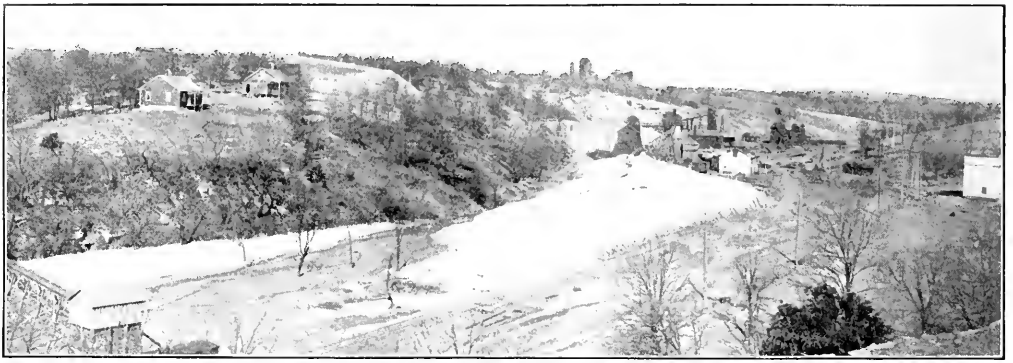


FIG. 33. THE KENNEDY MINE, HAZEL GREEN, WIS

PRINCIPAL OPERATING MINES

Mine	Location	Company
Coker	Livingston, Wis	Mineral Point Zinc Co.
Highland	Highland, Wis	Mineral Point Zinc Co.
New Coker	Livingston, Wis	Mineral Point Zinc Co.
Penna Benton	New Diggings, Wis.	Mineral Point Zinc Co
Fox	Hazel Green, Wis	Mineral Point Zinc Co.
Kennedy	Hazel Green, Wis.	Mineral Point Zinc Co.
Black Jack	Galena, Ill.	Mineral Point Zinc Co
Runell & Ellsworth	Livingston, Wis	Vinegar Hill Zinc Co.
Martin	Benton, Wis	Vinegar Hill Zinc Co.
Wilkinson	Benton, Wis.	Vinegar Hill Zinc Co.
New Unity	Day's Siding, Ill	Vinegar Hill Zinc Co.
Winskell	New Diggings, Wis	Wisconsin Zinc Co.
Champion	New Diggings, Wis.	Wisconsin Zinc Co.
Federal	Hazel Green, Wis	Wisconsin Zinc Co.
East End	Platteville, Wis.	Wisconsin Zinc Co.
Frontier-Calvert	Benton, Wis.	Frontier Mining Co.
Bull Moose	Benton, Wis.	Frontier Mining Co.
Cleveland	Hazel Green, Wis	Cleveland Mining Co.
Lawrence	Hazel Green, Wis.	Cleveland Mining Co.
Lucky Twelve	New Diggings, Wis.	Indian Mound Min. Co.
Crawhall	New Diggings, Wis.	Fields Mining Co.
Pittsburg	Galena, Ill.	Great Western Min. Co.
West Hill	Platteville, Wis	West Hill Mining Co.
Kistler	Platteville, Wis	Kistler Mining Co.
Optimo	Linden, Wis.	Optimo Mining Co.
Lucky Six	Mifflin, Wis.	Lucky Six Mining Co.
Squirrel	Mifflin, Wis.	E. M. & B. Mining Co
Peacock	Mifflin, Wis.	Peacock Mining Co.
Northwestern	Day's Siding, Ill.	Northwest'n L. & Z. Co

United States Graphite Output

According to the Geological Survey, the production of natural graphite in 1914 in the United States amounted to 1336 short tons, valued at $324,118. Of this quantity, 1725 tons were amorphous, valued at $38,750, and 2611 tons were crystalline, valued at $285,368. The greatest part of the crystalline graphite—all the "flake" variety—was produced in New York, Pennsylvania and Alabama. A small quantity of crystalline graphite was produced in Montana. The entire output of natural graphite in 1914 showed an increase in value as compared with that of 1913, but a slight decrease in quantity.

Early History of Braden Mines*

SYNOPSIS—Traditions surrounding the Braden copper mines and the early Chilean operations are recounted by William Braden, who also tells of the modern exploitation, the difficulties of construction in a new country and how these difficulties were overcome.

The traditions of the Braden Copper Co.'s mines date from the 18th century, when a Spanish lieutenant (*teniente*) who was a fugitive from justice escaped to the snow-crowned Andes between Chile and the Argentine, where he camped at what afterwards became known as the Mineral Teniente. This man is said to have discovered there a vein of high-grade ore, and out of the proceeds of shipments of it, to have paid to the authorities a fine which freed him from further difficulties with the colonial government. Be this as it may, the first official records date from 1819, when the working of the mine was undertaken by Don Juan de Dios Correa, *conde de la Conquista*, and owner of the immense hacienda stretching from the coast range of the Chilean Andes to the Argentine boundary, within the limits of which the mines are situated. Don Juan de Dios exploited the mine until the '70s of the last century, transporting the ore on muleback to the coast for exportation.

The First Smelting Plant

Partners were taken into the enterprise about that time, and one of them, Don Federico Gana, a graduate of Freiberg, took charge. He drove what is now known as Teniente No. 1 adit, to tap the orebody which until then had been attacked only by irregular inclined workings from the surface. A shaft was sunk from this adit to a depth of over 100 m., and an underground *malacate* was installed. An inclined wooden chute carried the ore down the mountain to a sorting floor near the *lagunas* or small lakes at the foot of the hills; and a smelting plant was installed at Perales, about 15 miles distant, near the junction of the Coya and Cachapoal Rivers. In short, what was considered an uptodate and progressive exploitation was undertaken.

On account of the heavy snowfall at the mines, no work was done during the winter months beyond keeping the shaft dewatered and preparing the mine for the extraction of high-grade ore during the ensuing working season.

According to one version of the accounts referring to operations at this time the mine boss and miners, during one of the winters, stole about all of the tools and equipment that could be carried off; and the following spring the owners found the shaft full of water. Another version is to the effect that water was suddenly encountered and that miners in the lower workings had barely time to escape, so rapidly did the water rise. At all events money was then required to get the mine into a state of production. The money not being forthcoming, the mine was abandoned and the taxes left unpaid.

About 1897, Don Enrique Concha y Toro, an enterprising mine capitalist, sent a prospector to the district; and after taking up claims to cover some of the most promising croppings including the old Teniente mine, he proceeded to sort high-grade ore from the old stopes of the latter, and sell it.

Correa Heirs Bring Suit

Don Carlos Irarrázaval, who was married to Doña Nicolasa Correa, the heiress of Don Juan de Dios Correa, then brought suit in the interest of the Correa estate, to enjoin Don Enrique Concha y Toro. The difficulties between the parties were adjusted after some legal warfare, by an arrangement giving Don Enrique a third interest in the Teniente mine, and the sole proprietorship of all the other mining claims which he had taken up in the neighborhood.

The Correa heirs would invest no capital in the business; and Señor Concha y Toro, not caring to work for the benefit of others in the Teniente, in which his partners owned a two-thirds share, limited his operations to looking for ore in that part of the property of which he was sole owner. He thus explored the Capitana and Subteniente, but principally the Fortuna mines, where he executed underground workings covering an area of about 100x150 ft. and reaching a depth of 150 ft., always on the lookout for shipping ore. This he did not find, as all the copper was in fractures of, or disseminated through, diorite country which made up a 4% Cu ore, requiring concentration on a more or less important scale to be profitable.

Effort to Interest European Capital

An Italian mining engineer, Don Marco Chiapponi, was consulted under these circumstances, as to what could be done with the property, and he recommended the construction of a concentrating plant. As such an installation, with the necessary wagon road, power plant and other equipment, involved more capital than Señor Concha y Toro cared to invest in what was considered a low-grade mine, Chiapponi was entrusted with the sale of the property.

Signor Chiapponi sent about 25 tons of the ore to Europe for concentrating tests; and as these proved successful, the business was submitted to mining capitalists in France and England. Engineers were sent to examine the property; but they were apparently unable to grasp the magnitude of the proposition, which, moreover, was at that time a new one in its way; and they reported adversely on it.

Mr. Braden Inspects and Invests

About two years later, Signor Chiapponi proposed the business to William Braden, who after careful inspections, formed a favorable opinion of it, and interested his friend E. W. Nash—since deceased, then president of the American Smelting & Refining Co., and one of the most enterprising of mining and smelting men in the United States—in the organization of the Braden Copper Co. for the exploitation of the property with a cash capital of $625,000.

With this money it was proposed to open up and equip the mines; build a wagon road about 35 mi. long to connect them with Graneros, a station on the Chilean state railroad 1600 ft. above the level of the sea, or about 6000 ft. lower than the mines; erect a 250-ton concentrating

*Excerpts from an article by William Braden in "Teniente Topics," June, 1915.

mill; construct three aërial trams; install a hydro-electric plant of approximately 1000 hp.; and provide living quarters at the mine and mill camps.

Equipment Completed as Scheduled

In view of this undertaking being the first of its kind in the Chilean Andes, and of its being realized under many little-known conditions it was with satisfaction that the plant was completed, and concentration started in the month of June, 1906, within the time set for beginning exploitation.

The usual route for reaching the mines had formerly been by trail from Rancagua through the village of Machalí, about 45 mi. distant, passing through the Isla ranch along the south bank of the Coya River. There were no houses at the property other than a couple of "rucas"—small low huts, with walls of loose rock and roofs of loose sheets of corrugated iron held in place by the weight of judiciously-strewn boulders. . . . The wagon road from Graneros was concluded in 1905. During the winter months of that year—June, July and August—about 4000 tons of machinery and construction material had been accumulated at the freighting station, La Compañia, near Graneros, for transportation to the mine; and it certainly looked like a big task.

Several Chilean gentlemen hazarded the opinion that it would take three or four years to haul this material to the Cordillera; and when it was explained that the company proposed not only to haul the material, but finish the plant and start running it the following June, their expressions of incredulity verged on the borders of derision. By hustling, the company's expectations were, however, fulfilled. There were as many as 250 ox-carts at work at one time—which meant the employment of over 2000 animals. These carts were at work on the farms in the neighboring country; and it was possible to induce the cartmen to leave their congenial surroundings in the wheat fields and orchards of the low-lying plains, for the work of hauling heavy loads to the Cordillera, only by paying them what was considered a very high rate of freight—25 pesos, Chilean paper currency, equal at that time to about $7.50 per ton. As a matter of fact, they responded to the call promptly.

Securing Labor in a New Country

Advertisements were inserted in the newspapers, and placards posted throughout the agricultural districts inviting them to "Come one, come all!"

About 1000 Chilean laborers were employed in the construction work at the camp during the summer season of 1905-6, that is from September to May inclusive. During the first months there were no houses for them. When a group of laborers presented themselves for work they were given a few sheets of corrugated iron, and they promptly built themselves a *ruca*. Some groups of workmen cooked their own meals; but the company maintained kitchens in tents where most of the men took their meals.

The work was accomplished, and in fact was only possible, by a defiance of the customs of the country. These, including immoderate consumption of liquor and the observation of numerous feast days, besides Sundays, throughout the year, were supposed to constitute a necessary evil with which it would be impossible to cope. Nevertheless, the introduction of liquor into the camp was prohibited, and gradually it was practically suppressed. The men learned to work instead of "laying off" on all the feast days.

Labor Efficient Under Proper Handling

Labor, man for man, was cheaper than in the United States; and under efficient direction, the company got as much out of Chilean labor, dollar for dollar, as could be gotten from labor in North America. Throughout the construction period, work went on smoothly. The men were well handled by their chiefs, who were always "on the job" and who gave an example to the peons—of which the latter showed their appreciation—in punctuality, steadiness and perseverance.

The construction of the mill was intrusted to W. E. Bradley; the power plant was in the hands of C. E. Doolittle; the aërial trams were built by Thomas Graham; and the opening up of the mine was undertaken by Thomas M. Hamilton. The work in the mine was different from anything the men had ever seen before, and at first was undoubtedly hard on the miners; but Mr. Hamilton's example of tireless energy and his genial character alike appealed to the men, who recognized in him a leader and a friend. While exacting strict compliance with duty, he always lent an attentive ear to suggestions, complaints or other representations of the men; he redressed every just grievance to which his attention was called, and patiently gave them object lessons in the proper handling of tools and employment of explosives—through which they worked out their contracts to better advantage, and contentedly reaped a good pecuniary harvest.

No Fatal Accident During Construction

Although there was a certain amount of danger connected with the work, much of which was done on the steep slopes of high rugged mountains where pieces of heavy timber were handled for the tram towers and other work, in places where many people would think there was no foothold for a single man, there were no accidents attended with loss of life during the construction period.

The first death by accident in the camp took place shortly after construction was finished and concentration had begun. It happened in the portal of the old Teniente mine where a miner, despite the company's regulations and in a manner approved among natives pretty much all over the Andes, tried to thaw out 46 sticks of dynamite in a shovel nicely balanced over the flames of a bright fire in a brazier 2 ft. in diameter. Somehow or other miners there will do this sort of thing with impunity over and over again until they think it is the proper way to go about the business. On this occasion it was not done with impunity. Fortunately there was no one present except the miner who stood on one side of the shovel, and his assistant who stood on the other; and strange to say, although both were the same distance from the explosive only the assistant was killed, the other escaping unhurt, suffering merely from slight deafness for a few days.

Rivalry in Construction Operations

At the time the fever of construction activity was at its height, there was considerable rivalry among the chiefs, each one of whom vied with the others in strenuous effort to get his part of the work completed first. Incidentally amusing and sometimes also annoying accidents took place. One day, while a bench for the Teniente power flume was being blasted out of the solid rock on the hillside just above the proposed course for the aërial tram, the

flying rock completely wrecked three tram towers; and the disgusted tram-construction superintendent, who had been congratulating himself on the rapid progress he had been making, could not be convinced that the shot had not been fired especially to knock down the towers and retard his work.

It was with difficulty that about 50 men were induced to "invernar" or pass the winter of 1905 in the mountains. The thing was accomplished, however; and before the following winter set in there were bunkhouses and living quarters for several hundred men. As an incentive to the laborers to stick to their work steadily, every man who worked from May to September was presented gratis with a number in a lottery, which was started in the camp, with prizes from 100 to 500 pesos, besides a few "consolation" prizes. This system was successfully used for several years to insure a full complement of workmen.

While the construction work was going ahead, at the camp and for some time after, the railroad to connect the mines with the state railroad at Rancagua was being surveyed, and the grade built almost as fast as it was surveyed. The work was at first under the direction of W. Titus, but was afterward taken over by George E. Montandon, who, in the rocky regions of the Cordillera, had to overcome many difficulties. The road rose from 480 m. above the sea at Rancagua, to its first proposed terminal station at the camp, 2016 m., with maximum grades of 4.5%, and curvatures rendered necessary by the topography of the country, which made the road 70 km. long, although the distance in a straight line between terminals was only 34 km.

Elk City and Dixie Mining Districts, Idaho

EDITORIAL CORRESPONDENCE

The Black Pine Mining Co. has completed its small mill for treating the ores from its property. At present the mill is not in operation, all efforts being centered upon advancing the tunnel which is to cut the oreshoot, rich on the surface, at a depth of about 275 ft. The mill has five stamps, with mortar block and timbering completed for an additional five. Plates and concentrators are provided, and the output will consist of bullion and concentrates. Power is supplied by a 120-hp. water turbine, supplied by a flume carrying water from the American River.

The Buster mine, near Elk City, is still shut down. The condition of the vein at 400-ft. depth is not considered satisfactory, and the principal owners, Bradley and MacKenzie, have decided not to carry out further explorations. Conditions are not good in the district and not much work is being done.

The Elk City Dredging Co. has been reorganized and operations are being continued on what is considered a satisfactory basis. The dredge has been rebuilt, the ladder having been lengthened so as to enable it to reach bedrock. The gravel is said to contain about 50c. per cu.yd. At the Col. Sellers mine, L. Basketh is operating in a small way, extracting high-grade ore from stringers. This ore is being roasted without crushing, which results in a mixed product, the largest pieces of which are about 1 in. in diameter. The material is cyanided, in this condition, by leaching. A 10-stamp mill is being built to handle the lower-grade ore. Amalgamation and cyanidation will be the process.

In the adjoining Dixie district there are no notable developments. No continuous operations are being carried on, although some ore is being milled at intervals and there is some development in progress.

Willow Creek and Broad Pass, Alaska

SPECIAL CORRESPONDENCE

The Willow Creek region, already known as one of the most prominent free-gold mining districts of Alaska, bids fair to become of even greater importance this year than heretofore owing to the recent discovery of several additional bodies of high-grade ore. A cleanup made early in July by the Gold Bullion Co. resulted in the shipment of over $16,000 in bullion said to run over $19 per ounce. The Alaska Free Gold Milling Co., which operates in the same district, expects to clean up $250,000 before cold weather terminates milling operations for the season. A portion of this amount, however, will be obtained by cyaniding the tailings. The Independence Mining Co., which at present operates but a small mill, has recently uncovered some excellent ore and will probably increase the capacity of its plant. An encouraging discovery made upon the Mabel group of claims has revealed the presence of richer ore than had hitherto been found upon this property. From a discovery prospect in the same district a couple of men working by crude methods on a small scale have been taking out $30 per day.

The Broad Pass region, owing to the lack of transportation and the fact that it is not a placer- but a quartz-mining country, has not hitherto been exploited to the extent that its merits warrant. The new railroad will pass directly through the heart of the district, which in addition to gold-bearing ore has deposits of excellent coal. Transportation being assured, it is believed that the coming year will witness a thorough prospecting of the entire region.

Du Pont Co. Doubles Capital

A plan for the sale of the E. I. du Pont de Nemours Powder Co. to a new company, to be known as E. I. du Pont de Nemours & Co., has been arranged by the directors and will be put in effect when approved by two-thirds of the stockholders. The purchase price is to be $120,000,000, of which $1,484,100 will be in cash, $59,661,700 in debenture stock and $58,854,200 in common stock.

The authorized capitalization of the old company was $60,000,000, of which $16,113,807 in preferred stock and $29,428,708 in common stock was outstanding, a total of $45,542,515. Besides this there were bond obligations amounting to $16,922,000.

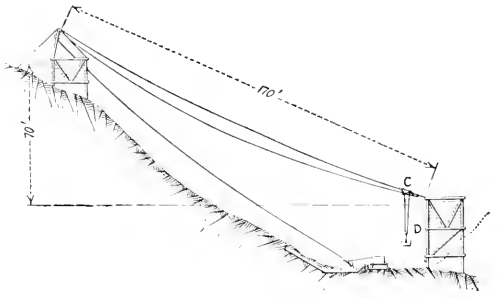
Potash Supply may come from the Philippines, according to a letter published in the "Daily Commerce Reports" of the Department of Commerce. It has been found that the ash of the seaweed collected on the shore of Manila Bay in Tondo yields 15% of potash. This discovery has aroused considerable interest, owing to the war-time scarcity of potash. No data are available to show just the amount of seaweed available, but it is known in a general way that it is abundant. Explorations and further exploitation will be conducted by the Government.

Details of Practical Mining

Alaskan Ore-Hoisting Rig

By Walter Swaren*

An interesting arrangement for reducing the attendance in conjunction with hoisting equipment at an Alaskan gravel mine is shown by the accompanying sketch. The particular work to be done by this installation was transmitting gravel from an ore bin—to which it was trammed from an open cut—to a breaker 70 ft. higher than the ore bin and on the opposite side of the cañon from the open cut. Several similar rigs have been put in operation for hoisting from a shallow shaft, a tripod being erected over the mouth of the shaft to take the strain of the cable of both hoisting and conveying. The installation here shown is designed to carry a load of 1500 lb. at a maximum speed of 400 ft. per min., although its normal speed is usually 200 ft. per min. The track cable is ⅞ in. and the



ORE-HOISTING RIG

hoisting rope ⅜ in. diameter. Two buckets are provided; while one is being loaded at the ore bin, the second is being hoisted.

The operation is as follows: The bucket *D* being loaded, the hoist hook is fastened in place. The traveler *C*, by a special locking arrangement, is held in position at the lower end of the track rope until the block carrying the bucket *D* has been hoisted vertically to the carrier. When the bucket is pulled to the carrier it is automatically caught by means of a trigger arrangement which releases the catch holding the traveler *C* at the lower end of the rope; the hoist continuing to run, draws the carrier *C* carrying the bucket up the track rope. A long loop of chain is attached to the uphill side. When the bucket has reached the upper ore bin this chain catches on a post or projecting beam and automatically dumps the bucket.

After dumping, by slacking off on the winch at the foot of the hill, the empty bucket drops to the lower end of the cable where the carrier engages the catch, and the bucket is released and dropped vertically into the ore bin or the mouth of the shaft, as the case may be. The first bucket, being released from the hook, the second bucket is attached, and the cycle of operation is repeated.

*R. R. No. 2, Box R, Hayward, Calif.

Turbines vs. Engines in Units of Small Capacities*

The term "units of small capacity" is here intended to include turbines and engines of less than 500-hp. capacity, including auxiliary units in large plants or central stations.

There are certain definite fields where the small turbine is of conceded superiority, and other fields wherein the engine must hold sway. The desirability of the one as compared with the other is largely determined by the following factors, which govern the adaptability, cost and economy of the equipment to be installed:

1. Speed conditions and limitations, involving consideration of maximum or minimum permissible speed, and whether the driven apparatus is of the constant- or variable-speed class, or such as requires uniform angular velocity in rotation.

2. Steam pressure and temperature conditions, involving consideration of initial and final pressures and superheat.

3. Power capacity of apparatus.

4. Relative space requirements of turbine and engine units, involving consideration of available room, character of power-house construction and cost of foundation or other supporting structure.

5. Use of application, if any, of the exhaust steam for feed-water heating, steam heating or industrial purposes.

6. Available cooling-water supply, if the turbine or engine is to run condensing, involving also consideration of the temperature of the water and whether it must be artificially cooled and recirculated.

7. Operating conditions, including consideration of attendance, oiling, starting and stopping, vibration, noise, etc.

8. Relative cost of complete installations, including the necessary foundations, piping and condenser equipment, if any.

Summarizing, the fields of usefulness of the turbine and engine may be briefly stated to be as follows:

For condensing service, turbines are best adapted to: Direct-connected 60-cycle generators in all sizes, 25-cycle generators above 1000-kw. capacity; direct-current generators in sizes up to 1000-kw. capacity, including exciter units of all sizes; centrifugal pumping machinery operating under substantially constant head and quantity conditions, and at moderately high head, say from 100 ft. up, depending upon the size of the unit; fans and blowers for delivering air at pressures from 1½-in. water column to 30 lb. per sq.in.

For noncondensing service turbines are applicable for all the above purposes, in those cases wherein steam economy is not the prime factor or where the exhaust steam can be completely utilized, and particularly where oil-free exhaust steam is desirable or essential.

*From a paper read by J. S. Barstow before a joint meeting of the A. S. M. E. and A. I. E. E. at the Engineers' Club, Philadelphia.

Still another field for the turbine is in geared units operating either condensing or noncondensing for all the aforementioned applications, and in addition, many others which would otherwise fall in the category of the steam engine, on account of the relatively slow speed of the apparatus to be driven.

For noncondensing service, engines are applicable for: Electric-generators of all classes excepting exciter sets of small capacity, unless belted from the main engine; centrifugal pumping machinery, operating under variable head and quantity conditions and at relatively low heads, say up to 100 ft., depending on the capacity of the unit; pumps and compressors for delivering water or gases in relatively small quantities and at relatively high pressures—in the case of pumps at pressures above 100 lb. per sq.in. and in the case of compressors at pressures from 1 lb. per sq.in. and above; fans and blowers (including induced-draft fans) for handling air in variable quantities and at relatively low pressures, say not over 5-in. water column; lineshafts of mills where the driven apparatus is closely grouped; and all apparatus requiring reversal in direction of rotation, as in hoisting engines and engines for traction purposes.

For condensing service the engine is adapted to the purposes cited, particularly where the condensing-water supply is limited, and must be recooled and recirculated.

Power for Driving an Aerial Rope Tramway*

When an aërial tramway has to be driven by power, the amount necessary is obtained from the following formula, the result being in foot-pounds per minute:

$$Power = [(W_1 + W_2 \times \mu_1 \times \frac{N}{2} \times V) + (w \times 2L \times \mu_2 \times V) \times (2R \times V) + F] + or - \textit{theoretical power}$$

Where

W_1 = Weight of full carrier;
W_2 = Weight of empty carrier;
μ_1 = Coefficient of friction for cars;
N = Total number of cars on line;
V = Velocity in ft. per min. of cars;
w = Weight per ft. of traction rope;
L = Length of line in feet;
μ_2 = Coefficient of friction for traction rope;
R = Number of supporting pulleys;
F = Power required for station friction.

The first four factors give the power necessary to overcome friction, and the theoretical power required or developed depends upon whether the loads are ascending or descending. The factor for station friction varies greatly for different lines and is solely a matter of experience, although 0.02 of the total weight of the moving parts in the station, multiplied by the speed, may be taken as a good mean.

When the line is of considerable length and consists of several sections, it often happens that one section is developing power while another needs power; in which case the latter may derive from the former the whole or part of the power it requires. Should an excess of power be developed over the whole line, it may be utilized in various ways, such as driving dynamos, pumping, etc.

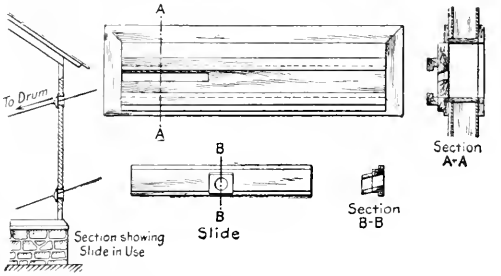
*Abstract from article in the "Engineer," London, July 23, 1915.

Sliding Board for Hoisting Ropes

By D. E. Charlton*

The slide board shown in the accompanying illustrations possesses two advantages over the usual method used on hoisting ropes at the point where the rope passes out of the engine house and onto the idlers before reaching the head sheave. Regular practice is to have a rectangular opening in the engine house at this point, through which the rope passes. This opening varies in length and width, but in nearly all cases is of sufficient size to admit considerable air. This in the summer months may be a desirable feature, but is not so in the winter. There is also a tendency on the part of the rope to have a certain amount of play, particularly in a vertical direction, and the use of such a device does not permit this at this point. The device may be placed on the original opening, as shown in the illustration, or may be built to suit any particular opening.

It consists of a 1¾-in. pine board, cut to fit the opening and toenailed into it, and slotted as shown—either on one side or the other, depending on whether it is for the lower or the upper rope. Below this a 1-in. strip of the same length is fastened to the frame of the opening,



DETAILS OF SLIDING-BOARD FOR HOISTING ROPE

so that along with the board already mentioned it forms a base to which the guides for the slide are fastened. These are of oak.

The slide, as shown in the lower elevation, is also of oak and made so that it moves along the guides with perfect freedom. The projecting piece is fastened to the main part of the slide. The inclined hole should be of sufficient size to permit of but slight play in the rope. The slide may be made entire or of two parts.

Packs, Sand Filling and Solid Pillars†

The substitution of packs and sand filling for isolated small solid pillars is gradually becoming general in the mines of the Rand. In describing the big subsidence at the Village Main Reef, attention was drawn to the fact that it was the solid ground which was affected by the rock movement. The only explanation seemed to be that the hanging-wall had slowly subsided onto the packed sand until no further movement was possible. As that subsidence must have also included the area held up by the

*Mining engineer, Virginia, Minn.

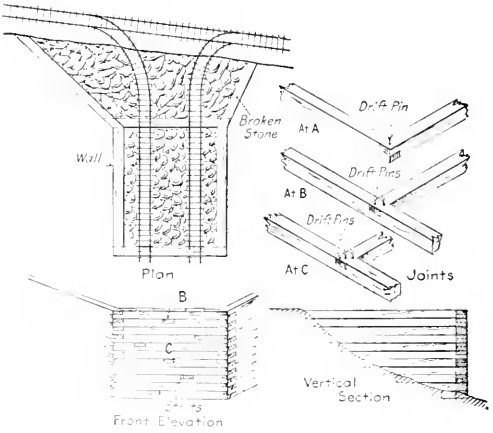
†Abstract from the "South African Mining Journal," July 10, 1915.

solid-rock pillar, it was clear that the latter had reached a state of acute compression and was disturbed by general movement of the underlying strata. This was sufficient to burst away the sides of the pillar, filling the drifts with débris and damaging the shaft timbers. The interesting feature of that occurrence was the fact that the area which could reasonably have been regarded as the safest and strongest became under the circumstances the weakest and most dangerous. An inspection of the immediate neighborhood of the shaft immediately after the occurrence revealed the fact that the workings and drifts in the sand-filled area were quite unaffected, no disturbance of the filling being detected. The result of that unusual accident was to detract considerably from the value of solid pillars unless they cover an excessive superficial area. Sand filling appears to be more effective, as it presents a slightly elastic resistance, allowing the strata to subside gradually without hurting the continuity of the hanging walls. The contrast to this is the solid pillar with its puncturing effect.

A Log Retaining-Wall

By Frederick W. Foote*

At a property with which I was recently connected, a railroad grade on the side of a steep mountain connected with an incline down the mountain. To allow room for the turning of the cars at right angles to the direction of the track by means of a short radius curve, it was necessary to build out the ground. This was done by constructing a timber retaining-wall which was filled with broken rock removed from the grade.



LOG RETAINING-WALL

The logs for this wall were hewn by contract requiring two sides to be flat and the faces to be at least 2 ft. wide. The contractor received 25c. a running foot for his labor. After the logs were cut and measured, the lumbermen were hired by day labor to "snake" them into piles by use of a portable boiler and hoist situated upon the railroad grade. A mast and boom were then rigged in the center of the proposed wall. The trenches were laid out and dug to bedrock (4 to 5 ft.) in benches not over 3 ft. high. Where bedrock was over 6 ft. below the surface, the trench was only dug 6 ft. deep and broken stone used as a filling. The logs were then tarred on their flat sides and put in position by means of the mast and boom. Guide ropes on the ends of the log assisted in this operation. Holes were drilled along the top of the log every 5 ft. with an air-auger and home-made drift pins of ⅞-in. round iron were used to fasten each log to the next one below it. Logs were placed at right angles to the walls in toward the ground about every other tier, and were securely fastened to the main structure with drift pins. They were usually placed horizontally and served as binders when they were later covered with loose rock. They were placed in the wing walls as well as the front wall.

In this manner the wall was raised some 30 ft. A slight batter was given the walls which required about 6000 running feet of timber. The walls A were built similarly, as foundations for the ore bins. The incline cars ran under this ore bin.

*University, Va.

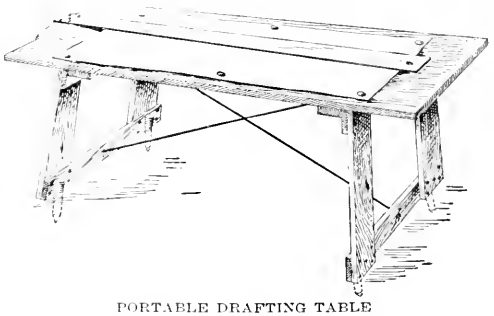
Drafting Table for Fieldwork

By Clinton P. Bernard*

A solid, steady drafting table, for use in fieldwork, that will take but little room in the wagon when moving camp and that may be set up on any kind of ground in two or three minutes, is a very desirable addition to an engineer's camping outfit.

The table described here I first saw used on a railroad outfit in the Southwest, and it was so satisfactory that I have used it several times since.

Two cleats 2 in. thick are screwed to the bottom of the drafting board or table, a suitable distance apart. The supports are made of 1x4-in. or 1x6-in. lumber as desired. Strong wires are fastened both at the top and at the bottom of one support and are passed through holes in the bottom and the top of the opposite support.



PORTABLE DRAFTING TABLE

When setting up the table, stakes are driven in the ground 18 to 24 in. farther apart than the cleats on the board, so as to give a decided slant to the supports. The table is placed upon the supports, the wires stretched tight and held by winding around a nail, and the table is ready.

If the wires be stretched tight the table will be steady and firm and stand better than one supported by horses. The use of stakes may be avoided by using two spreaders of proper length between the bottoms of the supports.

*34 Herriman Ave., Jamaica, N. Y.

Details of Milling and Smelting

Flotation Testing Machine

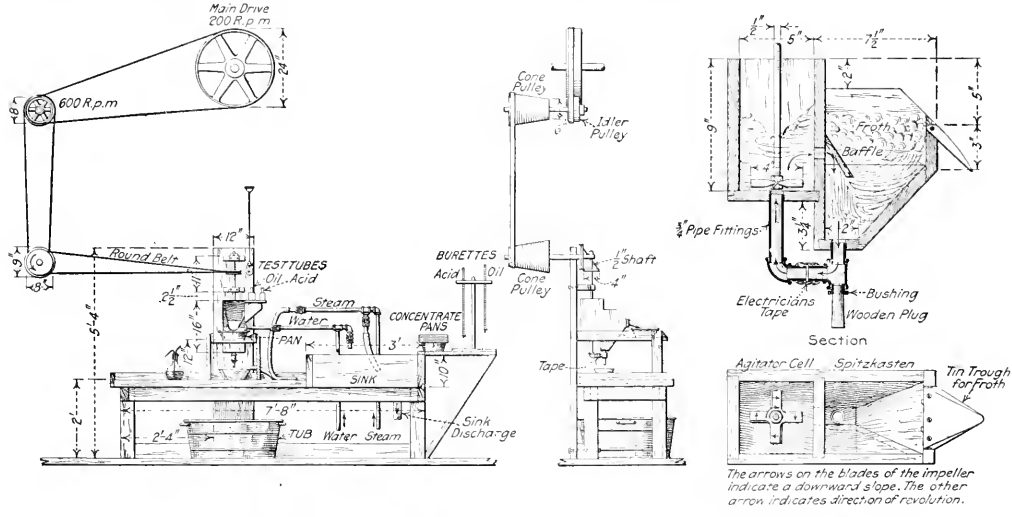
By Ralph W. Smith*

In designing a testing machine, it is well first to consider the character of work required of it, in order to arrange for flexibility in the desired directions. In flotation testing, there are so many influencing factors and their combinations, that must be varied in the testing work, that it is best to state these factors so that their relation to one another can be better appreciated. The variable factors are as follows: (1) Kind of oil; (2) amount of oil; (3) whether or not acid is to be used; (4) amount of acid (if used); (5) temperature of pulp; (6) length of time of agitation of pulp; (7) peripheral speed of impeller; (8) consistency of pulp; (9) effect of adding oil or acid first to the original pulp; (10) effect of retreatment of froth.

Not only must all of these factors be varied, but their combinations must also be varied and this must be done systematically. The testing machine described in this article was designed to afford ample opportunity to vary any or all of the essential factors, and furthermore to allow the operator to make the necessary changes with the minimum trouble and loss of time. There are many other advantages in using a testing machine of this design, but attention is drawn to these as they are outlined. The design and reason for certain arrangements are as follows:

This machine comprises a single closed-circuit cell, which exactly reproduces the proportions of a single cell of a large commercial multi-cell machine. This design has two advantages: By reproducing these proportions, the same physical conditions are imposed on the pulp as would be imposed on it in the commercial machine; the froth concentrates can be removed continuously from this cell, conditions in a commercial machine being thus exactly reproduced.

To be able to duplicate commercial conditions means much in testing. To explain this, consider the work done by a large machine. It usually comprises from 8 to 11 cells (of which this testing-machine cell is an exact duplicate in regard to proportions). These cells are connected in series, so that the pulp passes from one cell to the next and so on until it has passed through all of the cells and is discharged as tailings. This number of cells is used so as to gain the desired length of time of agitation, since a single particle of ore can be considered subjected to treatment so long as it remains in the machine. Thus, the number of cells is one factor in determining the time period of the passage of a single particle of pulp through the machine.



CLOSED-CIRCUIT, SINGLE-CELL, MINERALS-SEPARATION-TYPE FLOTATION TESTING MACHINE

Each cell can be considered a separate unit and each cell usually does its own particular kind of work. In most flotation practice, the first cell not only floats the greatest tonnage but also the highest grade of concentrates. It is nearly always found that the tonnage and assay per cell decrease as the pulp advances through the machine. The last one or two cells usually make a small tonnage of dirty concentrates. From this it can be seen that there is a practical limit to the time of agitation beyond which it is useless to go. When the final set of commercial operating conditions to be used has been determined upon from the testing work, there will be included among these conditions the speed and length of

*1845 Grant Ave., Denver, Colo.

time of agitation. Therefore it is imperative that the testing operator be able to determine these factors.

The second advantage of this design of testing machine—duplicating commercial operating conditions—depends on the fact that exact and reliable data can be obtained concerning the kind of work each cell would do in a commercial machine. This is because of the arrangement for continuous froth removal. With the closed-circuit cell as shown in the sketch the sulphide particles theoretically will become oiled in the agitator cell and ultimately be drawn over into the relatively quiescent spitzkasten. Here, the flotation phenomenon will manifest itself and the oiled mineral will rise to the surface. Not all of the sulphide minerals will rise instantly. Some particles may make the circuit from the agitator to the spitzkasten many times before they become incorporated in the froth. The most easily oiled mineral will float first, and the effect of the different gradations of this case of being oiled is to form the froth slowly and continuously for some time. The froth that forms first is usually the heaviest and thickest. The eye can easily tell when the practical end point has been reached, since at that point, the froth appears thin and lean.

In testing machines of other design, there is no quiet pool in which to allow the froth to rise, but the froth forms directly over the swiftly swirling pulp in the agitator cell. In order to separate the concentrates from the tailings the impeller is stopped and a thin partition is inserted between the froth and the pulp. Thus, the froth is formed under unfavorable conditions and removed in an unscientific manner. There are several ways in which results can easily be "salted," high or low, in this type of machine. Furthermore, it does not duplicate commercial conditions.

The testing machine with the arrangement for continuous froth removal will furnish data relative to the kind of work that each cell of a commercial machine would do under the same conditions, as follows:

Assume the total length of time of agitation, or, total length of time during which froth is removed, to be 5 min. Then, the total froth formed and removed during the first, second, third, fourth and fifth minutes respectively, should be gathered in separate pans, weighed and assayed separately. The information contained in this data will indicate exactly the relative quantity and quality of concentrates which would be formed in the respective cells of a commercial machine, under the same conditions.

This constitutes the most important single advantage of this design. Ease of operation and handiness should be added to this, but these last two can be better appreciated after one has run some tests in the machine. Now as to the design in particular. In order to be able to determine the best speed of agitation, it is necessary that we have several speeds readily available when the testing work is being done.

In the sketches, it will be noticed that the method of drive is by cone pulleys and belts. A much neater and equally satisfactory drive is a small vertically mounted, electric motor, connected with a rheostat in order to obtain various speeds. But in many cases, the absence of available current for such a connection, makes this installation undesirable or even impossible. Since testing work of this character is often carried on in an operating mill, the most convenient method of drive depends upon the kind of power in the mill. If electric power be available or be used in the mill, the motor drive should be used. The machine under discussion was designed to be used in a mill where steam power is used, and other conditions did not seem to advise the motor drive.

The sketch explains itself. The weight of the shaft, impeller and pulley is supported by the set collar, shown on the upper end of the vertical shaft. One set collar only is used, so that the shaft can be lifted and changes or adjustments made in the impeller. The impeller shown on the end of the vertical shaft may be cut from a piece of $\frac{1}{16}$-in. sheet iron. The arms are bent in a direction similar to the blades on an electric fan. However, further attention should be given the bending of these arms. The direction of revolution of the vertical shaft should be traced out from the pulleys and belts, and the arms on the impeller should be twisted so that the revolving impeller will pull the pulp through the feed pipe directly underneath it. It is this lifting action which causes the efficient circulation of the pulp, which must be in the direction of the arrows in the cell sketch. The impeller can be fastened to the end of the vertical shaft by threading the end and using a nut above and below the impeller. The threaded portion of the shaft which might stick out of the impeller should be sawed off flush with the nut. This is done so that the impeller may be brought as close to the bottom of the agitator cell as desired. When in place the impeller should clear the floor of the agitator by $\frac{1}{4}$ in.

A convenient and satisfactory method of connecting the pipe fittings under the cell is by means of electrician's tape. An ordinary pipe union should not be used because there is a shoulder on it which necessitates the spreading of the parts shown, when the connection is made. The tape will not leak. When a test is being made, the tee at the base of the flotation cell is closed with a bushing into which has been driven a wooden plug. This arrangement has the advantage of leaving no chamber above it in which the pulp can settle. If a valve be used, it can at best only be connected by a close nipple, and this will leave a small chamber above the valve gate, into which some of the pulp will settle during the test, and receive no treatment. Results will therefore be inaccurate.

The water should be connected close to the bottom of the agitator cell, so as to wash the agitator out after each test and supply water conveniently for further tests. The steam should not be piped to the machine, since the steam will create a great disturbance if introduced into the cold pulp, if the pulp is relatively quiet. A much more satisfactory way is to connect it to a short length of hose as shown. When the pulp is to be heated the impeller should be running and the end of the hose should be pushed under the surface of the pulp in the agitator cell. If the steam is turned on under these conditions, the rapidly swirling pulp will cause the steam to enter silently, and the rise in temperature can be well observed in the front or spitzkasten. The particular charges of oil and acid, which are to be used in a test, should be placed at some convenient place as shown.

The cross-section of the cell shows its proportions, how it is constructed and the flow of the pulp. There are usually enough pulleys, shafting, lumber and belting around a mill, so that it is not necessary to order anything for this machine except the cone pulleys. An ordinary millwright or carpenter can construct the whole. If results are systematically sought and the machine properly attended, accurate and valuable results can be obtained from a machine of this design.

Lead and Zinc Movement

There have been such remarkable changes in the movement of lead and zinc during the past year that it is of special interest just now to give the figures of the Department of Commerce for the fiscal year ended June 30, which covers approximately a year of war conditions.

Imports and Exports of Lead

The imports and exports of lead for June and the fiscal year are reported as follows in short tons:

	June		Fiscal Year	
Imports:	1914	1915	1913-1914	1914-1915
Lead, metallic	1	2	118	405
Lead, ore and base bullion	2,521	2,537	30,093	41,230
Total imports	2,522	2,539	30,211	41,635
Exports:				
Domestic lead, exports		5,401		86,512
Foreign lead, re-exports	976	1,912	23,768	29,929
Total exports	976	7,313	23,768	116,441

The imports of lead in ore and base bullion in 1914-15 included 38,080 tons from Mexico and 1672 tons from Chile. The imports from Mexico were almost double those of the preceding year.

Imports and Exports of Zinc

Imports and exports of zinc in metallic form for June and the fiscal year ended June 30 are reported as follows, in short tons:

	June		Fiscal Year	
Imports:	1914	1915	1913-1914	1914-1915
Blocks, pigs, etc.	35	163	1,073	862
Exports:				
Domestic	269	9,470	1,998	128,345
Foreign (re-exports)		1,286	140	11,116
Total	269	10,756	2,138	139,561

The comparison here is between a normal year and a year of war conditions, the effect of which is shown by the extraordinary increase of exports.

The imports and exports of secondary zinc products are given as follows, in short tons:

	June		Fiscal Year	
Imports:	1914	1915	1913-1914	1914-1915
Zinc dust	174	24	2,404	1,439
Exports:				
Zinc dust		21	66	275
Zinc dross		562	286	5,181

The exports of zinc dust were all reëxports of foreign material.

The movement of zinc ores for June and the fiscal year was as follows:

	June		Fiscal Year	
	1914	1915	1913-1914	1914-1915
Exports, tons, contents not given	1,431		14,294	3,345
Imports, tons	2,136	19,175	18,280	79,814
Zinc contents, lb.	1,399,921	15,121,176	14,484,802	66,649,820

In 1913-14 reëxports of foreign ore having zinc contents of 1,184,629 lb. were made. In 1914-15 no such reëxports are given in the returns.

Lake Shipping Conditions

For the first time since 1907 iron-ore shippers are now canvassing the vessel owners and offering ore-carrying contracts. In fact, several instances have been noted where carriers have refused contracts, preferring to take wild cargoes until later. Vesselmen complain that the present season has been an unprofitable one because of low rates. They say that in the past, when a dull season wound up with a rush, as at present, it indicated a prosperous year to follow, hence their reluctance to contract until the rush is at its height. The ship owners could take more ore if it were not for the fact that they anticipate only a moderate coal movement up the lakes this fall. At the present rates on ore it is only profitable to carry coal one way and ore the other. Grain is another factor counteracting against the ore trade. Brokers are bidding 2½c. for boats for grain at Duluth or Fort William for Lake Erie ports. This rate is theoretically equivalent to 93½c. on ore, and in actual practice about 75c., as against the nominal iron-ore rate of 50c.

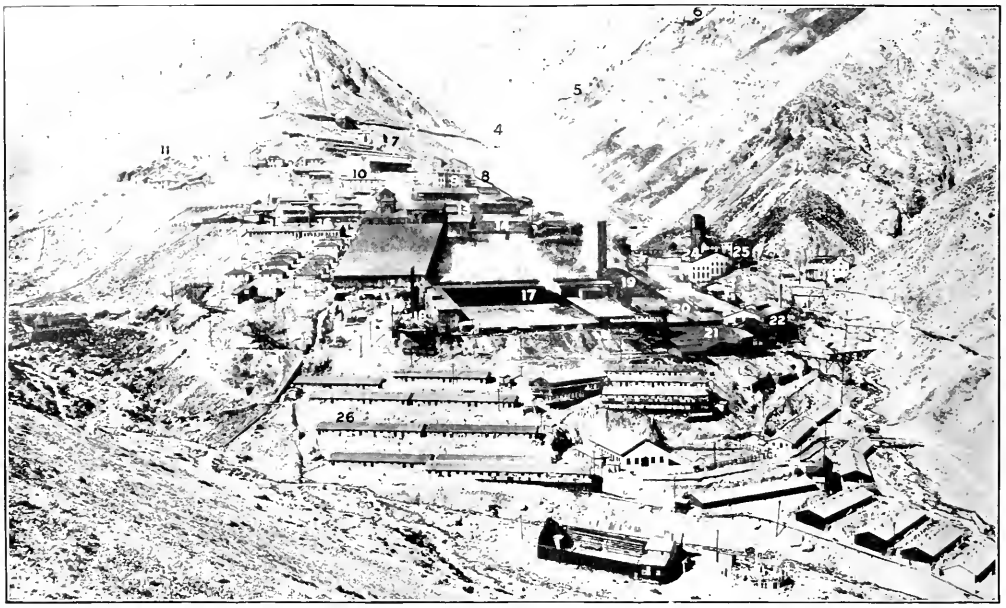
Vannoy H. Manning

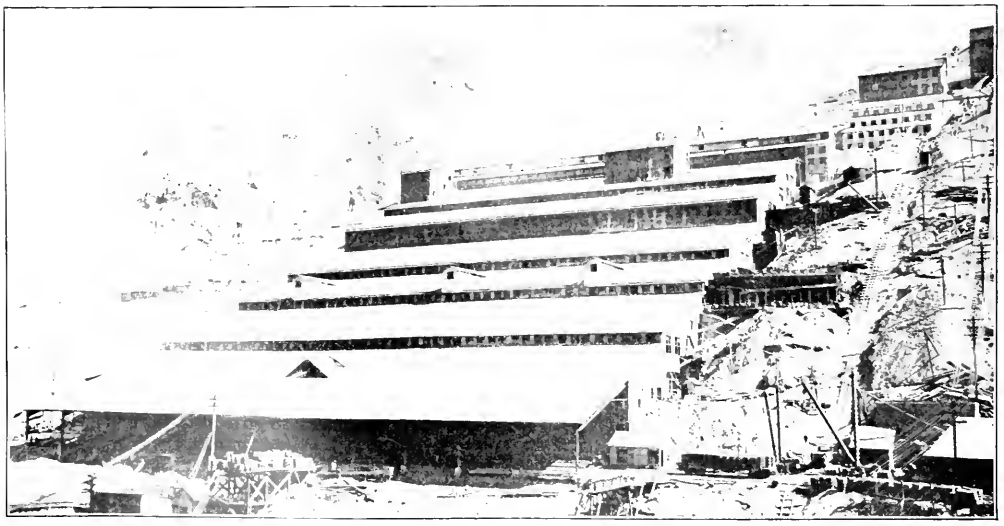
Vannoy H. Manning, the new Director of the Bureau of Mines, was born at Horn Lake Depot, Miss., Dec. 15, 1861. For more than 20 years he has been engaged in technical and scientific work in the Department of the Interior. From 1885 to 1910, as civil engineer with the United States Geological Survey, he was engaged in topographic mapping in nearly every state of the Union. When the Bureau of Mines was established in 1910, Mr. Manning was appointed to an administrative position in it by Secretary Ballinger, and on Jan. 1, 1911, was made Assistant Director; he has been Acting Director of the bureau in immediate charge of its work

VANNOY H. MANNING

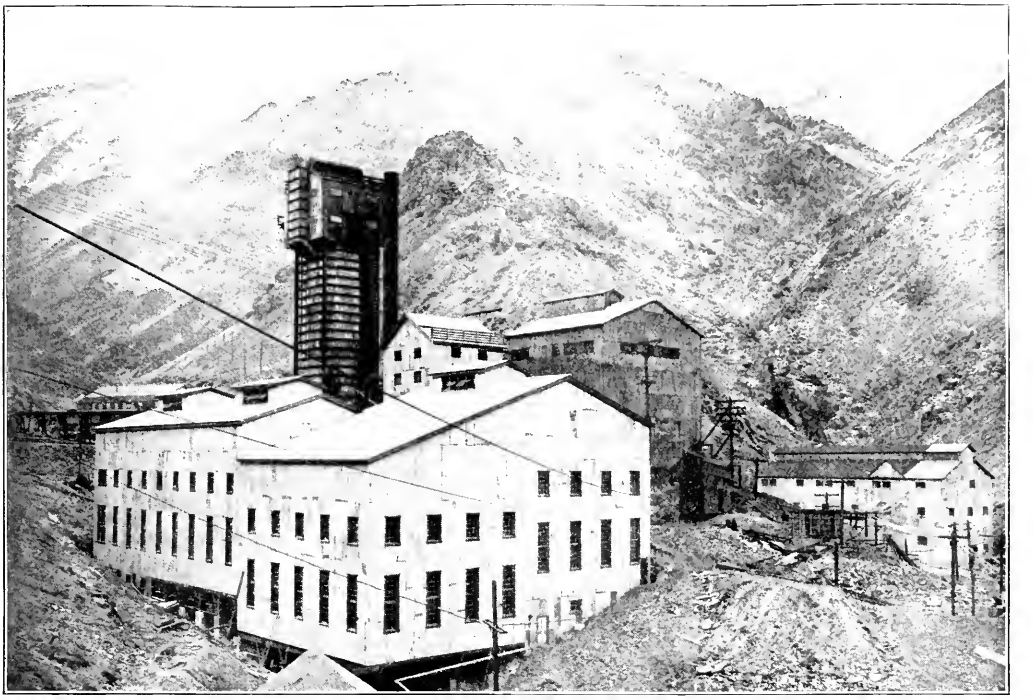
since Jan. 1, 1914, at which time Doctor Holmes, on account of illness, had to relinquish active work. During his service with the bureau Mr. Manning has had charge of methods relating to appointments, expenditures and the conduct of investigations, loyally supporting Dr. Holmes in every effort to make the bureau of greater service to the public, and by handling a mass of detail enabling Dr. Holmes to give attention to matters of policy and to the coördination of the work of the bureau with that of other Government and private institutions or establishments seeking to increase safety and efficiency in the mining, quarrying and metallurgical industries. Since June 1, 1914, Mr. Manning has had charge of all the technological investigations being conducted by the bureau, of the operation of its mine-rescue cars and stations, and of the educational work of safety and health that the bureau is doing in the mining and metallurgical districts of the United States.

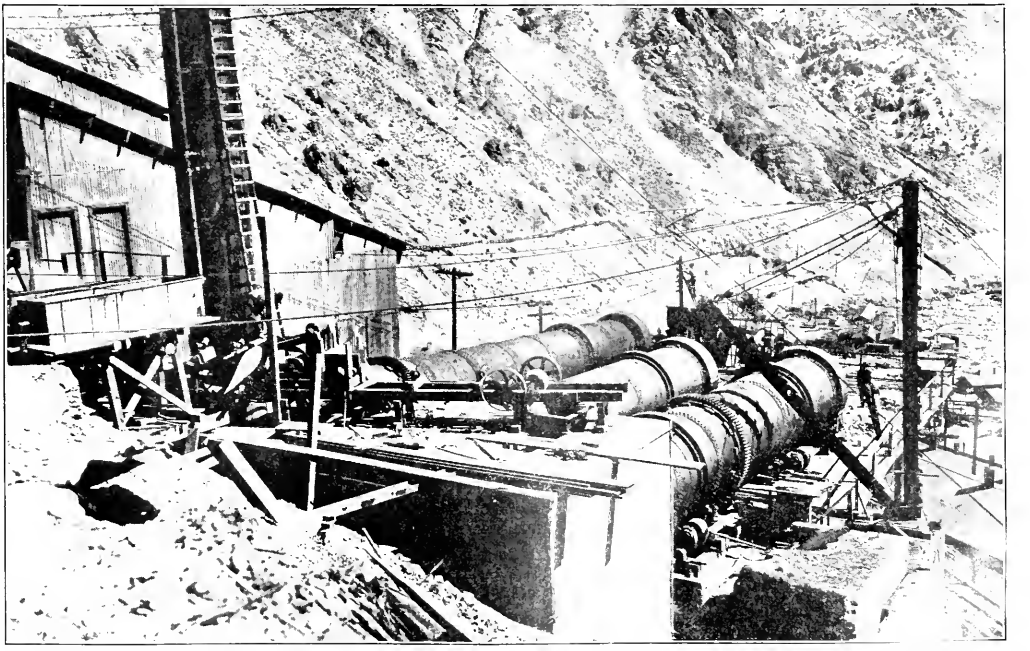
Braden Works, Sewell, Chile





The upper view shows the Braden Copper Co.'s reduction works at Sewell, Chile. The name of the town was formerly Molino, but was changed to Sewell on March 1, 1915, in memory of the late president, Barton Sewell. The mines are about 1½ miles up Teniente Cañon at the right. The chief features of interest in Sewell are: 1, penstock and high-pressure water line; 2, coarse-ore bins; 3, electric railroad to mine; 4, 5, 6, adits of Teniente mine; 7, crushing plant; 8, mill; 9, staff house; 10, main office; 11, American townsite; 12, store and warehouse; 13, mechanical shops; 14, foundry; 15, laundry; 16, laboratory; 17, smeltery charge bins; 18, nodulizing cylinders; 19, dust chambers; 20, blast-furnace building; 21, converter plant; 22, electrolytic building; 23, leaching plant; 24, sulphuric-acid plant; 25, roasting plant; 26, native quarters and town. Farther up the hill is the staff house, a modern hospital has been provided. The lower illustration is a closer view of the mill, which employs both gravity and flotation concentration.





The upper view shows the sulphuric-acid plant which supplies acid for the flotation process and for [illegible]ching experiments. The lower view shows the nodulizing cylinders in which the flotation concentrates are agglomerated to make them suitable for blast-furnace charging.

Manganiferous Iron Ores of the Cuyuna Range

By Edward P. McCarty*

SYNOPSIS—Orebodies occur lens-shaped averaging 300 ft. wide on the North Range and 125 ft. on the South Range. North Range ores are manganiferous, the South Range ores are not. Ores are of secondary origin. A small tonnage is low in phosphorus. A large tonnage is high-phosphorus and can now only be used in mixtures to make pig iron. Beneficiation is difficult and mechanical washing and concentrating tests thus far show only indifferent results. Magnetic separation would reduce phosphorus but could not separate iron and manganese.

The iron and manganese orebodies of the Cuyuna range, Minnesota, are irregular in form though usually lens-shaped. Both iron and manganese occur within the same lens. These lenses may be broad, narrow, single or double, and often parallel, separated by lean ore material or barren rock. They stand at steep dips.

As to size great variation is to be noted. The ore-bearing formation without doubt is continuous for many miles, but the length of a single lens is not great. The lenses of ore have a tendency to overlap. A rapid change in the formation may cause the pinching out of a lens. Irregularities in the shape of the lens may make it appear as though the lens had pinched out. This may be due to the pitching trough. Underground development alone will show actual conditions. On the North Range the greatest width of lens does not exceed in all probability 500 ft. The average will be much less, not exceeding 200 ft. On the South Range 125 ft. is nearer the maximum width with an average of about 50 ft. It is not likely that commercial ore will be found extending to a great depth since ore concentration has taken place from the top down. Perhaps 150 ft. deep for the North Range and 300 ft. deep for the South Range would be a fair estimate for the average depth of merchantable ore, having in mind the iron ore rather than the manganiferous ore.

The Cuyuna iron ores are mostly hydrated hematites of a red, brown, and black color, and in some cases earthy in character. The ores show high loss on ignition. This is owing to the driving off of the water of crystallization and the decomposition of carbonates that may be present. Such ores smelt readily. Some of the ores are true hematites, especially the North Range deposits. The brown and black ores are characteristic of the South Range and are somewhat magnetic.

Manganiferous Ores of the North Range

The North Range contains areas of highly manganiferous ores so far lacking in the South Range. The iron content of this ore averages about 55%. On the South Range it is almost an invariable rule that the highest percentage of iron is found in the ore near the surface and the iron content decreases with increased depth. This is also true, to a certain extent, on the North Range. Siliceous material is present in considerable quantities. Where the iron runs high the silica runs low and vice versa. With increased depth the silica rapidly increases until the ore becomes too lean to be merchantable. The average phosphorus content is high, about 0.30%. Present developments show a bessemer iron orebody in only one 80-acre tract. The alumina averages well for merchantable ore, although the ores are slaty in places; little or no paint rock occurs. The manganese presents an interesting phase relative to the ores of the district.

On the North Range there exist orebodies carrying 25% manganese for part of a drill hole while the rest of the hole may show little or no manganese. Many drill holes average from 6 to 15% manganese, while a short distance from the hole the orebody shows very little manganese. As a rule it follows the iron in a high percentage near the surface, decreasing with depth. In the general run of bodies the manganese will be less than 1%. In certain cases development shows a higher percentage of manganese than that indicated by drill holes. As usual with manganese minerals the ore formation is spotty.

The moisture content of the ores varies from 6 to 14% with an average of about 12%. The shape of the orebodies and their relation to the adjacent rocks exclude the idea of their being contemporaneous with the enclosing rock. Their occurrence near the erosion surface indicates a secondary development in the nature of a concentration by meteoric waters. Iron carbonate was undoubtedly present in the original iron-bearing rocks. The Cuyuna orebodies therefore may contain some iron carbonate where the weathering has been incomplete.

The manganiferous ores of the Cuyuna Range may be classified into: (1) Low-phosphorus manganiferous iron ore, and (2) high-phosphorus manganiferous iron ore.

The first class is made up of a small tonnage of manganiferous ore low in phosphorus; that is, an ore which is sufficiently high in manganese and of a character suitable for the manufacture of spiegeleisen—the alloy used for recarburizing in the bessemer process and to some slight extent in the open hearth. Such ore is found in one of the operating mines and to a small extent elsewhere. The analysis is variable, but may be taken at: Iron 44.25%; phosphorus .036%; manganese 10.50%; silica 18.25%; moisture 9.55%. Its tonnage, however, is small. The layers containing this low-phosphorus manganiferous iron ore will ultimately run into stringers of material containing so much phosphorus as to cause the orebody to pass into the high-phosphorus manganiferous iron ore.

High-Phosphorus Ores

The second class consists of a considerable tonnage of high-phosphorus manganiferous iron ore. It is difficult to give to this class an average grade, but the table on the following page gives some representative analyses.

*Professor of mining, University of Minnesota

It is at once apparent that such ores would have their only use in mixture with other ores in the manufacture of pig iron, where the regular mixture does not carry sufficient manganese. The present tendency of steel makers is to increase the manganese charge in their ores. The presence of 1% manganese is desirable in basic iron on account of the beneficial effects which this element has with respect to sulphur. Many ores do not contain sufficient manganese to make an iron containing as high as 1%. The ores carrying from 15 to 16% manganese

ANALYSES BY PER CENT., DRY WEIGHT

Iron	Phosphorus	Manganese	Silica	Alumina
46.85	0.239	6.84	4.80	3.66
48.39	0.314	7.02	6.07	2.35
40.85	0.273	15.24	3.21	2.91
38.74	0.262	16.23	3.21	2.91
51.16	0.288	6.61	6.07	2.35

could be used in making spiegeleisen, if the phosphorus percentage was not so high. Spiegeleisen must contain less than $\frac{1}{10}$ of 1% in phosphorus. If these ores were smelted directly without any previous treatment, the resulting product would be a high-phosphorus spiegeleisen, varying in manganese from about 10%, for the low-manganese ores, to about 22% for the higher-manganese ores.

In the smelting of manganiferous iron ores, it is found that about three-fourths of the manganese will go into the metal and one-fourth into the slag. All the phosphorus, unfortunately, will remain with the metal. Owing to the high phosphorus of these ores they are unsuitable for spiegeleisen, and on account of the phosphorus content, they would naturally be graded as foundry ores, except that the high manganese precludes the use of such ores for foundry purposes.

Unmerchantable Low-Grade Ores

Owing to the low iron content these ores are not of merchantable grade at this time, even if the phosphorus and the manganese were in such percentages as to admit of their use as foundry ores or steel-making ores; such ores could not be used in a furnace on a basis of 100% of the charge on account of excess manganese.

According to Ledubur, an ore of the following composition is smelted in the Queen Mary steel plant in Germany: Iron oxide 39.30%; manganese 10.48%; silica 21.92%; alumina 11.84%; lime 0.27%; magnesia 1.19%; sulphur 0.01%; phosphorus 0.68%; loss on ignition 9.00%. This ore is a siderite containing high alumina and was, for the most part originally limonite, ultimately decomposed into a siderite. Little of such ore, however, has been utilized. It is to be noted that the composition of this ore is much like that covered in this class found on the Cuyuna Range. It is not to be confounded under any conditions with the class of ores called in the trade "manganese ores." Such manganese ores contain from 10 to 52% in manganese. Phosphorus analyzes from .01 to .05%. The iron percentage varies from 2 to 14. Manganese ore with percentages such as these is marketed in various parts of the world. It is to be noted that the percentage of phosphorus is low and the percentage of manganese high.

In England an iron carbonate is used. It is usually roasted before smelting. A typical analysis is as follows: Iron oxide 36.14%; manganese 1.12%; silica 10.17%; alumina 4.80%; lime 0.16%; magnesia 0.94%; sulphur 0.04%; phosphorus 0.33%; moisture 2.52%. From the above analysis it is at once seen that the phosphorus is practically the same as that carried by the Cuyuna Range ore, but the iron is in the form of a siderite and in no wise directly comparable with the Cuyuna ore.

Problem of Beneficiation

Since the high phosphorus manganiferous ore cannot be smelted and treated at a profit without prior beneficiation, the question at once arises, How may such beneficiation be done? By beneficiation is meant the increasing of the iron and manganese content or the purifying of the mass by the removal of the phosphorus, silica, sulphur, etc. Beneficiation along metallurgical lines does not offer an inviting field. Hence resort must be had to some mechanical treatment of the ore. Such ore might be screen-sized, classified, washed in a log washer, jigged, treated on reciprocating tables or magnetically concentrated. Tests made so far have shown only indifferent results.

Magnetic concentration might aid in reducing the phosphorus content, but cannot separate iron and manganese. The phosphorus may exist in an iron ore, or manganiferous iron ore, as on the Cuyuna Range, in the form of several minerals, principally apatite ($CaFCl.Ca_4P_2O_{12}$) and vivianite ($Fe_3P_2O_{8}.8H_2O$). In New York, operating on a magnetic ore—note the Cuyuna ore is a hematite—by fine grinding and magnetically concentrating the product, commercial apatite is formed as a byproduct and a nonbessemer ore rendered bessemer. In the Cuyuna ores the phosphorus exists in the form of apatite in part only, crystals of apatite have been found, but the percentage of phosphorus is greatly in excess of that carried by the apatite. It is a fair assumption that much of the phosphorus is in the form of vivianite or similar minerals. When thus combined, the iron and phosphorus cannot be separated magnetically.

Present indications are not favorable to beneficiating Cuyuna ore by magnetic concentration alone.

Tonnages Developed

The tonnages and grade of high-phosphorus manganiferous ore so far developed on the Cuyuna Range is as follows:

ANALYSES BY PER CENT., DRY WEIGHT

Tons	Iron	Phosphorus	Manganese	Iron and Manganese
123,771	54.65	0.179	1.22	55.87
3,122,031	56.38	0.159	1.36	57.74
720,488	53.69	0.258	3.53	57.22
644,750	50.85	0.350	4.98	55.83
713,490	48.15	0.236	5.90	54.05
468,566	47.27	0.058	9.19	56.46
948,802	46.46	0.236	10.99	57.45
1,939,417	42.57	0.226	11.30	53.87
408,878	39.27	0.090	15.45	54.72
183,716	43.26	0.156	15.96	59.22
100,000	30.82	0.070	21.93	52.75

The total as shown above amounts to 9,373,909 tons of such ore. Without question further drilling will increase this tonnage, but the fact remains that the general character of such ore has been established and the value, whether materially increased or not, is practically settled. Many erroneous statements have been made at different times relative to these manganiferous ores, and until recently a correct knowledge of them had not been acquired.

Nothing has been said about ferromanganese which was of such interest a few months since. There is no ore on the Cuyuna Range from which ferromanganese may be manufactured. A small tonnage of spiegeleisen can be produced.

It should be borne in mind that the consumption of ferromanganese is increasing in the United States, as the making of openhearth steel increases, while the use of spiegeleisen is decreasing as its principal role is that of a recarburizing agent in the bessemer process of steel manufacture.

The Minnesota School of Mines Experiment Station has in press a bulletin entitled "Preliminary Concentration Tests on Cuyuna Ores." This publication takes up the treatment of the ores with considerable detail and deals especially with log washing and jigging tests. A chapter is devoted to the manganiferous ores.

Draining a Swamp by Air Lifts

SPECIAL CORRESPONDENCE

At the American mine, Diorite, Mich., J. R. Thompson, manager and part owner, has devised a novel method for removing the water from a large swamp which lies above some of the mine's ore deposits. The swamp is about 2 mi. in length and 1 mi. in width, containing a great deal of water, and it was feared that if it ever came into the workings in large quantities it would cause trouble. To get rid of the water was considered quite a problem, but Mr. Thompson did some figuring and believed that he could solve it. He had a diamond-drill company put down several holes in the swamp, to find how close the ledge was to surface, which would give some idea of the amount of water that the swamp held. The drills showed that the ledge varied from about 70 to 125 ft. below surface. On top there was about 10 ft. of black muck, with quicksand and gravel below. The diamond-drill firm was asked to put down several 8-in. holes to the gravel, but its engineer stated that the task would be too great, as the quicksand would cause difficulties. Mr. Thompson then undertook the work himself, putting down the first pipe a distance of 76 ft. in three days after the tripod was rigged up. The pipe was not touched with a hammer. It was sunk by turning, forcing air down the inside at the same time. When the pipe was bottomed in the gravel the air caused the water to shoot to surface. This pipe is now producing about 1000 gal. per min. Since that time five more pipes have been put down, some of them reaching a depth of over 100 ft. One went through the gravel, being put down deeper than any of the others, and no water is now flowing from it. An attempt was made to blast it off higher up, but without success. One of the other pipes is also inactive. The four that are now working are sending about 5000 gal. per min. to surface. Two of the pipes are 10 in. in diameter, but they do not give any better results than the 8-in. pipes. This system of an air-lift has lowered the water level in that huge swamp over 20 ft. during the short time that it has been in operation. When most of the water is out, a drift will be extended from the 140-ft. level of the mine and a 3500-gal. centrifugal pump installed to care for any water that comes into the swamp later on. The method is very cheap, as the pipes need no attention after they get in operation. Some idea of the force of the water can be gained from the fact that granite rocks weighing as much as 85 lb. were brought to surface through one of the pipes. The water coming from below runs into a ditch that was made by using dynamite and forms quite a sizable stream. The principal of the air-lift is quite old, but we do not know that it has ever been applied to this kind of work before.

Bureau of Mines Suggested Regulations for Mines

A publication of considerable interest to the metal-mining districts of the United States has just been issued by the Bureau of Mines, under the title, "Rules and Regulations for Metal Mines." It is to be known as Bulletin 55 and the authors are W. R. Ingalls, J. Parke Channing, James Douglas, James R. Finlay, and John Hays Hammond.

The above committee was originally appointed at a meeting of the American Mining Congress at Denver, Colo., in November, 1906, and its object was the drafting of a modern law governing quarrying and metalliferous mining which could be recommended to the several states for adoption, in the hope that the passage of such a uniform law by the mining states would tend to lower the number of fatal and serious accidents.

When the committee took up its work, it found that Colorado, Missouri, Montana and New York were the only states that had enacted mining laws of broad scope applicable to other than coal mines. California, Arizona, Idaho, Kansas, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, South Dakota, Tennessee, Utah, Washington, and Wyoming were found to have statutes pertaining to metalliferous mining, but with few and incomplete safety provisions.

This committee of the American Mining Congress did considerable work along this line and made a number of reports. In April, 1911, Dr. Joseph A. Holmes, Director of the Bureau of Mines, invited the committee to serve as a committee of that bureau with the idea of preparing a final draft of a law, and this invitation was accepted.

Starting with a composite of existing laws, the committee by successive stages endeavored to work out a general law that would embody the best mining thought of the day, be in accord with approved modern mining practices, and yet at the same time be effective and practical in operation, not merely a collection of rules and regulations to be disregarded or enforced at will. The committee in discussing its report says:

"We have found that a great deal of interest and attention among mine operators has been awakened by our advocacy of improved means for promoting safety in mining. However, we are under no illusion that our recommendations will be immediately and generally adopted. We consider our work to be especially of educational character rather than anything else. It will be useful in three main ways, we think, as follows:

"1. As a basis for State legislation.

"2. As a basis for private systems of inspection.

"3. As a collection of simple rules for the guidance of everybody engaged in mining.

"Since the publication of our first report several States have adopted new mining laws and amended their old ones. In this connection our code has served some purpose; for example, in the drafting of the laws that now stand on the books of the states of Nevada and Arizona. We do not expect that any state will at once adopt all of our recommendations, especially those that are essentially of legal character. We offer them as what we think ought to be and hope some day will be.

"Since our first publication, furthermore, most of the mining companies of consequence have adopted inspection systems or have at least framed codes of safety rules, which have been based to a large extent on our code, notably so in the case of the Cleveland-Cliffs Iron Co. This tendency, in fact, has become one of the most important phases in the national movement for 'Safety First.' This is the gratifying consummation that we had in mind. Unquestionably, also, the widespread adoption of state laws providing compensation for injured workmen has helped the safety movement by making accident prevention worth while.

"We consider, however, that the chief usefulness of the code of rules that we have formulated will be to small operators, who frequently engage in unsafe practices without knowing that they are unsafe or without thinking about the matter at all. There is a reasonable hope that our report will be of educational value to all mining operators.

"The act that we have drafted may be regarded from two angles—from the legal and from the technical. With respect to the latter we have had in mind the conditions and practice of mining existing and prevailing in the several parts of the United States. In our treatment of the matter from the legal standpoint, in which we have had the advice of good lawyers, we have refused to clothe the inspector of mines with the optional powers that are given to him under the laws of many of the British colonies, and also we have refused to convey to him the sweeping power that is given to health inspectors in some of our own states.

"The code of mining rules that has been finally drafted by the committee is the coördination of the experiences, opinions, and suggestions of a great many men who have been associated with the committee in an advisory capacity and as directly employed aids. The former have included many engineers actively engaged in practice, members of professional societies, and members of the bar; the latter have included members of the regular staff of the Bureau of Mines and of the personal staffs of members of the committee. The committee has sought to obtain many points of view and to summarize many experiences. The draft that has been prepared is not offered as the last word upon this subject. There are many phases of this subject with which the committee has been unable to deal thoroughly. Thus the committee confesses its inability to formulate at the present time adequate rules covering the important subject of ventilation of mines. Similarly there are many practices in opencut mining, by steam shovels, etc., regarding which the committee has felt unable to formulate rules. We feel, however, that the rules so far as prescribed may advantageously be applied to open mining whether it be simple quarrying or the extraction of metalliferous mineral, as well as to underground mining."

Lake Superior Mining Institute

The twentieth annual meeting of the Lake Superior Mining Institute will be held on Sept. 6, 7 and 8, 1915, assembling at Ishpeming, Mich.

A first-aid contest will be held Monday morning, Sept. 6. In the afternoon automobiles will be taken for a trip over the range, visiting the following mines: Norrie Group, Newport, Colby and Wakefield. The Wakefield is the new property opened by the M. A. Hanna Co. and is described in a paper by W. C. Hart. Stops will also be made at other mines en route. A business session will be held at the New Central High School at 7:45 p.m. Trains will leave for the Cuyuna at 11 p.m., arriving at Crosby, Minn., at 7:30 a.m. Breakfast will be served on the dining cars from 6 a.m. Cars will be provided to take the party to the following mines: Croft, Thompson, Armour No. 1 and No. 2, Kennedy, Pennington, Mahnomen, Mille Lacs, Iron Mountain, Sultana and Hill Crest. This is the first visit of the Institute to the Cuyuna Range. Another business session will be held in the evening, and trains will leave for Minneapolis at 11 p.m.

On Wednesday the party will be met at the train by a special committee of the Minneapolis Civic and Commerce Association. Automobiles will be provided for a visit to the Minnesota School of Mines. Luncheon will be served at the Minnikahda Club at 1 p.m. and after luncheon the party will visit the State Fair.

Following is a partial list of papers to be presented during the meeting: "Sheet-Ground Mining in the Joplin District, Missouri," by Edwin Higgins, mining engineer, Bureau of Mines, Ironwood, Mich.; "Rock-Drifting in the Morris-Lloyd Mine, Marquette Range," by J. E. Hayden, mining engineer, Ishpeming, Mich.; "Sinking of the Woodbury Shaft at the Newport Mine, Gogebic Range," by J. M. Broan, mining engineer, Ironwood, Mich.; "Mining Methods on the Gogebic Range," by Messrs. Oscar Olson, Frank Blackwell, O. M. Schaus, Committee; "A Survey of the Developments and Operations in the Cuyuna Iron Ore District of Minnesota," by Carl Zapffe, geologist, Brainerd, Minn.; "The Mining School of the Cleveland-Cliffs Iron Co.," by C. S. Stevenson, director, educational department, Ishpeming, Mich.; "Grouting at the Francis Mine Shaft of the Cleveland-Cliffs Iron Co.," by John R. Reigart, assistant superintendent, Princeton, Mich.; "New Stock-Pile Trestle, Colby Iron Mining Co.," by G. S. Barber, superintendent, Bessemer, Mich.; "Opening of the Wakefield Mine," by W. C. Hart, superintendent, Wakefield, Mich.; "The Use of Gunite in a Steel Shaft and in an Underground Pump-House on the Gogebic Range," by Steven Royce, general engineer, Hurley, Wis.

Cuyuna Range Tonnage for 1915

BRAINERD CORRESPONDENCE

Under present expectations the Cuyuna Range will ship 1,075,000 tons in the 1915 season. This estimate is based on announced ore sales and other definite factors. Of this tonnage the Soo Line will haul fully 80%, the remainder going via the Northern Pacific. Detailed tabulation is as follows:

	Expected Tonnage	Maximum
*Armour No. 1	75,000	75,000
*Armour No. 2	200,000	250,000
Adams	.....	.....
Barrows	.....	.....
Brainerd-Cuyuna	.....	2,000
Croft	.....	.....
Cuyuna-Mille Lacs	40,000	50,000
Cuyuna-Duluth	.....	10,000
Hill Crest	.....	.....
*Iron Mountain	10,000	10,000
†Kennedy	200,000	225,000
Mahnomen	.....	10,000
*Meacham	.....	.....
*Pennington	100,000	100,000
*Rowe	200,000	300,000
Rowley	.....	.....
Sultana	.....	2,000
*Thompson	200,000	200,000
Wilcox	50,000	60,000
	1,075,000	1,294,000

*Ships via Soo Line. †One-half tonnage to the Soo and one-half to the Northern Pacific. The remainder ship via Northern Pacific or are not tied up.

Electrical Power for the Cuyuna Range

BRAINERD CORRESPONDENCE

The Cuyuna Range is supplied with hydro-electric power by the Cuyuna Range Power Co., whose power plant is located on the Crow Wing River southwest of Brainerd. A large proportion of the underground pumping is done electrically, although operators have found it necessary to safeguard themselves by the installation of auxiliary steam pumping plants. The Wilcox mine, at Woodrow on the South Range, has perhaps the best equipment in this respect. Here the pumping facilities consist of one 1200-gal. two-stage electric station pump (100-hp. motor), one 800-gal. four-stage electric sinking pump (65-hp. motor) as an auxiliary, and a small electric pump for boiler feed, etc. A like capacity of simple and compound, noncondensing steam pumps is carried for emergency purposes only. Air for drilling is compressed by a 100-hp. electrically driven machine. The remainder of the plant is steam, two 150-

hp. boilers furnishing power for hoisting and for operating the auxiliary pumps. At the Rowe mine, Riverton, electrically operated pumps have served admirably in furnishing water for the hydraulicking operations, which are now practically completed.

English and Canadian Tough Oakes Companies

SPECIAL CORRESPONDENCE

The Tough Oakes Co. in Kirkland Lake, which has received so much publicity on account of the financial mazes through which its promoters have carried it, is again in the limelight because of an endeavor to have the English company liquidated.

There are two companies of the same name, one English and the other Canadian, the former having contracted to purchase the stock of the Canadian company through the agency of the Kirkland Lake Proprietary, which is also an English company. The Proprietary and the English Tough Oakes were promoted by the same people, and in the process of transferring the stock a substantial commission was obtained by the Proprietary company.

The English Tough Oakes Co. sold stock to the extent of £200,000, and of this amount only £15,000 was paid to the Canadian company. The balance of £155,000 was practically all loaned to several companies in which the promoters of the English company and the Proprietary held control, and the stock of these various companies was given as security for the loans. After the war broke out it was impossible for the English company to realize on any of these securities—some of which did not have anything very substantial behind them—so that the contracts with the Canadian company could not be carried out. A petition was presented in the English courts asking for the winding up of the English Tough Oakes Co., and this petition was supported by holders of 20,500 shares, while those opposing the petition represented 155,000 shares.

The judge ordered the petition to stand over pending the hearings of the actions in the Kings Bench Division, and also ordered the company to use its best endeavors to collect the moneys owing.

College Teams in a National First-Aid Meet

In view of the great interest manifested by first-aid teams from mining colleges in the third annual joint field meet to be held in San Francisco, Sept. 23 and 24, by the United States Bureau of Mines, the American Mine Safety Association and the California Metal Producers' Association, the rules committee has withdrawn the restrictions against the participation of such teams in the meet.

The ruling previously made that only teams from bona-fide mining, smelting and milling companies should be admitted to the interstate contests of Sept. 24, hereby restricting teams from mining colleges to participation in the demonstrations of Sept. 23, has been modified to provide that such teams and teams from state departments or other institutions interested in safety in mining, but not concerned in mine operation, may compete among themselves on the 24th for a special prize for the most proficient team from an educational institution.

Freeman's Appeal Wins New Trial

The United States Circuit Court of Appeals handed down a decision reversing the judgment of the trial court in the case of Albert Freeman, who, with Julian Hawthorne and Dr. William J. Morton, was convicted of using the mails in a scheme to defraud investors in mining stocks, and sentenced to serve a term of five years' imprisonment in the Atlanta penitentiary. In reversing the judgment the Appellate Court orders a new trial for Freeman.

Hawthorne and Doctor Morton did not appeal, and since the trial they have served their sentences.

The appeal was granted on the ground that two different judges could not hear the same case. While the trial of Freeman, Hawthorne, and Doctor Morton was under way in the Criminal Branch of the Federal District Court, Judge Charles M. Hough, who was presiding, was taken suddenly ill, and then, in accordance with a stipulation entered into by District Attorney Marshall for the Government and counsel for the defendants, the trial was continued and finished before Judge Julius M. Mayer.

Later, on a motion, irregularities concerning the jury were brought to Judge Mayer's notice.

Freeman was convicted in March, 1912, and in asking for a new trial asserted that one of the trial jurors was disqualified because as a Grand Juror he had previously investigated the Hawthorne Silver & Iron Mining enterprises. Freeman further asserted that three of his witnesses were intimidated and threatened with prosecution if they crossed the Canadian border to swear to the accuracy of their reports which were used in the sale of mining stock.

Gold and Silver Production in 1914

The revised statement of the Director of the Mint shows that the production of gold and silver in the United States during 1914 was actually considerably in excess of the preliminary estimate published last January. The production of the precious metals in 1914 therefore compares with that of 1913 as follows:

	1913	1914	Changes
Gold, value	$88,884,400	$94,531,800	I. $5,647,400
Silver, fine oz.	66,807,500	72,455,100	I. 5,653,600

The corrected totals exceed the earlier estimate for 1914 by $1,708,300 gold and 4,525,400 oz. fine silver. The approximate value of the silver produced in 1914 was $39,713,365, at the average price of the year.

Bureau of Mines Car Schedule

The Bureau of Mines Denver Car No. 2, J. H. East in charge, will follow the following schedule for the next 10 days:

	Arrive	Leave
Bisbee, Ariz.	Sept. 5	Sept. 7
Clifton, Ariz.	Sept. 7	Sept. 9
Globe, Ariz.	Sept. 9	Sept. 11
Los Angeles, Calif.	Sept. 12	Sept. 13
San Francisco, Calif.	Sept. 14	.....

The Shawinigan Electro-Products Co., Baltimore, Md., will erect a plant for the manufacture of calcium carbide, according to report.

Editorials

Mining-Stock Brokers

The spirit of speculation that has once more overtaken our people is naturally developing an activity in the mining-stock exchanges of New York and the interior, or the semblance of such. Already there are reports of scandals and of operations that are attracting the attention of the authorities. The latter should be on the alert, else the work they did in cleaning up the criminal dirt that accumulated during the boom of 1906-7 and soon afterward will be undone.

Now let us have a clear understanding of what the conditions are. Almost all branches of business are speculative, mining being so neither more nor less than any other. Utah Copper Co., for example, exemplifies an enterprise in which millions of money were expended in developing a huge deposit of copper ore. During the development period there was speculation as to how large the ore deposit would prove, whether the estimates of grade would be verified, whether unforeseen difficulties in the extraction and beneficiation of the ore would crop out, etc. There were violent controversies over some of those matters. After the lapse of nearly 10 years the disputes have disappeared, the position of Utah has been established, investment in its shares has come to be regarded as safer than investment in New York City real estate. Yet there is still speculation in them. The market for copper, the policy of the management, the possibilities of progress in the arts of mining and metallurgy—all constitute factors that affect value and afford opportunity for speculation than which nothing is more legitimate.

Another kind of speculation in mining is equally legitimate and is indeed the mainstay of the mining industry. This is the venturing of capital in looking for mines, in making mines. In this the chances for loss are greatest and conversely the chances for big returns are correspondingly large. Such speculation is usually undertaken privately by a small group of persons, or by a larger group through the medium of an exploration company. The public is seldom invited to participate, nor should it be, and there is no need for the listing of stock upon an exchange. When a mine has been brought to some degree of success its shares become more and more distributed. Private trading is followed naturally by public trading on the curb, and finally the stock goes upon the New York Stock Exchange, the great market of the country.

To this legitimate business in mining the so-called "business" on the minor exchanges bears about the same relation that the betting ring of a race course does to a trading place for commodities. The prime function of those exchanges is the gambling in things that do not mean anything, in pieces of paper, in mere names. Almost everywhere in the United States the faro bank, the roulette wheel, the pool room have been exterminated. The managers of the "mining-stock exchanges" say that they are doing "business," their dealers and lookouts and cappers call themselves brokers and the police are impotent against them. Recently the brokers of the exchange in Salt Lake City suspended a regular session in order to congregate in the so-called Gold Room of the Commercial Club in order to do honor to a notorious exponent of the black art who was warmly welcomed and feasted, for was he not going to foster a boom in Alta stocks? Try to imagine the brokers of the New York Stock Exchange doing that. In fact nearly all of these stock exchanges of the interior are cheap, contemptible. We are disposed to have most respect for the San Francisco exchange merely for the reason that there is no pretense that the dealing in Comstock shares is anything but gambling. A considerable portion of the population of San Francisco wants to gamble and the authorities are willing to permit them to do so under the guise of doing business, although they will not permit ordinary gambling. Moreover, the San Francisco brokers, satisfied with their regular clientele, make no attempt to inveigle unwary widows living in Vermont.

Reports from the West are to the effect that "mining brokers everywhere who have the best interests of the mining industry at heart are taking an active part in the proposed organization of a National Mining Brokers Association." When the prospectus gets to us we shall like to ask *when* did the "mining brokers" anywhere *ever* have the "best interests of the mining industry at heart"?

*

Democracy and Inefficiency

"The pioneer democrat had the backwoods and the Indian to fight. He won. He thought very well of himself in consequence. So his brains went raw. Raw, ready brains sufficed for his needs and emergencies. With an ax, a gun, a vote and some patent medicine, he survived. This greatly reinforced his initial generalization that 'one man was as good as another.' Very despotic was this son of liberty in his backwoods. His notion of liberty was that everybody was *free to agree with him.*

"Before we came into the world, the times were filled with phrases. Our birthday was celebrated by a phrase: All men are created equal. Into the Declaration of Independence Jefferson, a slaveholder, wrote this and all the signers signed it; and thus phrases and falsehood were made bone of our bone and flesh of our flesh. They essayed to reconcile equality and slavery by explaining that negroes were not exactly men.

"But you cannot continue to swallow a contradiction like slavery and equality for very long, without important results to your mental integrity. You never can substitute rhetoric for reality without important results to your brain. You cannot fight trained armies with rhetoric; and so the English burned Washington. The War of 1812, however, taught nothing to our phrase-mongers in Congress and elsewhere. We continued to be the 'land of the free,' and to boast about our 'glorious institutions and destiny.' We spoke of Europe's 'effete despotisms'; we said, 'Uncle Sam had a farm for everybody'; and our public orators from Jefferson to Bryan continued to build commonwealths with hot air.

"The cherishing the equality and slavery lie, and thus nourishing our Optimistic Fallacy with phrases which our easy success in the backwoods seemed to validate, we acquired our instinct to look away from any reality that fell short of squaring with the Optimistic Fallacy, any truth that refused to combine agreeably with it. From all such unpleasant facts, political and social, all facts that grated on the Optimistic Fallacy, we turned our eyes so quickly and so hard, that our national sincerity ended by acquiring a perpetual squint. Slavery was abolished—we know at what cost—but the four years' struggle of true national conscience, while it exalted a generation forever, could not undo the work of the 60 or 70 preceding years; the squint went on, it had become chronic. In great things, as in small, we hid behind phrases; changing the *words* satisfied us just as well as if we had thereby changed the *facts*. For instance, 'first' and 'second' class couldn't be painted on railroad cars; all passengers, being Americans, were equal; it would be 'un-American'; but paint 'Pullman' on a car, and everybody was satisfied.

"Under a great shock we see straight. If clumsily, still we are struggling for social justice. Our business honesty has improved. Perhaps we shall be cured of our squint without a surgical operation. Perhaps Uncle Sam may escape the fall he seems to be riding for; but if this is to be the case, we must see straight and keep ourselves right-minded on small as well as great occasions."

The foregoing paragraphs are composed from sentences selected and strung together from an article by Owen Wister in the *Atlantic Monthly* for June, 1915. They seem to us to reflect sharply the failing from which the welfare of our country has suffered more than is commonly comprehended. To such ideas as are therein exposed are traceable our muddling in military affairs; for example, in the Spanish-American War; our incompetency and waste that are most glaringly displayed in our municipal government, our ridiculous inefficiency in running our post office, and the harassing of our railways and great industrial corporations. Only exceptionally have we collectively done any great work well—the building of the Panama Canal being the brightest example—and when that has happened it has been for the reason that we have turned it over to an expert and kept our hands off. Probably if the Post-Office Department were turned over to Colonel Goethals in a similar way he would soon renovate it and run it as a well-organized business.

In our private and corporate affairs we have suffered largely from the same kind of inefficiency, although we have had such wonderfully rich resources to deal with that the results of disgraceful blundering have been dwarfed by the big returns that often have come in spite of ourselves. In late years we have begun to emancipate ourselves—at least our leaders have. A new spirit has pervaded us. Yet it has aroused the opposition of a large part of the people who would have us stick to the wastefulness of the corner-store retailer who must be protected in the competition which meant the survival only of the fittest. The labor leaders have consistently opposed everything savoring of scientific management.

In mining we have had similar experiences. The backwoodsmen operated lead mines in Missouri and Wisconsin, pick in one hand, rifle in the other, made something out of them and acquired the theory that anybody could run a mine—a theory that obtained until very recently. In many districts the ores sticking out among the grass roots were so rich and so easily won that indeed anybody could run such a mine, whether most advantageously or not is another matter. But since we have had recourse to the deposits of low-grade ore, involving engineering as a necessity, there has been another story.

The shock produced by the outbreak of the Great War has opened the eyes of America to many of its inefficiencies, has brushed away many false ideas. The hunters of the money devil who wanted to have the stock exchanges and commodity exchanges closed for being gambling hells saw them closed and the business of the country halted thereby, and having gained their wish voiced no opposition when they reopened. The trust-baiters ceased from blatherskiting and rejoiced over the efficiency that the great corporations exhibited in holding up the shattered props of our industries and later in reaching out into the foreign markets. But most impressive of all has been the lessons that Germany has been teaching the world, not only in warfare but also in peaceful sciences and arts. We shiver at the thoughts of what would happen if America had to match her ingenuity and power against the German kind of efficiency and organization.

New Director of U. S. B. M.

The appointment of Vannoy H. Manning to the directorship of the Bureau of Mines comes as a great relief from the apprehensions of what might have been. No longer have we to dread the shadow of the walking-delegate or of any of the friends of Brother Wilson, who presides over the Labor Department.

The leadership of the United States Bureau of Mines demands administrative ability above anything else. Our ideal for the directorship is a mining engineer of attainment and professional recognition, and administrative ability. But, alas! that ideal, like most ideals, is extraordinarily difficult of realization.

Mr. Manning is not a mining engineer, but he possesses executive ability. During the long illness of Doctor Holmes, when he was acting director, he won golden words of praise, not only for his administration, but also for his fine loyalty to his incapacitated chief and the ingenuous effacement of himself. It is always a good sign when a man's assistants support his promotion and work for it. Mr. Manning was the choice of the U. S. B. M. staff.

The *Journal* joins not only in the congratulations to Mr. Manning, but also to the President for making so good an appointment and to the mining industry for having a good man put at the head of the bureau that is so directly concerned with the welfare of all miners.

Inspiration Notes

The Inspiration engineers are working out some highly interesting problems, both in mining and metallurgy. The mill is now treating about 2700 tons of ore per day, and it is expected that it will be doing about 7000 tons by Nov. 1. After that everything depends upon getting the mine ready to deliver the enormous quantity of 14,000 tons of ore per day. That tonnage is indeed exceeded by far at Bingham, but that is a steam-shovel operation. Inspiration is going to hoist it through two shafts, 105 ft. apart. We may be in error, but we think that the achievement of this will be unprecedented. That it will be done there is no doubt. It is only a question of time.

In the Miami smeltery the Anaconda metallurgists, under the direction of Doctor Ricketts, have also cut loose from all precedents. Here is the first modern plant with no dust chambers. The Cottrell system is the substitute. The reverberatory furnaces—oil fired—are working upon an exceptionally rich charge—33% copper. They make more than 100 tons of copper per furnace per day, which is as much copper as there is slag. The slag runs 12 to 14% in alumina. In the flotation concentrates there appears to be an enrichment of alumina.

The Miami smelting plant was put in operation without a hitch. This is the modern American way of doing things, and especially is it the way of the Anaconda metallurgists. The report is becoming so common that it will soon cease to attract any attention. Nevertheless the feat, although often repeated, reflects great credit upon the engineers who perform it.

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It is said that spelter will be made from calamine at Donora, Penn., as early as Oct. 1. If that be done the engineers of the Steel Corporation will surpass all previous records in zinc-smelting construction. However, they have every incentive to be swift, and every facility is being given them. Construction work is being carried on by night as well as by day, and it is said that this job has precedence among all of those that the Steel Corporation has in hand.

BY THE WAY

In the opinion of a British officer, the best soldier is the miner. He is strong in the back, used to cramped positions, familiar with danger and explosions, and is said to put two and two together much quicker than men from other trades. This has been recognized by the Canadian military authorities, who have sent out a special appeal to all the mining camps for men for the proposed pioneer battalion.

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Alta and Emma Copper on the curb had their prices more than cut in half on Aug. 25. From 86c. the day before Alta was driven down to 30, closing at 42, and Emma from 88 vanished to 28, with a comeback to 43. This disaster, according to curb market gossip, was a heavy thrust at George Graham Rice. According to the New York *Sun*, Emma and Alta have been his two favorite mediums of speculation for some time. Since his return to the curb it has been common rumor that a group of sharpshooters as clever in their way as Rice once was in his have been gunning for him. The Aug. 25 drive was said to be their great coup. The stocks came back the following day with a modest degree of recuperative power, closing five or six points higher than on the day before, after bad breaks during the day. George Graham Rice at the close of the day smilingly reported that there was nothing in the stories that the gunners had hurt him, and to prove his triumph readily exhibited a fat bank roll with several bills of high denomination. The fall in the stocks, it was said, was a drive by the loan brokers. Other Curb Market experts attribute it to Rice himself, who is an old hand in such operations.

The late Jacob Langeloth, who at the time of his death, Aug. 14, 1914, was identified with many important mining enterprises, besides being chairman of the Board of Directors of the American Metal Co., left, as part of his $5,000,000 estate, the following securities, according to the appraisal of the state controller just published: 1300 shares in the American Metal Co., appraised at $1,201,000; 2000 shares of the F. W. Woolworth Co., preferred, $224,000; 2000 shares of the common stock of the same corporation, $168,000; 2350 shares of the Studebaker Corporation preferred, $190,350; 2520 shares of the common stock of the same company, $70,560; 600 shares of the Metallbank und Metallurgische Gesellschaft, $186,000; 11,400 shares of the Miami Copper Co., $171,000; 2430 shares of the Granby Consolidated Mining, Smelting and Power Co., $162,810; 1500 shares of the Nichols Copper Co., $135,000; and 750 shares of Sears, Roebuck & Co., common, $109,040, and 300 shares of the preferred stock of the same concern, $36,000. The bond holdings of the estate included: Philippine Island Government, $50,000; the Nichols Copper Co., $175,000; Mexican Petroleum Co., $55,500; and the State of New York, $26,750.

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August Mining Dividends

Dividends disbursed in August, 1915, by 23 United States mining companies making public reports amount to $3,637,387, as compared with $1,830,362 in August, 1914. Industrial and holding companies allied to mining paid $18,191,785 as compared with $11,617,745 a year ago, although it might be claimed that Amalgamated $3.77

United States Mining Companies	Situation	Per Share	Total
Alaska Treadwell, g	Alas	0 75	150,000
Alaska United, g	Alas.	0 40	72,080
Bunker Hill & Sullivan, l.s.	Ida.	0 25	81,750
Bunker Hill Con., g	Calif	0 02½	5,000
Caledonia, l.s.c	Ida.	0 03	78,150
Champion, c	Mich	3 00	300,000
Chief, s.l.	Utah	0 05	43,838
Con. Interstate Callahan, z.	Ida.	2 00	920,000
Eagle & Blue Bell, g s.l	Utah	0 10	89,315
Golden Cycle, g	Colo.	0 02	30,000
Hecla, l.s.	Ida.	0 07	70,000
Homestake, g	S. D	0 65	163,254
Jim Butler, g.s	Nev	0 10	200,000
Mohawk, c	Mich	2 00	200,000
Miami, c	Ariz	0 75	560,069
May Day, g.s.l	Utah	0 03	24,000
Prince Con, g	Utah	0 02½	25,000
Shattuck Arizona, c	Ariz.	0 50	175,000
Success, z	Ida	0 08	120,000
United Verde, c	Ariz.	0 75	225,000
Wasp No. 2, g	S. D	0 01	5,000
Wellington, g	Colo.	0 00½	50,000
Yellow Pine, l z s	Nev.	0 05	50,000
Iron, Industrial and Holding Companies	**Situation**	**Per Share**	**Total**
Amalgamated, c	Mont.	1 00	2,308,318
Amalgamated, c	Mont.	3 77	8,702,359
Cambria, i	Penn.	0 62½	562,500
International Nickel, pfd	N. J.	1 50	133,689
St. Mary's Mineral Land	Mich.	1 00	160,000
U. S. Steel, pfd.	U. S.	1 75	6,304,919
White Knob Cop. & Dev. Co.	Calif.	0 10	20,000
Canadian, Mexican and Central American Companies	**Situation**	**Per Share**	**Total**
Coniagas, s	Ont	0 30	240,000
Dominion Steel	Can.	1 50	105,000
Granby, c	Ont.	1 50	222,721
Hollinger, g	Ont.	0 20	120,000
Lucky Tiger, g s	Mex.	0 09	64,380
Seneca-Superior, s	Ont.	0 16	47,888

distribution was a return of capital rather than a dividend. Canadian and Mexican companies paid $799,989, as compared with $563,506 a year ago.

The totals for the first eight months of the year are as follows: Mining companies, $40,691,163, as against $42,410,582 in 1914; metallurgical and holding companies, $54,825,758, as against $56,167,506 in 1914; Canadian and Mexican mines, $5,297,340, as against $12,064,368 in 1914. The accompanying table shows details of the month's payments.

Correspondence and Discussion

Transactions of the International Engineering Congress

The International Engineering Congress is a serious effort on the part of the five societies under whose auspices it is conducted to give to the profession and the world at large something of real professional value in the shape of a clear statement of present practice in all branches of engineering in the different countries of the world. The work of securing, editing and publishing the *Transactions* of the congress is enormous and is being performed purely as a labor of love. The officers and members of the committee of management representing the five societies guarantee the expense, and the price of the publications has been fixed just high enough to cover the actual cost of clerical work, printing and binding, on an assumption of membership which before the outbreak of the European war, was extremely conservative.

While the war and the resultant conditions, even in neutral countries, have greatly reduced the anticipated enrollment of members, they have not resulted in a proportionate reduction in either the quality or the quantity of the material offered for publication in the *Transactions*. Sufficient papers have already been received to assure the success of the congress and the value of the *Transactions;* but in order that the congress should be the greatest possible benefit to the profession, it is essential that it should enroll the greatest possible number of members.

W. A. CATTELL.

San Francisco, Calif., Aug. 19, 1915.

Fineness of Crushing for Assaying

To Mr. Nason's request for data on the differences in assay value produced by variation in the fineness to which the ore is crushed I give one example that may be of value when correlated with other examples.

Some years ago in assaying a large number of samples I found that the first "batch," run in duplicate, did not check. I give the results on one sample that is typical for the group. The ore was quartz, containing free gold about 1 oz. of silver and 5% to 10% of sulphides. On this ore the duty of a 1000-lb. stamp, taking 1½-in. feed and crushing to 20-mesh, was four tons. For assaying, the pulp was crushed to 100% through 100-mesh and 50% through 150-mesh. Results for the sample were: First run—original, $18.60; check, $22.10. Second run—original, $21.90; check, $19.20.

The ore was then crushed to 100% through 150-mesh and about 70% through 200-mesh and assayed with the following results: Original, $20.35; check, $20.40.

It is my opinion that the variation in results was owing to error in sampling a pulp that had not been crushed to a uniform size. While the fact that the last set of assays checks does not prove that the results are correct, if we consider that the average of the first four is very nearly the same value, and that a commercial assayer obtained substantially the same result, it seems reasonable to suppose that the true value was obtained.

Although I am not an expert assayer—my assaying for the last six years having been confined to the assaying of samples taken in the examination of mines, and my opinion is therefore to be weighed accordingly—it has been my experience that coarse crushing gives variable, but not necessarily low results. I have never found that fine crushing decreases the assay value. If the pulp sample is of reasonable size, I believe that the steel worn off the crusher will be relatively small in amount and therefore negligible.

G. A. JOSLIN.

Los Angeles, Calif., Aug. 20, 1915.

NEW PATENTS

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

AMALGAMATOR. Elmer W. Hoffman, Tulsa, Okla. (U. S. No. 1,150,191; Aug. 17, 1915.)

BLAST FURNACE—Water-Cooled Valve. Luther L. Knox, Avalon, Penn., assignor to Knox Pressed & Welded Steel Co., Pittsburgh, Penn. (U. S. No. 1,151,193; Aug. 24, 1915.)

BLAST-FURNACE CONSTRUCTION. Luther L. Knox, Avalon, Penn., assignor to Knox Pressed & Welded Steel Co., Pittsburgh, Penn. (U. S. No. 1,151,192; Aug. 24, 1915.)

CAR—Cinder or Hot-Metal Car. Edgar A. Weimer, Lebanon, Penn. (U. S. No. 1,151,312; Aug. 24, 1915.)

CLASSIFIER. Albert E. Vandercook, Alameda, Calif., assignor to California Macvan Co., San Francisco, Calif. (U. S. No. 1,151,137; Aug. 24, 1915.)

CONCENTRATING TABLE. Robert Hunter, Spokane, Wash. (U. S. No. 1,151,466; Aug. 24, 1915.)

CRUSHER MANTLE. Ray C. Newhouse, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,151,119; Aug. 24, 1915.)

DRILLS—Valve for Percussive Tools. William Clement, Phillipsburg, N. J., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 13,959, reissue; Aug. 10, 1915.)

ELECTRIC DEPOSITION of Metals by Fusion. Arthur Percy Strohmenger, Westminster, London, England, assignor to Slaughter & Co., Ltd., London, Eng. (U. S. No. 13,970; Aug. 24, 1915.)

ELECTRIC FURNACE. James G. Marshall, Niagara Falls, N. Y., assignor to Union Carbide Co., New York, N. Y. (U. S. No. 1,149,202; Aug. 10, 1915.)

ELECTROLYTES—Process for Regenerating Electrolytes. Oliver Curtis Martin and Frederick Jaeger, Perth Amboy, N. J. (U. S. No. 1,140,522; Aug. 3, 1915.)

FELDSPAR—Treatment of Feldspar, Leucite, and the Like. Franz A. Rody and Harvey M. Burkey, Newark, N. J. (U. S. Nos. 1,151,498 and 1,151,533; Aug. 24, 1915.)

LEACHING—Device for Treating Ores. James Alexander Fleming, Globe, Ariz. (U. S. No. 1,150,669; Aug. 17, 1915.)

LEACHING—Recovery of Cuprous Sulphide from Ores and the Like. Raymond F. Bacon, Pittsburgh, Penn., assignor to Metals Research Co., New York, N. Y. (U. S. Nos. 1,151,234 and 1,151,235; Aug. 24, 1915.)

MINE-CAR COUPLING. William Towers, Christopher, Ill., assignor of forty-five one-hundredths to Roy Lockridge, Christopher, Ill. (U. S. No. 1,150,980; Aug. 24, 1915.)

MINING MACHINE. Edward O'Toole, Gary, W. Va. (U. S. No. 1,151,383; Aug. 24, 1915.)

MIXING APPARATUS. Ralph Baggaley, Pittsburgh, Penn. (U. S. No. 1,151,332; Aug. 24, 1915.)

ORE TREATMENT—Method of Treating Metalliferous Materials with Nitric Acid, and Recovering Solvents Used. Harry D. Rankin, Crafton, Penn., assignor, by mesne assignments, to Rankin Process Co., Phœnix, Ariz. (U. S. No. 1,150,787; Aug. 17, 1915.)

PHOSPHATE—Apparatus for Making Ammonium Phosphate. Frank S. Washburn, Nashville, Tenn. (U. S. No. 1,151,074; Aug. 24, 1915.)

ROASTING—Mechanical Ore-Roasting and Like Furnace. John Harris, Sheffield, England. (U. S. No. 1,149,754; Aug. 10, 1915.)

PERSONALS

George Watkin Evans, of Seattle, Wash., in Alaska on professional business.

A. Charles Meagher, recently with H. Kenyon Burch at Miami, Ariz., has returned to San Francisco.

H. W. Hardinge, president of the Hardinge Conical Mill Co., is visiting the mining districts of northern Ontario.

Leo Von Rosenberg has returned to New York from Cripple Creek, Colo., where he made examinations of several properties.

K. Freitag is now at Lower Rochester, Nev., where he is constructing a 100-ton cyanide mill for the Nevada Packard Mines.

Hon. Edward Brown, of the Manitoba Government, has gone to make an examination of the Herb Lake gold field in northern Manitoba.

W. R. Parker and J. P. Watson, directors of the Mining Corporation of Canada, have been inspecting the company's properties in Cobalt.

P. G. Spilsbury, manager of the Aguacate Mines, is returning to San Mateo, Costa Rica, after a visit of several months in the United States.

E. S. Dickinson, formerly assistant professor of mining at the University of Kansas, has taken a position on the mining staff of the Canadian Copper Co. at Copper Cliff, Ont.

A. O. Baer, assistant superintendent of the blast furnace plant of the Illinois Steel Co. at South Chicago, has been appointed superintendent of blast furnaces for the Minnesota Steel Co., Duluth.

As a memorial to the late Dr. Joseph A. Holmes, Director of the Bureau of Mines, the Colorado School of Mines has established the Joseph A. Holmes Professorship of Safety and Efficiency Engineering.

L. D. Adams, of Oakland, Calif., and C. H. Maxey, of Rutherford, N. J., are two of the incorporators of the Zinc Company, Ltd., of Sherbrooke, Quebec, organized to establish zinc-smelting works and refinery.

H. G. Palsgrove, formerly manager of the Dolores mine and also of La Dura in Mexico, has accepted the position of general superintendent for the Aguacate Mines and will sail for Costa Rica early in September from New Orleans.

Charles E. Duncan has been appointed superintendent of the rolling mills and axle plant of the Cambria Steel Co., Johnstown, Penn., to succeed J. C. Fox, resigned. Mr. Duncan has been identified with the Lake Superior Consolidated Steel Co., Sault Ste. Marie.

Charles Camsell, of the Canadian Geological Survey, who was commissioned to make an investigation into alleged silver discoveries in the Lake Athabasca region, reports that nothing of economic value has been found there. Some nickel ore was found to occur, but not in commercial quantities.

E. A. Cappelen Smith is expected to arrive in New York about Sept. 10, returning from the successful starting of the leaching plant at Chuquicamata, for which he was the consulting metallurgist. While in Chile he also inspected the reduction works of the Braden Copper Co. at Sewell.

Horatio C. Ray will return to his duties as professor in the School of Mines of the University of Pittsburgh after spending his summer doing experimental flotation work with the Butte & Superior Copper Co. at Butte, Mont. On his way home Professor Ray will examine properties in Oregon and Colorado, besides visiting the Exposition at San Francisco.

OBITUARY

H. S. Bion, assistant superintendent of the Geological Survey of India, died at Calcutta on June 6.

Herbert Kynaston, director of the Geological Survey of the Union of South Africa, died at Pretoria, on June 28, aged 46 years.

Henry Richards, of Dover, N. J., for many years known as a mining engineer and manufacturer, died Mar. 26 last. He was a member of the American Institute of Mining Engineers.

Matthew Doyle, discoverer of the 85 Mine at Lordsburg, Grant County, N. M., a well-known Southwestern prospector, died in an El Paso, Tex., hospital Aug. 19. Mr. Doyle was born in Scotland 73 years ago and came to America at the age of 30 years, being employed in coal mines in Pennsylvania. He later moved to Colorado and thence to New Mexico, where he operated mines and prospected new territory. He had accumulated considerable property. The remains were interred in Evergreen Cemetery, El Paso.

Dr. Herbert Gray Torrey died at his home at Stirling, N. J., Aug. 29, aged 74 years. He was born in New York, being a son of Dr. John G. Torrey, for some time professor in Columbia College and the first head of the New York Assay Office. Herbert Torrey graduated from the College of the City of New York in 1860 and later from the College of Physicians and Surgeons. He entered the New York Assay Office and on his father's death succeeded him as chief assayer, holding that position for 39 years, until 1910, when he resigned. He had since acted as consulting metallurgical engineer. He was considered a high authority and during his service at the assay office was constantly consulted on metallurgical questions. He was a member of the American Institute of Mining Engineers and of the Society of the Cincinnati.

Max Hebgen, of Butte, Mont., vice-president and general manager of the Montana Power Co., died at the Presbyterian Hospital Aug. 24. Mr. Hebgen was recognized as a leading electrical engineer and had been prominently identified with several of the largest power projects in this country. He was born in Beaver Dam, Wis., in 1869; went to Butte in 1889, and up to the time of his death had been a resident of that city. In Butte he was associated with W. A. Clark as superintendent of the old Butte Electric Light Co. He was continuously in the employ of that company and associated concerns until the final organization of the Montana Power Co., of which he was vice-president, general manager and director. Mr. Hebgen was the active engineering and directing head of all development work of the Montana Power Co. and the concerns it succeeded. He had a large part in the organization of that company, one of the largest concerns of its kind in the world, which, upon completion of plants now under construction, will develop and market 225,000 hp. Mr. Hebgen's illness, which last June forced him to undergo treatment at the Chicago hospital, dated from an attack of pneumonia contracted more than a year ago on an inspection trip to the Thompson Falls power plant. From this illness he never completely recovered. He leaves a widow and a son 13 years old.

SOCIETIES

Lake Superior Mining Institute—About 300 members and guests of the institute will assemble at Ironwood on Labor Day, Sept. 6, for the 20th annual meeting. One day will be spent on the Gogebic range, where the second annual first-aid meet will take place in the forenoon. Edwin Higgins, engineer in the Lake Superior district for the Bureau of Mines, will be in charge. Dr. A. F. Knoefel, president of the American Mine Safety Association, will be the chief judge, assisted by six physicians from outside the district. Teams have been entered by the following companies from the different ranges: Oliver Iron Mining Co., Mesabi; Montreal Mining Co., Gogebic; Odanah Mining Co., Gogebic; Verona Iron Co., Menominee; Oliver Iron Mining Co., Gogebic; Judson Mining Co., Menominee; Castile Mining Co., Gogebic; Colby Mining Co., Gogebic; Republic Iron & Steel Co., Mesabi; Newport Mining Co., Gogebic; Pickands, Mather & Co., Mesabi; Republic Iron & Steel Co., Marquette; Cleveland-Cliffs Iron Co., two teams, Marquette. In the afternoon automobiles will transport the party to the Newport, Woodbury, Palms-Anvil, Wakefield, Norrie and Colby mines. In the evening a business session will be held.

INDUSTRIAL NEWS

Business growth has caused the Western Electric Co. to give up its old quarters at Portland, Oregon. Since 1910 the Company has been located on Fifth Street, but has now moved into a new two-story brick and concrete building which has been made ready for it at East Ash and Union Streets.

The General Naval Stores Co., 175 Front St., New York City, has taken up the sale of flotation oils as a specialty branch of its business. Recently the company has introduced a number of new oils for this purpose, including coal-tar oils, wood creosotes, etc. It is the intention to provide ... oils for various ores, and a laboratory is maintained for this purpose, in which to test and match oils.

Editorial Correspondence

SAN FRANCISCO—Aug. 25

Total Production of California Petroleum in July was 7,738,643 bbl., an increase over the June production of 294,686 bbl. Shipments did not maintain the lead over production in July, which was the encouraging feature in the June operations. The July shipments amounted to 7,643,049 bbl., being 95,908 bbl. less than the production. Still this is not a discouraging figure. The total stocks at Aug. 1 were 59,650,219 bbl.

Committees for the National Mine Rescue and first-aid meet to be held at the Exposition, September 23 and 24, have been practically completed since making some necessary changes. Robert I. Kerr, secretary of the Metal Producers Association, is made chairman of the committee on recording and is also on the executive committee. Albert Burch resigned as chairman of the executive committee and George W. Metcalfe, manager of the Mammoth Copper Mining Co., has been elected in his place. Mr. Burch will remain on the committee. It is understood that D. C. Botting, commissioner of the Washington Coal Operators Association, has been appointed to the chairmanship of the committee to judge mine rescue work, R. Y. Williams having found it impossible to act. James Bagley, mine inspector of Washington, and Thomas Graham, chief mine inspector of British Columbia, have also been appointed to this committee. Dudley Michell, one of Mr. Graham's assistants, will probably be appointed to the committee on judging mine rescue. H. M. Wilson, formerly of the Bureau of Mines, continues to act as chairman of the board of managers.

Panama-Pacific Convention will be held in San Francisco Sept. 16 to 18 by the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers, and the American Institute of Mining Engineers. The International Engineering Congress, which has been organized by these four societies and by the Society of Naval Architects and Marine Engineers, will be held from Sept. 20 to 25. A comprehensive program of technical sessions, inspection trips and other interesting features has been arranged for the benefit of those attending this general gathering of the engineering profession. A special train will leave New York on Sept. 9 arriving in San Francisco on Sept. 15, with stopovers at Niagara Falls, Colorado Springs and the Grand Cañon. A special train will also leave New Orleans on Sept. 12, arriving at San Francisco on Sept. 15. There will be no return special train service, but a choice of several routes is offered. Representative Canadian committees of the British Institution of Civil Engineers, the Canadian Society of Civil Engineers and the American Society of Civil Engineers have invited those attending the congress to return through Canada, inspecting en route the engineering works within convenient distance of the main line of transportation through the provinces of British Columbia and Alberta. The installations visited will include the water-power development of the British Columbia Electric Railway Co., the Western Canada Power Co., the Calgary Power Co. and a number of large irrigation projects in Alberta.

Dancing on the Deck of a Gold Dredge is the novel method employed by the Feather River Gold Dredging Co. to celebrate the completion of the hull of a new dredge being constructed at Sumpter, Ore. The dredge has 7½-cu.ft. buckets and is of the California type of elevator dredge. The framing of the hull was started on June 6 and the laying of the deck completed on June 30. The Yuba Construction Co., the builders of the dredge, invited the people of Sumpter, Baker and Columbia aboard the boat for a dance on the night of June 30. The deck was temporarily housed in all round with canvas 8 ft. high. The main truss posts, stay rods and similar parts were concealed with evergreens and 155 electric lights were arranged for lighting and ornamental effect. On shore a tent was erected off the stern of the boat, having a covered passage between the tent and the boat, and fitted up as a ladies' cloak room. Refreshments were served in the construction camp dining room. Aboard the boat, punch was served, and the Sumpter orchestra, providing the dancing music, was installed in the space between the main gantry posts; the posts being concealed by evergreens. The well hole was planked over so that the dancers could make complete and uninterrupted round of the deck. There were 125 couples in the grand march. The Yuba Construction Co. has always been noted for its fair treatment of employees in construction camps and in regions like this it has never been difficult to obtain sufficient labor where the character of labor necessary is usually scarce. The novelty of the dance aboard the dredge attracted the entire country. The entertainment was presided over by Paul E. Morse, construction superintendent, and his wife and daughter.

DENVER—Aug. 26

Contract to Furnish 5000 Tons of Steel Rails for the main line of the government railroad inland from Seward, Alaska, has been made by Colorado Fuel & Iron Co.

Elktou Consolidated Gold Mining Co. passed its quarterly dividend, due this month. With promised drainage benefits from the renewed pushing of the Roosevelt tunnel, the directors deemed it well to prepare for extensive exploration of the mine at new depths.

Suit Has Been Brought by the El Paso Consolidated Gold Mining Co. against the Katinka Gold Mining Co. and the Progressive Mining & Leasing Co., both Cripple Creek concerns, for $10,000 alleged damages through wrongful removal of ore from the plaintiff's Ajax vein. Injunction is asked to restrain defendants from further trespass.

Colorado Gold Mining & Smelting Co., a corporation formerly operating mines and a smeltery in the Alma district, Park County, lost a foreclosure suit brought by the International Trust Co. of Denver. Judgment in the sum of $727,223 was declared for the plaintiff. Among the mines involved are the Atlantic and the Pacific.

President Zang, of the Vindicator, in sending out checks to cover dividends to stockholders for the last quarter, enclosed a circular letter concerning the company's financial affairs and the physical condition of the properties. Describing the Golden Cycle mine, he says: "The main orebody opened on the 18th level within two weeks shows an excellent grade of ore. Drifting is in progress with good values showing. In reaching this ore, a new orebody was encountered in a vein hitherto barren and it has been developed for over 180 ft. carrying average values of from $30 to $40 per ton. Two new orebodies have been opened on the 17th level. Sinking the shaft an additional 250 ft. from the 1900 level has begun." Of the Vindicator mine, he says: "Development on the 18 level has opened a large volume of ore in four different veins. Development during the coming quarter will undoubtedly add a considerable amount to the reserves."

Tungsten Ore has been reaching record prices in the Boulder County district. For a long time the standard price was $6 per unit for 60% WO_3 ore or concentrate. At times, during the past year, better prices have been announced and inducements offered miners to produce lower grades. Recently, demands for metallic tungsten in Eastern markets have exceeded the miners' ability to supply the raw materials. This was but natural in view of long refusals of dominating purchasing companies to buy any but rich materials. Now, purchasers have become liberal and have announced their eagerness to take any grade of tungsten ore from 3% upward, together with their readiness to pay $15 per unit irrespective of grade. Concentration of the ores is very simple. With the implied confessions on the part of purchasers, miners have given special study to the market and have concluded that, even yet, they are not "getting a square deal." With tungsten metal selling at $2 per lb., they feel that they should receive more than 75c. and, owing to the limited production, they are in position to insist on still better terms. Prediction is made that the price may jump to $20 per unit—$1 per lb.—any day.

BUTTE—Aug. 26

Butte Mines and Mills Now Employ 14,000 Men, according to reports recently received by State Mine Inspector W. B. Orem from 46 operating mines in and around Butte—10,597 under ground; 2820 on the surface; and 402 in mills. The Anaconda company has the greatest number of employees, 9865. It is working 30 mines, and the number employed averages more than 300 men to each mine. The Anaconda mine proper has the largest number of men employed, 750 under ground and 59 on the surface, a total of 809. Companies

other than the Anaconda, and the number of men employed, are as follows: North Butte, 848 men; Rainbow Development, 18 men; Butte & London, 14 men; Davis-Daly, 105 men; Butte & Superior, 1360 men; Butte-Alex Scott, 122 men; East Butte, 665 men; Butte-Ballaklava, 98 men; Atlantic Mines, 59 men; Pilot-Butte, 77 men; Tuolumne, 10 men; Elm Orlu, 260 men; Timber Butte mill, 134 men; Butte-Great Falls, 15 men; Bullwhacker, 25 men; Butte-Duluth, 3 men.

SALT LAKE CITY—Aug. 26

The United States Smelting Co. is increasing its roasting capacity at Midvale, by the addition of two Dwight & Lloyd roasters. This will make six, with the four at present in use. The installation will be completed in 10 days. There are 750 men on the payroll.

Investigations of Geologic and Topographic Conditions, and of water resources are to be undertaken in Utah by the U. S. Geological Survey at the request of Reed Smoot, senator from this state. The work contemplated includes general geological studies with reference to the ore deposits in the Oquirrh Range; a reconnaisance of the phosphate deposits of the Uinta Mountains; general investigation of the geology and ore deposits of the state; the completion of the Wellington-Sunnyside folio. Water investigations will be continued in coöperation with the state, and will include measurement of stream flow at 131 gage stations.

The Utah Power & Light Co. started its new power plant at Oneida on the Bear River, 17 miles northeast of Preston, Idaho, Aug. 13. The plant includes a 10,000-kw. water-wheel-driven generator, furnishing current at 6600 volts, transformers to step the voltage up to 130,000 volts, etc. This is delivered into the main line which runs to the terminal transformer station near Salt Lake City. From here it is stepped down to 44,000 volts and distributed over nine lines radiating to Bingham, Garfield, Salt Lake and other valley points. The new plant started up without a hitch and is in successful operation. It is one of several units or plants which will be added from time to time as more power is required. The company's property in Idaho has been assessed at $3,000,000 this year as compared to $2,700,000 the year previous.

SEATTLE—Aug. 24

Late Reports From Broad Pass, nick-named the "Rand of Alaska," are very encouraging. The Guggenheims have taken a number of options which late developments would indicate they intend exercising. About 50 miners and prospectors are now in the country either working on locations or prospecting for new lodes. Two towns, Colorado City and Wellsville, have been established at the mouth of Colorado River and a combined roadhouse and store has been built at Indian Creek. The area on which oreshoots have been exposed is about 10 miles in length and 300 ft. in width.

Small Stamp Mills Being Installed in many parts of Alaska show the substantial way in which a large number of properties are being developed. These mines are being made to pay their own way through the extraction of their own ore and there is no doubt in the minds of those who are in closest touch with Alaskan affairs that the small stamp mills which are becoming more and more numerous are already having an important bearing on the development of the territory. The investments run from $15,000 to $20,000 while the plant is capable of expansion through the simple process of adding stamps as they may be needed. Much is expected of the quartz in Fairbanks though it is conceded that were another Treadwell located there at this time it could not be operated on account of the exorbitant freight charges. In the experience of mining operators it takes about 10 years for a placer camp to turn over to a quartz camp after the rich placers are worked out, and while the district will produce millions from placers yet the cream has been taken out of the camp. The coming of another stamp mill means considerable better results to those who are now operating the mines, but it is confidently expected that it will be at least several years before Fairbanks is a full-fledged quartz camp of any proportions.

JOPLIN—Aug. 28

A New Zinc Smeltery to treat Joplin lead and zinc ores is being built at Kusa, a new town five miles east of Henryette, Okla., by George E. Nicholson and associates. Three blocks are expected to be in operation about Sept. 15, and additional blocks will be completed as quickly as possible until 10 are in operation. The Missouri, Oklahoma & Gulf R.R. has made a very low rate on zinc ore from Joplin to Kusa. The smelting company is said to have secured a natural-gas supply which will fulfill all their needs for at least 20 years.

HOUGHTON, MICH.—Aug. 28

The Stock of Copper which was accumulating on the docks here, much to the worry of some local people, has been moved. Several vessels came along and when they left the copper stock had vanished.

ISHPEMING, MICH.—Aug. 31

The Lake Superior & Ishpeming R.R., which handles most of the ore on the Marquette range, is operating to capacity. The mines are calling for cars but are unable to get all they want. The road placed an order for 500 steel cars in the spring but they have not been delivered as yet. When they are put in service about 300 old wooden cars will be scrapped. Ore is going out at a rapid rate, but all that is now in stock will not be moved. However, the outlook for the coming winter is very bright.

DULUTH—Aug. 28

At the New Minnesota Steel Plant the blast-furnace department is now being stocked with limestone and coal preparatory to the initial operations several months hence. There are 50,000 tons of limestone and over 100,000 tons of coal now in stock and more arriving regularly. At present this material is unloaded at the Missabe ore docks, in Duluth, and transported to the steel plant by train. It is understood to be a part of the general scheme later to procure the deepening and straightening of the channel up the St. Louis River to the steel plant, which channel is now navigable only by small craft. Following this, raw material will be docked directly at the furnaces, obviating the intermediate handling expense. The City of Duluth plans a monster demonstration to mark the inauguration of operations at the plant. The details have not yet been worked out.

BRAINERD, MINN.—Aug. 28

Labor Conditions on the Minnesota Ranges are unusual. Two months ago $1 a day and board secured an abundance of labor in the Duluth market. Orders for men at $2.50 are now going unfilled, although this is partially due to the Dakota harvesting season. Difficulty is experienced in securing large crews, due to European situation. Austrians will not work with Slavs and Italians, and the labor market is picked so bare that it is impossible to secure large crews of any one nationality.

HIBBING, MICH.—Aug. 28

The State Attorney General Has Overruled request of Mayor V. L. Power, of Hibbing, that the mining companies in the village of Hibbing be enjoined from removing any ore from their properties until their delinquent taxes have been paid. Efforts of the municipal authorities to collect the $750,000 delinquent taxes from the mining companies have thus far proved unavailing, and the matter is now in the courts. The operating companies, claiming gross extravagance on the part of the village officials, have declined to pay their taxes until they shall have been reduced to figures commensurate with the needs of the community.

TORONTO—Aug. 28

The Canadian Mining & Exploration Co. has issued a circular to the shareholders showing the investments and cash on hand as of Aug. 19, 1915. The statement shows investments in bonds to the amount of $2,185,763; demand loans secured, $50,000, and cash on hand $249,824, or a total of $2,485,587. This amount at the present market value of the securities shows a decrease in assets of $14,412 as compared with the prices at which the securities were bought. The accrued interest is not, however, taken into consideration.

Much Excitement Has Been Caused in mining circles by an extraordinarily rich find of gold on the Leyson-Dobie claims in Munro Township, about 11 miles east of Matheson. These claims have been operated by the Dominion Reduction Co. for about two months and their output during that period is estimated at upwards of $500,000. The shaft is down about 90 ft. on a 2-ft. vein which is stated to yield ore so rich that it is impossible to drill it and it has to be cut with chisels. Two specimens weighing together over 200 lb. and running from 2000 to 3000 oz. to the ton have been shipped to Toronto to be shown at the Canadian National Exhibition now in progress. It is stated that about a ton of this ore is now sacked and under guard at the mine. The present owners maintained strict secrecy as to the value of the mine until they had bought up a number of other claims in the district. Since the news became public there has been a great rush of prospectors into the neighborhood. Thomas W. Gibson, Deputy Minister of Mines, states that there is no doubt that a very rich and important strike has been made

The Mining News

ALASKA

CLIFF GOLD (Valdez)—A new lead, richer and bigger than any before found on these claims has just been uncovered above old workings and traced for several hundred feet. It is 22 in. wide and carries free gold.

HOBEN-DAVIS, SULLIVAN-CASSIDY HOLDINGS (Hope) on Bear Creek have been purchased by Chas. E. Herron, who will install hydraulic plant to work the ground. Herron dredge on Six-Mile Creek near Sunrise is proving very successful and good season is predicted.

KENNECOTT (Cordova)—Bonanza and Jumbo have been shipping $2,000,000 worth copper a month since last June. It is announced that same production will be made during Winter and in order to handle this Copper River & N. W. Ry. has placed orders for considerable more equipment.

GRANITE (Valdez)—With new machinery in full operation company took out $25,000 during July and this will be greatly increased during August and September as much low-grade ore was run through mill past month. Work of developing mine continues and much underground work has been done, blocking out enough ore to run mill for three years.

LANDLOCK BAY (Landlock)—W. A. Dickey, president of company, reports that about $30,000 worth of copper ore has been shipped from property this season so far and development work is being pushed as rapidly as possible. Company has also taken out considerable ore on Mason and Gleason claims near by but will not ship until after snow flies.

ARIZONA

Cochise County

PRIMOS CHEMICAL (Russelville)—Installing plant consisting of rolls, concentrator, jigs, etc., for treating ore from Stein and Boericke claims. Owen T. Smith is manager.

CALIFORNIA

Amador County

KENNEDY (Jackson)—Iron pipe line which for number of years has delivered water from reservoir to north shaft is to be displaced by wooden pipe line. This will be of modern construction, built of 2-in. staves held with iron bands. Change from iron to wood probably due to present high cost of iron.

McFADDEN (Jackson)—John McFadden reported to have made important strike near Aqueduct, of good quartz measuring 12 in. wide at depth of 30 ft. Property produced in early days; ore being worked in arastres. McFadden has installed gasoline engine for prospecting.

Butte County

ORO FINO (Magalia)—Big bed of gravel carrying high gold reported. Property owned by Robbers Roost Mining Co.

EUREKA (Magalia)—High-grade ore reported being shipped by Richards, MacDowell & Whitlock. Property situated on Magalia Ridge near Mineral Slide.

NATOMAS (Oroville)—Practical tests to determine mineral carried in tailings in Oroville field in Feather River district will be made at Thermalito. Where contents will warrant, redredging will be considered. Method will be first undertaken at Folsom by new No. 4 boat that is being rebuilt after design which will make possible replacing of ground with soil on top so that land will be reclaimed for agriculture.

Eldorado County

LYMAN S. SNYDER AND CHARLES S. WRIGHT have taken purchase options on 160 acres of gravel claims between Hanks Exchange and Pleasant Valley. Development will start immediately. Property lies south of old Fort Jim gravel mines.

GEORGIA SLIDE (Georgetown)—Reconstruction of 10-stamp mill in progress. Large dump of ore will be worked.

RYAN (Shingle Springs)—Greenwater & Death Valley Copper Co., formerly operating in Inyo County and having also interests at Dale, San Bernardino County, has taken over this gold mine. Development is in progress with John McGee, formerly of Dale, as superintendent.

G. W. HOLLIWAY, of Granite, is preparing for development of an antimony claim in Greenhorn district. Miles H. Martin is also developing an antimony claim on Greenhorn Mountain and reports high-grade ore.

OLD MILL (Caliente)—M. Elliott, Fred Ramey and Joseph and Sebastian Aspurren own property. Ore is being sorted and packed out to county road. Reported that purchase option has been taken by Eastern men. It is stated that some of so called low-grade ore will run 55% antimony.

Shasta County

BALAKLALA (Coram)—Mining operations will be resumed at once. Ten-year contract with Mammoth Copper Mining Co. to smelt ore signed recently. Production to start will be 250 to 300 tons daily, and may be increased later.

GREEN HORN (Tower House)—New oreshoot struck recently in crosscut tunnel at 133 ft. from portal. Drifting under way. Connection with No. 3 level, where shipping-grade ore is opened, will be made. Development work being pushed; crew of 25 men employed. Seven cars ore shipped to Mammoth smelting plant recently with satisfactory results. In addition to shipping-grade ore, 900 tons milling-grade ore stored in bins; milling tests will be made to determine best method of treatment. Property nine miles west of Tower House.

Trinity County

GEM MINE (Eureka)—This placer mine, together with old Schauber property, total of 400 acres, has been sold for consideration stated to be $40,000. Mine is situated on Trinity River, opposite south fork. Considerable gold production made here in past, hydraulic work being done each winter; water supplied through four-mile flume. Some platinum found here in addition to gold.

Tuolumne County

TARANTULA (Jamestown)—Henry T. Gage, former governor of California, has consummated deal for purchase of this property from United Gold Mining & Milling Co. of Paris. Mine is situated near Eagle-Shawmut. Gage also owns Jones mine adjoining Tarantula and will work two in conjunction.

APP (Jamestown)—Interest is attached to visit of W. J. Loring of Bewick, Moreing & Co. He was accompanied by Albert Burch and J. H. Bell of the Plymouth Consolidated. Their visit included Dutch-Sweaney. Reopening of the App mine through Dutch-Sweaney would be more economical than independently from surface. This fact lends color to the conjecture that there is probability of two properties being taken over by Bewick, Moreing & Co. Dutch-Sweaney was recently taken over by interests operating Melones mine in Calaveras County.

COLORADO

Boulder County

MINES AT RICO shipped 72 carloads of ore during July, Rico-Wellington Mining Co. led with 55 cars of copper, lead and iron ores; the Rico Consolidated Mining Co. shipped 15 cars of copper ore to Garfield, Utah. District is busier than for several years past.

Hinsdale County

GOLDEN FLEECE (Lake City)—Foundations are being laid for mill below dump of No. 3 adit. Treatment will be concentration, slimes over canvas tables and cyanidation of tails.

Lake County

ZINC-CARBONATE OREBODIES have been discovered in the Mosquito Range near Weston Pass, about 12 miles, in an air line, southeast of Leadville.

GARBUTT (Leadville)—John Cortellini is replacing his original lot of mining machinery with heavier installation adequate to handle mine's new requirements. Steam, piped from Ibex boilers, will drive double-drum, first-motion hoist and new 15-drill compressor. He contemplates erecting 200-ton mill to handle low-grade gold ore, a million tons of which he estimates as developed.

YAK (Leadville)—Persistent rumor is to effect that this company has purchased Aladdin Group, of 122 acres, intersected at about six miles in tunnel. Deal is by bond for $800,000 running four years. If option to purchase be not exercised within that period, lease will continue additional 6 years. Development of this ground, well to east of main portion of this district, will be watched with interest.

Ouray County

MOUNTAIN KING (Red Mt.)—Vein of lead-silver-copper ore, 17 ft. thick, has been opened by leasers.

REVENUE (Ouray)—St. John Mining Co., Ltd., of London, Eng., has acquired this large tunnel project and will push further work as soon as war conditions will permit.

CAMP BIRD (Ouray)—During second quarter of 1915 mill stamped 7626 tons. Bullion and concentrate sales amounted to $187,992. Costs of mining, development, milling, shipment, smelting, and marketing products totaled $78,720. This figure does not cover expenses of maintaining foreign offices.

San Juan County

IOWA-TIGER (Silverton)—Flotation machinery is being installed

HAMLET (Howardsville)—After idleness of seven years, mill was put into service Aug. 15. Machinery has been considerably altered while mine has been developed and put into shape to keep mill supplied.

Teller County

BLUE FLAG (Cripple Creek)—At annual meeting held recently it was decided to sink main shaft 300 ft. below its present depth of 1100 ft.

AJAX (Victor)—Mill being repaired and altered in preparation for resumption. Mackay lease has opened shoot of high-grade ore.

INDEPENDENCE (Victor)—Gault lease, 400 level, has opened shoot of $20 ore. Thomas B. Crowe, metallurgist of Portland company, is remodeling mill and fitting it to handle ores from both these large groups of property. He does not expect to have mill ready for service before beginning of 1916. When it is in operation, no ores will require up-hill transportation from mines or dumps as is the case with the present Portland mill.

IDAHO

Shoshone County

CALEDONIA (Kellogg)—It is planned to maintain 3c. dividends rest of year. Raise is being driven from lower level to cut downward extension of ore-shoot. This will give additional depth of 500 ft. and is expected to double ore-reserve.

SUCCESS (Wallace)—New orebodies recently found are expected to lead to large increase of reserves. Crosscut on 1200-ft. level has penetrated 6 ft. of clean shipping ore that is estimated to average about 70% lead. Same oreshoot on 1100 was three times as wide but much lower grade. New shoot on 860 level shows 7 ft. of shipping ore.

INTERSTATE-CALLAHAN (Wallace)—At an annual meeting of stockholders at Duluth, Aug. 16, two seis of officers were elected. Roberts-Sussman interests, which have been in control during past year, elected J. A. Percival, former secretary, to presidency, while Callahan-Boutin contingent elected P. H. Nelson president. Attorneys for eastern investors secured temporary restraining order from courts enjoining James Callahan from voting 170,000 shares held by Callahan Mining Co. on ground that this was an Idaho corporation and therefore not entitled to vote at meeting held in Minnesota. With this block of stock disposed of they elected their own officers, who proceeded with transaction of other business, including declaration of quarterly dividend of 50c. a share. Compromise between two factions is unlikely and fight will undoubtedly be carried to courts.

MICHIGAN

Iron

EUREKA (Ramsey)—New 2000-ft. electrically driven compressor has been purchased for this property.

JONES & LAUGHLIN (Wakefield)—This company has started drilling on eastern extension of Gogebic range. Several drills will be worked all winter.

WICKWIRE (Iron River)—About 150,000 tons will be shipped from Homer mine this season. All of stockpile and everything that is being hoisted will be shipped.

BRISTOL (Crystal Falls)—Contract has been let for electrically driven compressor. Current will be purchased from Peninsular Power Co., which is to extend its line to Crystal Falls.

BALKAN (Alpha)—Draglines which have been stripping here are now getting out some ore. This is being pulled from pit in dump cars and taken to surface and loaded into railway cars. Draglines are working better than expected in this ore. Shaft is now concreted from top to bottom; work was finished this week. This mine will be big shipper next season.

CLEVELAND-CLIFFS IRON (North Lake)—Work of stripping overburden from orebody found on Sec. 6 was started by contractors this week. Temporary track from main line of railway was laid in fast time. Only 75,000 cu.yd. are to be moved and this will not take long. No ore will be shipped from there this year. Ore will be mined by milling method. There is only about 30 ft. of sand over ore and it would not be possible to take it out from Morris-Lloyd workings. There are over 200,000 tons in this deposit.

MINNESOTA

Cuyuna Range

BRAINERD-CUYUNA (Brainerd)—Company prepared to ship at least one cargo before close of season, although product has not as yet been sold. Pumps handling about 1600 gals.

IRON MOUNTAIN (Manganese)—Mine working to capacity, and all production being shipped. Third drift now being opened. Town of Manganese, dependent solely on this operation, is now crowded, all houses rented and many being built

Mesabi Range

FAYAL (Eveleth)—One shovel loading from stockpile Shovel in pit loads ore part time and is used part time loading paint rock.

SCHLEY (Gilbert)—Schley and Elba mines in need of more miners. Operations being extended every week. Large shipments of ore to be made before navigation closes.

LEONARD-BURT (Chisholm)—This pit mine has resumed operations. One hundred men given work the first day. One shovel working two shifts. The property was idle four years.

OLIVER IRON (Coleraine)—Mesabi road broke record for hauling ore from Oliver mines here this week. With only one shift working, 881 cars were sent out in one day. Thirteen trains left mines.

MISSABE MOUNTAIN (Virginia)—One shovel at work in pit and another at stockpile Mine was idle several years. Ore that is being moved from the surface stood at mine for almost five years.

OLIVER IRON (Chisholm)—Company's new operation in Sec. 27, 58-20, which has not yet been given name, is progressing rapidly. Main hoisting shaft is down 230 ft. and timber shaft 125 ft. Large volume of water being encountered, but no more than was anticipated. Surface equipment, power plant, etc., well under way.

MACE (Nashwauk)—Butler Bros., stripping contractors, are trying out new type of Bucyrus steam shovel in removing overburden from Mace No. 2 property. Shovel has heretofore been used mainly for coal loading in Pennsylvania fields. Besides being of extra large size, machine has boom of sufficient length so that overburden may be removed from deposit without necessity of laying tracks into pit, unless depth be too great.

Vermillion

PIONEER (Ely)—Night shift of 200 men added to crew.

McCOMBER (Ely)—Two 150-hp. boilers and other surface equipment being installed. Railroad spur 1¼ miles long has been surveyed. Shaft somewhat over 100 ft. deep; drifting in progress. Ore thus far encountered is similar to usual Vermilion Range product

MONTANA

Silver Bow County

EMMA MINE (Butte)—Under an agreement with Butte Copper & Zinc Co., owner of Emma mine, Anaconda is going ahead with development of property, at Colorado and Silver Streets in heart of Butte. Is now installing machinery preparatory to unwatering shaft and is building fence around property

DAVIS-DALY (Butte)—Company has cut another vein in southwest crosscut on 2500 level of Colorado mine. Whether new vein is Hesperus vein, for which company has been driving, is not yet known. It is reported that crosscut had cut into vein about 11 ft., all in good commercial ore Entire width of vein has not yet been ascertained.

LEXINGTON (Butte)—About 400 men are at work on this mine of Anaconda company, preparing same for reopening. Repairs and retimbering in shaft have reached below 600 ft. level close to water level, which is still about 1000 ft. deep in shaft. New engine house has been erected and old buildings on property have been repaired for use.

BUTTE & LONDON (Butte)—Reopened Aug. 5 with a force of 20 men. Present work is in hands of T. F. Cole and associates of Rainbow Development Co. which has a contract for development work outlined and will take stock in company for remuneration. Working force will be increased and it is expected that 45 men will be on payroll within short period.

BUTTE & SUPERIOR (Butte)—On Aug. 20 company filed in federal court its monthly statement of ore treated by oil-flotation process in month of July, in compliance with order of court made in November, 1913. According to statement, oil-flotation plant handled 41,547 tons of ore, recovering 9843 tons of concentrates. Cost of flotation per ton was $2.95; value of concentrates per ton was $75.76.

ANACONDA (Butte)—On fulfillment of management plans, will have a capacity for producing 300,000,000 lb. of copper a year. In addition sulphuric acid and spelter will be turned out in quantities not yet fully determined. A one-ton experimental plant has been completed for purpose of devising method for profitably treating zinc ores. Three sections of concentrator have been remodeled and remaining five will be altered in rotation to conform with those already changed. Nominal capacity of each unit will be 2000 tons per day. One will always be kept in reserve so that probable capacity of plant will be close to 15,000 tons from seven operating sections. New copper refinery at Great Falls will be completed, it is expected, by Jan. 1, 1916. It will have monthly capacity of from 10,000,000 to 15,000,000 lb. of copper, against 5,000,000 lb. from old plant Existing Great Falls refinery will be scrapped

NEVADA

Storey County

COMSTOCK PUMPING ASSOCIATION (Virginia City)—Cleaning out east crosscut from Ophir-Mexican winze on 2700 level and preparing to install electric hoist at Ophir shaft.

MEXICAN (Virginia City)—West crosscut on 2700 level from winze station passed through 15 ft. of quartz and vein matter of low assay. Six-foot east crosscut shows quartz formation with streaks sampling to $25 per ton.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Mill received 979 tons dump rock and shipped bar of bullion to smeltery. Timbering and general repairs continued.

OPHIR (Virginia City)—Development begun at top and bottom of vein 7 ft. wide. Samples assay from $3.75 to $22.75 per ton. Central tunnel development continues; 440 cars of ore saved from stopes and drifts; 326 tons milled.

UNION CON. (Virginia City)—On 2500 level, 65 ft. south of old Sierra Nevada incline station, 6 cars taken out in sampling, averaged $23.85 per ton. North drift in quartz 7 to 12 ft. wide; last 14 cars extracted sampled $17.55 per ton.

NEW MEXICO

Grant County

OCTO (Lordsburg)—Company has completed erection of headframe at Lee's Peak mine and will proceed with shaft sinking on contract. Bids have not yet been opened.

MEEKER MINING CO. (Silver City)—Company has just been incorporated by Z. D. White, J. A. Peterson and Adam Esplane. Will operate mines and mill at Pinos Altos.

JOHNNY BULL (Steins)—Mine has been taken over under lease by John Moffitt of El Paso, Tex. In same camp James Coil has made rich discovery of high-grade copper-gold ore north of Steins.

85 MINE (Lordsburg)—Company has put two diamond drills to work exploring ground below 450-ft. level. Smith and Travers, of Ontario, in charge of drilling. Caterpillar tractors formerly on 85 Mine ore haul have moved to Safford, Ariz., and will haul from Graham Mountains.

HOP CAÑON (Kelly)—Company is doing development work and getting into paying ore. Operations in district are encouraging.

Socorro County

ROSEDALE MINING & MILLING CO. (Rosedale)—Property will be sold, to satisfy judgment for $75,613, at Socorro County court house on Sept. 7.

Taos County

BUFFALO-NEW MEXICO (Red River)—Two shifts employed in sinking Silver King shaft at rate of 4 ft. per day. Shaft is now down 170 ft. and will be sunk to 300-ft. point before Nov. 1. Twenty feet of milling ore exposed in crosscut at 100 ft. level, 9 ft. averaging $15 per ton gold and silver, and 5 ft. averaging $19.90.

MEMPHIS-RED RIVER (Red River)—Upper tunnel on Memphis claim has been driven distance of [illegible] ft. on [illegible] ft. of ore averaging $30. Breast of intermediate tunnel has reached a point 200 ft. from portal. Vein at [illegible] 2.5 ft.; assays approximate those in tunnel No. 1. The [illegible] tunnels recently connected by 120-ft. raise.

PENNSYLVANIA

Lebanon County

LACKAWANNA STEEL (Lebanon)—Will erect benzol plant at Lebanon where it has two blast furnaces and byproduct coke plant. Estimated output of plant is 1600 gal. a day. It is reported that contract has been closed for sale of its 1916 output.

Potter County

NEW JERSEY ZINC (Millport)—Construction of extensive addition to zinc-oxide plant is now under way, and it is contemplated to complete it by end of November.

UTAH

Beaver County

LEONORA (Milford)—Recently ore was opened on 400 level on east-west fissure, and drifting is being done for intersection with north-south fissure. Machine drills are being used. These are part of the new equipment recently installed, including a three-drill compressor and hoist, both electrically driven.

Juab County

TINTIC MILLING (Silver City)—Excavating for mill has been completed, and concrete work is receiving attention.

SCOTIA (Tintic Junction)—Cave 180 ft. long, showing some mineralization, has been opened at this property, which is being worked under bond and lease by Chief Consolidated.

GEMINI (Eureka)—Pumping plant is keeping 1650 and lower levels of this property and the Ridge & Valley unwatered. Good tonnage was shipped by company and by leasers in July.

MAMMOTH (Mammoth)—Copper ore carrying gold and silver is being shipped. Five cars of low grade from mill dump southeast of Silver City were shipped week ended Aug. 13.

BULLION BECK (Eureka)—Zinc ore is being mined in four places by lessees, who are making shipments. Anderson-Goodwin lease is jigging 10 tons of ore daily from dumps and making a lead-silver concentrate.

UNCLE SAM (Eureka)—Work has been started to try and find extension of new orebody or ore zone just opened in Yankee property adjoining. Uncle Sam and Yankee each own part of original Humbug claim in which strike was made. Two ore shoots have previously been opened in this ground.

EAGLE & BLUE BELL (Eureka)—Ore has been opened from winze sunk 82 ft. below 1700 or deepest level. Drift 60 ft. south of winze cut full face shipping ore. It is proposed to drift from 1700 level to newly acquired Victoria property, which can be reached in 900 ft., and 600 feet, deeper than present Victoria workings.

YANKEE (Eureka)—Sinking is being done on new strike and 5 ft. of silver-lead ore has been opened. Raising for ore bed from tunnel 175 ft. lower will be done. Strike is in western part of Humbug claim and is apparently an entirely new orebody. Twenty-four leasers are mining zinc ore and are making shipments.

MAY DAY (Eureka)—Seven cars of high-grade silver-lead ore have been mined since recent dividend of 3c. a share, or $24,000, was declared. Some of this ore runs $70 to $80 a ton and gross value of seven cars is approximately equal to the dividend. Developments in western part of property have been particularly encouraging.

Salt Lake County

MICHIGAN-UTAH (Alta)—Tramway is now working and taking ore from City Rocks lease down to Tanner's Flat.

WASATCH MINES (Alta)—Projected drainage tunnel to be driven 400 ft. deeper than old Columbus Consolidated workings, is to be started soon. Length will be 5000 ft., of which 3000 ft. is to be in mineralized ground.

PRINCE (Little Cottonwood Lake)—Work of driving main tunnel is progressing. Hoisting works will probably be installed when power line to Cardiff is completed. Objective point of tunnel is ore-bearing fissure, which has been opened on surface by trenching.

Summit County

JOHN THE BAPTIST CONSOLIDATED (Park City)—Fissure has been cut on 450 level on footwall line. Five feet of oxidized vein material showing ore is being followed on main level. Small shipments running well in silver and lead have recently been made.

NEW QUINCY (Park City)—This company, formerly Thompson-Quincy Consolidated Mining Co. has been reorganized to provide funds for carrying forward development. An assessment of 5c. a share has been levied, delinquent Sept. 2. Development has been opened. The property lies between the Daly West and Daly-Judge. W. Mont Ferry is president.

WILLIAMS DEVELOPMENT CO. (Salt Lake)—F. T. Williams, president of this company, which for several years has leased upper levels of Daly West in Park City, has taken 3-year lease and bond on old Miller property in American Fork Cañon. Ike Wadley has property under lease at present, and sub-lease has been given to him to Williams company, which has been working about 10 men for the past two months. New lease and bond begins Nov. 1.

Utah County

MINERAL FLAT (American Fork)—Leasers are working at this property, and have ore ready for shipment.

MILLER HILL (American Fork)—Wadley lease has several teams hauling ore. Lead-carbonates have been opened in three places on Wyoming claim.

DUTCHMAN (American Fork)—Tunnel is being driven by Wild brothers to cut vein at greater depth. This reached ore at 200 ft. Shipments will be resumed.

WISCONSIN

Zinc-Lead District

AN INCREASED OUTPUT OF HIGH-GRADE ZINC ORE will result from many additions being made in roasting capacity. There are now in operation the National and Campbell plants, at Cuba City, the Empire and Homestead, at Platteville, the Linden Zinc, at Linden, and that of the Mineral Point Zinc Co., at Mineral Point. The old Enterprise roaster, at Platteville, has been overhauled by Kistler & Stephens and will be in operation soon; Utt & Thorne Co. will start up the Benton roaster, at Benton, recently purchased by it; the Wisconsin Zinc Co. is repairing the Joplin plant, at Galena, and is rushing to completion the new $100,000 roasting equipment at New Diggings.

LONGHENRY (Benton)—Longhenry Brothers are erecting small milling plant on Spensley land adjacent to the Fox mine.

POLLARD & SANE (Linden)—High-grade sheets of jack have been penetrated by shaft on Gillam land just ahead of the Ross mine at Linden.

VINEGAR HILL ZINC (Platteville)—This company has proved up and verified drill-hole results obtained on this tract adjoining Champion mine, at New Diggings, and has begun shaft sinking.

KING SOLOMON (Platteville)—Local company has opened up good body of high-grade zinc ore in shaft and crosscut in this abandoned property seven miles south west of Platteville.

CRUSON (Platteville)—Stephens & Kistler will start at once to sink shaft and construct milling plant two miles south of Platteville. Rich cuttings were found in number of drill holes ahead of old mine workings which were abandoned four years ago.

CANADA

Manitoba

GOLD PAN (Gold Lake)—This property recently taken over by Boston and St. Paul capitalists is showing rich ore in new workings. A 4-ft. vein, showing free gold, has been struck at depth of 15 ft.

Ontario

BELLELLEN (South Lorraine)—Will resume operations.

TECK-HUGHES (Kirkland Lake)—Buffalo after sampling this mine has declined to purchase.

IMPERIAL (Porcupine)—Has cut promising vein on the 100-ft. level. This property has just been re-opened.

JUPITER (Porcupine)—Meeting has been called for Sept. 8 to reach decision with regard to offers made for property.

MINING CORPORATION (Cobalt)—For four weeks ending July 20 milled 10,257 tons from which net profit was £10,171.

CONIAGAS (Cobalt)—Will install small cyanide plant to treat concentrates which assay about 100 oz. and were formerly sent to smeltery.

NIPISSING (Cobalt)—The hoist room at shaft No. 64 was struck by lightning and burned down on Aug. 25, causing loss of $2000, covered by insurance.

CROWN-RESERVE (Cobalt)—The directors have decided to discontinue dividends for time, owing to disappointing results from draining of Kerr Lake and low price of silver.

NORTH DOME (Porcupine)—Timiskaming of Cobalt, which has a controlling interest in this property, has commenced diamond-drilling; results of which will determine its future policy.

DOME LAKE (Porcupine)—Ore averaging from $18 to $20 per ton is now being taken from 400 level. Oreshoot is 3 ft. in width and has been developed for about 30 ft. in length, vein being still good in face.

COBALT LAKE (Cobalt)—An oreshoot developed at 380 level shows 26 in. of high grade. In one week's development 36 tons of ore, which it is estimated will yield net profits of $35,000, have been extracted.

CONIAGAS (Cobalt)—The erection of a small cyanide mill is in progress, which is expected to be in running order in two months. Slime tailing will be re-treated over canvas and precipitate obtained refined at Thorold smeltery.

CITY OF COBALT (Cobalt)—System of veins has been developed under center of town of Cobalt at 200 and 300 levels. Vein 5 in. wide of high-grade ore has been opened up and numerous small veins in wall rock of drifts are undergoing development with satisfactory results.

WEST DOME (Porcupine)—Shareholders on Aug. 20 ratified re-organization plan submitted by directorate which involves formation of a new company, "West Dome Consolidated Mines," capitalized at $3,000,000. Two-thirds of stock will be issued to old shareholders in proportion of two shares of new for every three of old stock.

MEXICO

Sonora

EL TIGRE (Ysabel)—Several tons of precipitates have been brought out and shipped to Selby, which is first shipment made for several months.

SANTA ROSA (Cabullona)—H. F. Brown who is operating property has encountered vein, about 12 in. wide, of oxide ore running about 30% copper.

MINA MEXICO (Tonichi)—This property has practically closed down and it will be some time before work is resumed. Has been unable to operate smeltery for lack of coke, as Southern Pacific which ran to mine, has about been abandoned on account of troubles south of Hermosillo.

The Market Report

Metal Markets

NEW YORK—Sept. 1

The markets for copper, lead and zinc were excited and rather chaotic during the last week, there being in each case a sharp rise at the beginning of the week which was followed by a decline, especially sharp in the case of copper.

Copper, Tin, Lead and Zinc

Copper—At the close of our last week of record, sales of copper at 16.85c., basis New York, had been made. On Thursday the market opened with sales at 16⅞c., and closed with sales at 17⅜c., or about 18c., regular terms. Thus, the market had come to the asking price of the principal producers, a large business being done on the way up. However, the market never became firmly established at 18c., regular terms, there being sales on Friday and Saturday all the way from 17½@18c., regular terms. Some of the principal producers even appeared to be willing to accept business at small concessions; moreover, none of them was averse to taking business for export at prices ranging from £87, c.i.f. London, to £84½, c.i.f. London, which at current rates of exchange figure out ½ to ¾c. below the New York price. By Monday the domestic demand for copper had about petered out and the smaller producers and agencies promptly cut prices and continued to do so on Tuesday and Wednesday, during which part of the week business was very light indeed.

What appears to have happened in the market is something like this: It has been recognized for a long time that there was potentially a large demand. At the latter part of the previous week this began to exhibit itself, and the buying for prompt delivery indicated that the stocks of manufacturers were low. A very large volume of business developed on Thursday, and sellers, misreading the signs, raised their prices too sharply. This frightened and disgusted many manufacturers who were interested in contracting for copper but were under no immediate pressure to do so, and went home saying they would await developments.

The business transacted during our last week of record is estimated at 30 to 40 million pounds, which was probably about equally divided between domestic and foreign orders. A highly encouraging feature of the domestic business was the buying of considerable quantities of copper by wire-drawers, who are not supposed to have any connection whatever with military contracts.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 18.50@19c. per lb. at mill.

Copper Exports from the United States in June are reported by the Department of Commerce as follows: Pigs, ingots and bars, 36,739,762 lb.; plates and sheets, 3,554,055; rods and wire, 8,559,324; scrap and old, 1,238,845; total, 50,091,986 lb. Exports for the fiscal year ended June 30 were 677,303,822 lb. In addition 5026 tons ore and matte were exported in June. Imports for June were 24,773,059 lb. metallic copper and 8,387,583 lb. in ore and matte; 33,160,642 lb. in all. The imports for the fiscal year ended June 30 were 152,443,247 lb. copper and 99,967,985 lb. in ore and matte; 252,411,232 lb. in all.

Tin—The tin market was dull and a little easier, chiefly on account of the drop in sterling exchange. The statistics for August are good. The tin committee of the New York Metal Exchange has issued a circular explaining how the British Consular guarantees should be complied with.

Lead—On Aug. 26 the A. S. & R. Co. raised its price to 4.70c., but before it did so, other producers had sold largely at 4.60c. and 4.65c., a big tonnage being placed especially with ammunition contractors. On Aug. 27 the A. S. & R. Co. raised its price to 4.90c., following sales by outsiders at 4.80c. On Saturday and Monday outsiders, not to be outdone again, became more reserved and succeeded in realizing 5c. on some moderate tonnages, especially for deliveries during the last quarter of the year. The demand then faded away, however, and at the close the lead market was showing a weaker tone. Reports from corroders and sheet and pipe manufacturers are not very good. The demand of last week was chiefly from the makers of ammunition.

Spelter—On Aug. 26-28 the principal consumer bought a large quantity of spelter at a sharp advance in price, especially as between Aug. 27 and 28. This buying, together with other orders, created confused and excited conditions similar to what prevailed when spelter was 10c. higher. Spelter was bought and sold in round lots for the same delivery in the same office at a difference of 1c. per lb. in price, within 10 minutes. The large demand having been filled, buyers became conspicuous by their absence, and sellers immediately exhibited once more their desire to get spelter off their hands, with the natural result that the price began to sag off again. Business last week was chiefly for delivery during the last quarter of the year. However, some considerable sales were made for delivery during the first quarter of 1916. This business was taken at a large discount from current quotations. A trifling amount of prompt business was done at fancy prices.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
Aug Sept	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
26	4 6475	46⅛	@ 16⅞ @ 17⅜	34¼	4 60 @ 4 70	4 45 @ 4 65	12 00 @ 14 00
27	4 6325	47¼	@ 17⅜	34¼	4 80 @ 4 90	4 65 @ 4 80	13 50 @ 15 50
28	4 6325	46⅞	17 35 @ 17 85	34¼	4 90 @ 5 00	4 80 @ 4 85	15 00 @ 16 50
30	4 6250	47	17 30 @ 17 50	33½	4 90 @ 5 00	4 80 @ 4 85	14 50 @ 15 50
31	4 5850	46⅝	17 10 @ 17 20	33½	4 90	4 75	14 00 @ 15 00
1	4 5100	46¼	17 00 @ 17 20	32	4 85 @ 4 90	4 70 @ 4 75	13 50 @ 14 50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
Aug Sept	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts per Lb.
26	22 11/16	70⅜	72	82½	17.02	155	156¾	22⅛	4 62	66	13 62
27	23 3/16	71¼	72¼	84½	17 44	153	154	22 11/16	4 71	68	14 03
28	22 11/16										
30	23	68½	69¼	84½	17.44	150½	151¾	22¼	4 69	70	14 45
31	23	68½	67¼	84½	17 32	150½	152	22⅛	4 58	72	14 76
1	23 1/16	67¼	69	84½	17 07	150½	153	22 5/16	4 51	72	14 77

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 5 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.86: £1 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. For amounts, £1 = 0.21c.

The American business of Beer, Sondheimer & Co. has been incorporated under the laws of the State of New York as Beer, Sondheimer & Co., Inc., with B. Elkan, president, and O. Frohnknecht, as vice-president.

Brass special spelter was reported sold on Sept. 1 at 17.40c. per pound.

Zinc Sheets—Business has been on a considerable scale. The base price for carload lots is unchanged at $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 1

Aluminum—Supplies are still rather low and demand is steady. Quotations are 35@37c. per lb. for No. 1 ingots, New York.

Antimony—Sales are rather slow, though there are some large inquiries reported on the market. Ordinary brands are quoted 29@31c. per lb., while 45@48c. per lb. is named for Cookson's.

Nickel—Prices are steady and unchanged at 40@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic.

Quicksilver—Trade has been fair. New York quotations are $89 per flask of 75 lb. for large lots; $90 per flask for smaller orders. San Francisco reports by telegraph $87.50@90 per flask, with market firm, but active; $95 was paid early in the week. London price remains £18 per flask, the same price being quoted by second hands.

Gold, Silver and Platinum

Gold—Another very large shipment of gold has been received at New York from London. Notwithstanding this sterling exchange has again fallen to a point lower than ever before reported, being about 7% below par.

Platinum—The market is still rather unsettled, but is inclined to be stronger. There is no quotable change, however. Dealers ask $39@41 per oz. for refined platinum, and $45@48 for hard metal, according to grade.

Silver—The market has ruled steady the past week with upward tendency in London due to limited supplies. Market closes steady at 23 $\frac{5}{16}$d.; the New York price has been seriously affected by the fall in sterling exchange from $4.65 to $4.51 during the week.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Aug. 28

The base price paid this week for 60% zinc ore was $65@75 per ton. The base price paid for 80% lead ore was $50 per ton.

SHIPMENTS, WEEK ENDED AUG. 28

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,754,230	380,000	628,500
Year	125,276,440	4,463,160	18,728,710

Shipped during week to separating plants, 4,823,900 lb. zinc ore.

JOPLIN, MO.—Aug. 28

Blende, high price $87.50; base price per ton of 60% zinc, premium ore, $86; medium, $85@80; lower grades down to $75, and early purchases at $70. Calamine, base per ton 40% zinc, $70@[illegible]; average, all grades of zinc, $74.67 per ton. Lead, high price [illegible]; base price $45 per ton of 80% metal content; average all grades of lead, $44.95 per ton.

SHIPMENTS WEEK ENDED AUG. 28

	Blende	Calamine	Lead	Values
Totals this week	[illegible]	457,020	1,993,150	$429,050
Totals this year	[illegible]	30,221,580	58,216,880	16,377,310

Blende value, the week, [illegible]74,700; eight months, $14,177,870.
Calamine value, the week, $8550; eight months, $660,590.
Lead value, the week, [illegible]; eight months, $1,538,850.

A few cars of zinc ore were picked up early in the week around $70 base, but week-end purchases were largely above $80 for all grades sought. The American Metal Co. has been a very active purchasing agent for four weeks, and reports have been received here that this company has purchased all available ore in Wisconsin. The upward market is welcomed heartily, and producers are greatly encouraged with hopes of a further advance, at least in premium ores.

Iron Trade Review

NEW YORK—Sept. 1

Increased and increasing activity is manifest everywhere in the iron and steel trades. Mills are full and are beginning to fall behind on deliveries in a way that has not been seen for more than a year. Increased home orders are helping the munition or export orders to fill up the mills.

Pig iron markets are showing much strength and gains everywhere. Orders are coming in and prices are advancing steadily. The blowing in of additional furnaces has checked the advance to some extent, but the higher prices already made are being generally held, especially on Southern iron.

PITTSBURGH—Aug. 31

The booking of actual shipping orders in the steel trade in August has covered fully as large a tonnage as in July, while the export bookings have been heavier. The domestic business has been confined largely to specifications on old contracts, on which the buyers had a decided advantage as compared with prices currently quoted. The mills have no difficulty in finding business enough to operate at capacity, and are indeed falling behind in deliveries in nearly all lines, in some cases because the finishing departments are crowded and in other cases because the crude steel is scarce.

It is the general expectation that strictly new buying in steel products will be much heavier in September than it has been in August and in some quarters an actual famine in steel is predicted. It is understood that the railroads are considering the steel situation very carefully, realizing the possibility of not being able to secure deliveries desired in 1916, and at satisfactory prices, if they do not buy in time. The situation as to rails is particularly interesting, as so many rail mills are now rolling large steel rounds for shrapnel.

A part of the demand for steel in the past two or three months has been due to the desire of jobbers and manufacturing consumers to replenish their stocks, which had naturally been reduced to a very low level when mill deliveries were prompt. This extra demand of course is only temporary, and it may require a greater increase in general industrial activity than is now generally apprehended to maintain pressure upon the steel mills for steel.

Steel prices have continued to strengthen. The 1.30c. quotation on bars has disappeared, making the market 1.35c., while structural shapes and plates are trending to the same level. Blue annealed sheets have advanced $2 a ton to 1.50c., while black sheets are firmer.

Pig Iron—The American Steel Foundries has bought 10,000 tons basic iron from two middle interests for delivery to Sharon and Alliance over the balance of the year, on the basis of $14.50 at Valley furnaces, firmly establishing the market at this advanced figure and disposing some sellers to quote $14.75 or $15. A sale of 3000 tons of bessemer has been made at $15.50, Valley, for export early in September. The odd lots of malleable and foundry that were available at $14 at furnace have disappeared and the market is firm at $14.50 for this year's delivery, with $15 asked for the first half of next year. There remain very considerable stocks of basic iron, held largely in middle hands and there is some comment on the facility with which pig iron prices have been advancing when the sales have been light. The Jones & Laughlin Steel Co. recently bought 25,000 tons of basic iron from E. W. Mudge & Co., at a price below the present market. We quote: Bessemer, $15.50; basic, malleable and No. 2 foundry, $14.50@15; forge, $14.25@14.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

COKE

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie, seven months ended July 31, in short tons:

	1914	1915	Changes
Anthracite	6,241,171	6,076,487	D. 164,684
Bituminous	25,739,730	23,929,923	D. 1,809,807
Coke	6,039,016	6,090,263	I. 51,247
Totals	38,019,917	36,096,673	D. 1,923,244

The total decrease this year was 5.1%. The July tonnage was 5,412,510 tons, showing a gain of 122,929 tons over last year.

Chemicals

NEW YORK—Sept. 1

Conditions in the general market show no special changes from last week, the position being rather strong.

Arsenic—Business is moderate but the market is firm. Prices are about $3.50 per 100 lb. for carload lots, and up to $4 per 100 lb. for smaller parcels.

Copper Sulphate—Trade is fair but without change in prices, $7.25 per 100 lb. being asked for large lots and $7.50 for smaller parcels.

Nitrate of Soda—The market is rather stiff, conditions remaining unchanged. September deliveries are quoted at 2.42½c. per lb.; while 2.45c. is named for futures.

Pyrites—Imports at Baltimore for the week included 4094 tons pyrites from Huelva, Spain.

Assessments

Company	Delinq.	Sale	Amt.
Belmont, Ida	Aug 10	Sept. 10	$0 003
Blue Bell, Ida., (post		Aug 30	0 003
Bonanza Con., Utah	Sept 15	Oct. 6	0.015
Buffalo, Mont..	July 22	Sept. 10	0 003
Bullion, Ida......	Aug 30	Sept. 25	0 005
Cedar Creek, Ida..	Aug. 28	Sept 29	0.005
Comet, Ida	Aug 30	Sept. 30	0 0005
Copper Chief, Ida	Aug 30	Sept 25	0.005
East Coeur d'Alene, Ida	Aug 9	Sept. 9	0 001
East Hercules Ext., Wash	Aug 10	Sept. 10	0 0015
Gethin Le Roy, Utah	Sept. 25	Oct. 13	0.01
Great Bend, Nev.	Sept. 10	Oct. 10	0 01
Hancock Cons , Mich	Sept. 1		1 00
Hancock Cons., Mich	Jan. 3		1.00
Happy Day, Ida	Aug 26	Sept 30	0.0025
Hector, Ida	Sept. 4	Oct. 4	0.005
Hennessy-Burns, Ida	Aug. 20	Sept 24	0 005
Honolulu, Ida.	Aug. 24	Sept. 13	0 0035
Idaho Los Angeles, Ida	Sept 3	Sept 25	0 005
Idaho Montana, Ida.	Sept. 3	Sept. 25	0 001
Idaho Nevada, Ida	Sept 7	Oct 1	0 002
Imperial, Ida	Aug 31	Oct 1	0 005
Keweenaw, Mich	Sept. 1		1 00
Laclede, Ida	Sept. 3	Sept. 27	0 003
Lake Superior & West., Ariz.			0 02
Liquidator, Ida	Aug. 28	Sept. 28	0 003
Lucky-Calumet, Ida	Aug 27	Sept. 27	0 005
MacNamara, Nev	Aug 23	Sept. 13	0 02
New Arcadian, Mich	Dec 1		0.50
New Baltic, Mich	Jan 15		0 50
New Quincy, Utah	Sept 2	Sept 23	0.01
Old Veteran, Ida	Sept. 2	Sept. 30	0 002
Oom Paul, Ida.	Aug 28	Sept. 28	0 01
Oom Paul Con, Ida	Aug 30	Oct 4	0 01
Oreano, Ida	Aug 2	Sept 2	0.0015
Phoenix, Mich	Sept 1		1 00
Phoenix, Mich	Jan 1		1 00
Revelator, Utah.	Oct 4	Oct 25	0 00½
Royal, Ida	Sept 1	Oct 1	0 001
Sandstorm Kendall, Nev	Aug 23	Sept. 27	0 01
Selma Utah ...	Sept. 8	Sept. 25	0 005
Smuggler, Utah	Aug 17	Sept. 10	0 005
Snowshoe, Ida	Aug. 26	Sept 27	0 005
Sonora, Ida.	July 23	Aug. 31	0 004
Springfield, Ida	July 30	Aug 30	0 002
Sunset Dev., Wash	Aug 25	Sept 18	0 002
Syndicate, Utah	Sept 11	Oct 2	0 001
Tonopah Bonanza, Nev	Sept 13	Oct 11	0 01
Tonopah Midway, Nev	Aug 18	Sept 18	0 01
Union Cons , Nev	Aug 24	Sept 14	0 05
White Caps, Nev	Aug 14	Sept 18	0 015

Stock Quotations

New York sales at auction: 800 Mines Co. of Amer., 20c.; 3500 Cobalt Central and 50 Nevada-Utah M. & S., $3 lot; 424,-750 Ely-Giroux Copper, $500 lot.

COLO. SPRINGS Aug 30		SALT LAKE Aug 30	
Name of Comp.	Bid	Name of Comp.	Bid.
Acacia	02½	Beck Tunnel	05½
Cripple Cr'k Con.	069	Black Jack .	09½
C. K. & N.... .	02	Colorado Mining.	05
Doctor Jack Pot	09¼	Crown Point.	01
Elkton Con........	27½	Daly-Judge	6 00
El Paso.......	80	Gold Chain	16
Findlay	03½	Grand Central	50
Gold Dollar.......	02	Iron Blossom	66
Gold Sovereign....	02	Little Bell	‡ 10
Golden Cycle	1 78½	Lower Mammoth	03
Isabella	15½	Mason Valley	2 00
Jack Pot.......	06½	May Day	16½
Jennie Sample....	‡ 02	Opohongo	‡ 00½
Jerry Johnson.	04½	Prince Con	67
Lexington	005	Seven Troughs	01½
Mary McKinney...	37½	Silver King Coal'n	3 37
Pharmacist.	008	Silver King Con	2 02½
Portland	1 47	Sioux Con	01½
Raven B. H	92	Uncle Sam	06½
Vindicator	1 57½	Yankee	24

TORONTO Aug 30			
Bailey ...	04	Dome Exten	18
Coniagas.	4 00	Foley O'Brien	27
Peterson Lake	19	Hollinger	24 00
Right of Way..	‡ 02	Imperial	05
Seneca Superior	78	Jupiter	11½
Silver Queen	‡ 01	McIntyre	48
T. & Hudson Bay.	20 00	Pearl Lake	‡ 00½
Timiskaming	32	Porcu Crown	70
Wettlaufer-Lor	04	Preston E. D.	05
Dome Mines	21 50	Rea	‡ 10

SAN FRANCISCO Aug 30			
Comstock Stocks		Misc. Nev & Cal	
Alta..	06	Belmont	3 80
Andes ...	10	Jim Butler	80
Best & Belcher .	08	Lone Star	03
Caledonia	80	MacNamara	02
Challenge Con	09	Midway	10
Chollar	04	Mont.-Tonopah	25
Confidence	17	North Star	10
Con. Virginia	19	Rescue Eula	06
Gould & Curry.	05	West End Con.	57
Hale & Norcross	07	Atlanta	30
Julia	02	Booth	42
Mexican ...	57	C O D Con	04
Occidental......	79	Comb Frac	08
Ophir..........	43	D'field Daisy	03
Overman.......	10	Jumbo Extension	1 50
Potosi..........	03	Pitts -Silver Peak	06
Savage....	09	Round Mountain	39
Sierra Nevada. ..	25	Sandstorm Kendall	06
Union Con	58	Silver Pick	08
Yellow Jacket	17	Central Eureka	14

N. Y. EXCH. Aug. 30	
Name of Comp.	Clg.
Am.Sm.&Ref.,com .	80¾
Am. Sm. & Ref., pf.	107
Am. Sm. Sec., pf. B	80
Anaconda.	73¼
Batopilas Min	1¼
Bethlehem Steel	291
Bethlehem Steel, pf.	140½
Chino. .	46¾
Colo. Fuel & Iron.	42½
Crucible Steel	75¼
Federal M. & S., pf.	49
Great Nor., ore., ctf.	42¾
Guggen. Exp....	67
Homestake....	117
Inspiration Con.	36
Mex. Petroleum	84½
Miami Copper.	26¾
Nat'l Lead, com	65
National Lead, pf..	112
Nev. Consol....	15
Ontario Min	3¼
Quicksilver...	3½
Ray Con.......	23½
Republic I&S, com..	43½
Republic I&S, pf...	101½
SlossSheff'd, com.	53¾
Tennessee Copper. .	56¼
Utah Copper..	68
U. S. Steel, com..	75½
U. S. Steel, pf......	112½

N. Y. CURB Aug. 30	
Alaska Juneau	13½
Alta Con	.42
Beaver Con	28
Big Four..	05
Blue Bell	02
Braden Copper.	8¾
Buffalo Mines.	¾
Can. Cop. Corpn	‡1¼
Cashboy......	.05
Chambers Ferland	12
Chile Cop...	19
Con. Ariz. Sm	⅞
Con. Coppermines.	1½
Con. Nev.-Utah	5/16
Dia Black B	03
Florence	45
Goldfield Con..	1½
Goldfield Merger	19
Greene Cananea	40
International Nickel	182
Kennecott Cop	52½
Kerr Lake.	3½
La Rose..	7/16
Magma	14½
McKinley-Dar-Sa	.25
Mines of Am	‡2¾
Nevada Hills	.20
New Utah Bingham	3¾
Nipissing Mines	5¾
Oro.	07
St. Joseph Lead	13½
South Utah.	16
Stand'd Oil of N.J	448
Standard S. L.	1 9/16
Stewart .	1 3/16
Success.	1 3/32
Tonopah	5½
Tonopah Ex.	2 7/16
Tonopah Merger	35
Tribullion...	5/16
Tularosa .	‡ 3/16
Yukon Gold	2½

LONDON Aug 19	
Alaska Tre'dwell	£7 1s 3d
Burma Corp..	1 13 9
Cam & Motor..	0 12 6
Camp Bird	0 5 0
El Oro...	0 7 6
Esperanza.	0 7 9
Mexico Mines	3 12 6
Nechi, pfd.	0 12 0
Oroville.	0 15 0
Santa Gert'dis	0 7 6
Tomboy	1 0 0
Tough Oakes.	0 6 6

BOSTON EXCH Aug 30	
Name of Comp.	Clg
Adventure	1½
Ahmeek	398
Alaska Gold M	33½
Algomah	2½
Allouez	51
Am. Zinc	55½
Ariz. Com., ctfs.	8¼
Bonanza	.35
Butte-Balaklava	4½
Butte & Superior	66½
Calumet & Ariz	64
Calumet & Hecla.	560
Centennial	19
Cliff	‡ 90
Copper Range	55½
Daly West	3
East Butte	13
Franklin	9½
Granby	86
Hancock	16½
Hedley	26
Helvetia.	25
Indiana	5
Island Cr'k, com.	48
Island Cr'k, pfd.	89½
Isle Royale......	26½
Keweenaw	1½
Lake.	11¼
La Salle	5
Mass	10½
Mayflower	3½
Michigan	2¼
Mohawk.	72½
New Arcadian.	10½
North Butte.	30½
North Lake	1½
Ojibway	1½
Old Colony.	‡2½
Old Dominion	54
Osceola	83
Quincy..	85
Santa Fe.	2½
Shannon.	7½
Shattuck-Ariz..	25¾
Superior	27½
Superior & Bost.	2½
Tamarack.	52½
Trinity	3½
Tuolumne	17
U. S. Smelting	41
U. S. Smelt'g, pf.	46½
Utah Apex	3¾
Utah Con	13
Victoria	2½
Winona	3½
Wolverine	63½
Wyandot	1¾

BOSTON CURB Aug. 30	
Alvarado	.50
Bingham Mines.	8¾
Boston Ely	.23
Butte & Lon'n Dev	.35
Calaveras	1½
Calumet-Corbin.	04
Chief Con	.97
Corbin.	‡.50
Cortez	.45
Crown Reserve	.32
Davis-Daly	1½
Eagle & Blue Bell..	1¾
First Nat Cop.	2¾
Houghton Copper	3
Iron Cap Cop , pf	5
Majestic	52
Mexican Metals	23
Nevada-Douglas	60
New Baltic.	3
Ohio Copper.	.10
Oneco	1
Raven Copper	.12
Smokey Dev. ..	.15
So Lake	6½
Tonopah Victor.	26
Trethewey	11
United Verde Ext	5½

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62 938	57.572	48.855	28 983	26 553	22.731
February	61 642	57 506	48.477	28 357	26 573	22.753
March.	57 870	58 067	50 241	26 669	26 788	23.708
April	59 490	58 519	50 250	27 416	26 958	23.709
May.	60 361	58 175	49 915	27 825	26 704	23.570
June	58 990	56.471	49 034	27 199	25 948	23.267
July	58 721	54 678	47 519	27 074	25 219	22.597
August	59 293	54 344	47 163	27 335	25 979	22 780
September	60 640	53 290		27 986	24.260	
October	60 793	50 654		28 083	23 199	
November	58 995	49 082		27 263	22 703	
December	57 760	49 375		26 720	22 900	
Year	59 791	54 811		27 576	25 314	..

New York quotations cents per ounce troy, fine silver: London, pence per ounce, sterling silver, 0 925 fine

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14 223	13.641	64.304	60 756	69 488	65 719
February	14 491	14.394	65.259	63 494	70 188	*
March...	14 131	14.787	64 276	66. 152	69 170	*
April.	14 211	16.811	64.747	75. 069	69 313	*
May.	13 99	18.506	63. 182	77 600	67 786	*
June	13 603	19 477	61. 336	82 574	66 274	95 333
July....	13.223	18.796	60. 540	76 011	61 955	91. 409
August	*	16.941	‡	68 673	‡	82 333
September	*		‡		‡	
October...	*	..	‡		‡	
November.	11.739	...	53. 227			
December .	12.801	.	56. 841		*	
Year	.					

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January.......	37.779	34 260	171.905	156.550
February.......	39.830	37 415	181.556	176.925
March.	38.038	48. 426	173 619	180.141
April..........	36 154	47 884	163 963	166.225
May............	33 360	38. 790	150 702	162.675
June...........	30 577	40.288	138.321	167 636
July...........	31 707	37.423	142 517	167.080
August.........	*	34 389	‡	151.440
September......	32.675		‡	
October........	30.284		‡	
November.......	33.304		1 9.391	
December	33.601		147.102	
Av. year.....	34 301		..	...

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January...	4.111	3.729	4.011	3.548	19 665	18.606
February..	4 048	3.827	3 937	3.718	19 606	19.122
March.....	3 970	4.053	3.850	3 997	19 651	21.883
April...	3.810	4.221	3.688	4 142	18 225	21.094
May.	3.900	4.274	3.808	1 182	18.503	20.347
June....	3.900	5 932	3.810	5 836	19.411	25.170
July......	3 891	5 659	3 738	5 531	19 051	24.611
August...	3.875	4 656	3 715	4 520	‡	21.946
September	3.828		3 658		‡	
October ...	3.528		3 384		‡	
November	3.683	..	3.585		18 500	
December	3 800		3.662		19 097	
Year	3.862	...	3.727		.	.

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January..	5 262	6.386	5.112	6.211	21 533	30.844
February.	5 377	8.436	5.228	8.255	21 413	39.819
March.....	5 250	8.541	5.100	8.366	21.460	44.141
April. ...	5 113	10.012	4.963	9.837	21 569	49.888
May.	5 074	14 781	4.924	14.610	21.393	68.100
June...	5 000	21.208	4 850	21.038	21 345	100.614
July....	4 920	19 026	4.770	18 856	21 568	97.250
August ..	5 568	12.781	5.418	12 611	‡	67 786
September	5 380	.	5.230		‡	.
October...	4 909		4.750		‡	
November	5.112		4.962		25 016	.
December .	5.592	..	5.430		27 369	.
Year ...	5.213	.....	5.061			

New York and St Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January.	$14 94	$14.59	$13 23	$13.45	$13.99	$13.90
February.	15 06	14.55	14.12	13 45	14 08	13.90
March.....	15 07	14.55	13 94	13.45	14 10	13 95
April......	14 90	14.55	13.90	13 45	14 13	13 95
May......	14 90	14 61	13 90	13.60	14 27	13 83
June......	14.90	14 70	13 90	13.67	13 ..	13 77
July.... ..	14 90	14.94	13 90	13.91	13 90	13 68
August..	14 90	16.10	13 90	15.08	14 08	14 75
September	14 90		13 90		14 03	
October...	14 84		13 75		13.97	
November.	14 59		13 4.		13 83	
December .	14 70		13.47		13 83	
Year...	$14 88	.	$13 78		$14 01	

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown, inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

1698—CHILE—Bosquejo del Estado Actual de la Industria Minera del Cobre en el Estranjero i en Chile. J. G. Matta. (Bol. Soc. Nac. de Mineria. Mar. and Apr., 1915; 20 pp., illus.) To be continued.

1699—EFFICIENCY ENGINEERING in the Copper Country. P. B. McDonald. (Min. and Sci. Press, July 24, 1915; 1½ pp.) 20c.

1700—HYDRO-ELECTROLYTIC TREATMENT of Copper Ores. Robert Rhea Goodrich. (Am. Electrochem. Soc., Apr. 18, 1914; 127 pp., illus.)

1701—LEACHING—Roasting and Leaching Concentrator Slimes Tailings. Lawrence Addicks. (Bull. A. I. M. E., Aug., 1915, 13⅓2 pp., illus.) 40c.

1702—NEW MEXICO—Tyrone District, Grant County, New Mexico. Clifford C. Blood. (Min. and Eng. Wld., Aug. 21, 1915; 2¾ pp., illus.) 20c.

1703—ORE TREATMENT—Ueber die Verarbeitung kupferarmer, kieselsaure reicher, Kalk und Magnesia enthaltender Kupfererze. Binder. (Chem.-Ztg., May 15, 1915; ½ p.) On the treatment of copper ores poor in copper, but rich in silica which contain also lime and magnesia.

1704—REFINING—The Sources of Impurities in Cathode Copper. Lawrence Addicks. (Advance copy, Proc. Am. Electrochem. Soc., Oct., 1914; 11 pp., illus.)

1705—SLAG-SETTLER—Granby Tapered Settler. Frank E. Lathe. (Eng. and Min. Journ., Aug. 14, 1915, ½ p., illus.) 20c.

1706—SLAGS—Metal Loss in Copper Slags. Frank E. Lathe. (Eng. and Min. Journ., Aug. 7, 14 and 21, 1915; 11¾ pp., illus.) 60c.

GOLD AND SILVER—GEOLOGY

1707—KALGOORLIE—The Geology of Kalgoorlie. C. O. G. Larcombe. (Min. and Sci. Press, Aug. 14, 1915; 8 pp., illus.) 20c.

1708—ONTARIO—The Ordovician Rocks of Lake Timiskaming. M. Y. Williams. (Can. Dept. of Mines, Geol. Surv., Museum Bull. No. 17; 9 pp.)

GOLD DREDGING, PLACER MINING, ETC.

1709—ALASKA—Bagley Scraper for Gravel Mines in Alaska. Lewis H. Eddy. (Eng. and Min. Journ., Aug. 14, 1915; 1½ pp., illus.) 20c.

1710—CANADA—Rocker and Grizzly Mining on the North Saskatchewan. J. A. Macdonald. (Eng. and Min. Journ., July 31, 1915, 1¼ pp., illus.) 20c.

1711—OREGON—Hydraulicking at Waldo, Ore. W. H. Wright. (Eng. and Min. Journ., Aug. 7, 1915; 3¾ pp., illus.) 20c.

1712—SIBERIA—The Gold Mines of the Lena. C. W. Purington. (Min. Mag., June, 1915; 9½ pp., illus.) 60c.

1713—THAWING METHODS at Fairbanks. Hubert I. Ellis. (Eng. and Min. Journ., July 3, 1915; 5¼ pp., illus.) 20c.

GOLD AND SILVER—CYANIDING

1714—CALIFORNIA—Amador Consolidated Milling Plant, Amador City. (Min. and Sci. Press, T. S. O'Brien. (Eng. and Min. Journ., Aug. 14, 1915, 2½ pp., illus.) 20c.

1715—COLORADO—Cyanidation of Low-Grade Sulphide Ores in Colorado—II. H. C. Fairnelee. (Met. and Chem. Eng., Aug., 1915, 3 pp., illus.) Continuation of article previously indexed. 40c.

1716—COSTS—An Example of Low Working Costs at Corinthian North Mine, West Australia. V. F. Stanley Low (Proc. Australian Inst. of Min. Engrs., No. 18, 1915; 9½ pp., illus.)

1717—ELECTRICITY—An Alternating-Current Rectifier for Metallurgical Laboratories. Paul W. Avery and Angel O. Ulloa. (Mex. Min. Journ., July, 1915; 1 p., illus.) 20c.

1718—MEXICO—La Lucha Cyanide Mill. T. E. Pratt. (Mex. Min. Journ., May, 1915; 2½ pp., illus.) 20c.

1719—MONTANA—Piegan-Gloster Cyanide Mill. Alexander McLaren. (Eng. and Min. Journ., July 31, 1915; 3½ p., illus.) 20c.

1720—NEVADA—The Tonopah Plant of the Belmont Milling Co. A. B. Jones. (Bull. A. I. M. E., Aug. 1915; 27½ pp., illus.) 40c.

1721—PRECIPITATION—Gold Precipitation on Paper. Douglas Lay. (Eng. and Min. Journ., Aug. 14, 1915; 1½ pp.) 20c.

1722—SLIME AGITATION and Solution Replacement Methods at the West End Mill, Tonopah, Nev. Jay A. Carpenter. (Bull. A. I. M. E., Aug., 1915; 13 pp., illus.) 40c.

1723—SOLUTION—The Precipitating Action of Carbon in Contact with Auriferous Cyanide Solutions. W. R. Feldtmann. (Bull. 130, I. M. M., July 22, 1915; 2 pp.) Further contributed remarks on paper previously indexed.

1724—SOLUTIONS—Notes on the Practical Testing of Working Cyanide Solutions. Edward H. Croghan. (Journ. Chem., Met. and Min. Soc. of S. A., May, 1915; 2 pp.) Discussion on paper previously indexed.

1725—TUBE MILLING—The Theory of Tube Milling. H. A. White. (Journ. Chem., Met. and Min. Soc. of So. Afr., May, 1915. 3¼ p.) Discussion of paper previously indexed.

GOLD AND SILVER—GENERAL

1726—ALASKA—Gold, Silver and Copper in Alaska in 1914. Alfred H. Brooks. (Mineral Resources of the U. S., 1914, Pt. I, 19 pp.)

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A Trip Through Bolivia

By Stanley C. Bullock*

SYNOPSIS—The general manager of a Chilean mine visits the alti plano of Bolivia, inspecting some of the leading tin-mining operations. His notes and the data about the train and hotel accommodations should be useful to engineers who contemplate traveling in this South American country.

The Bolivian frontier is crossed a few kilometers after leaving Ollague, the last station on the Chilean section of the Antofagasta & Bolivia Ry. The distance from Antofagasta by rail is roughly 440 km., and the time required by the express train is 18 hr. At the time of writing—March, 1915—only one express was being run weekly, reaching Ollague on Sunday, but, as the intention was to go first to Potosí, it was necessary to take a slow train in order to make the connection at Rio Mulato, from which place the train leaves only once a week — on Saturday. Ollague therefore was left on Thursday at 3 p.m. (La Paz time), and Uyuni, at which place the train stopped, was reached the same night at 8:30 p.m. The hotel here—the Uyuni—is good for the size of the place, and the charges reasonable—bed, dinner, breakfast and attendance costing 5 bolivianos (1 boliviano = 15d. = $0.30, March, 1915).

ORURO, THE COMMERCIAL CAPITAL OF BOLIVIA

Ollague to Uyuni—Uninteresting Tableland

From Ollague to Uyuni the country is most uninteresting, being comparatively a level plain 12,000 ft. high, with little or no vegetation and very saline in character; mirages of water are seen continually along the route. There are a few mines on a branch line from Uyuni to Huanchaca, but these were not visited, since work was said to have been much curtailed and my time was limited.

The next stage of the journey started at 8 a.m. on Friday morning, and Rio Mulato, where it was necessary to stop until the next morning, was reached at 11:30 a.m. The country between Uyuni and Rio Mulato is a little more fertile than the previous section; llamas and donkeys were grazing along the line, and in places the ground had been tilled and barley grown.

There is a river at Rio Mulato, from which the place presumably gains its name, but were it not for the junction to Potosí, it would be of no importance. The hotel here is poor, and since there is no competition it has little inducement to improve. The prices are comparatively high, the charge made being 6 bolivianos per diem, though the food is not good.

The train for Potosí left at 8:30 a.m.; the fare was 14 bolivianos, the same as from Ollague to Rio Mulato. The railway gage from Rio Mulato to Potosí is 1 m. and though the main line from Antofagasta is being changed to this also, the alteration has not yet been completed. From Rio Mulato the line starts to ascend, reaching an altitude of 16,000 ft. and then descends to Potosí, which is about 14,000 ft. above sea level. The country passed through is attractive, well-watered, and cultivated on the mountainsides. Hundreds of llamas and donkeys can be seen grazing, while occasionally a bunch of vicuñas is visible fairly close to the railway line.

The only point of mining interest is the concentration plant of the Porco Tin Mines, Ltd., in course of erection at Agua Castilla, which is about 7 hr. from Rio Mulato. The mill is right at the railway, while the mine is connected to it by an aërial tramway. As the train, however, only stopped a few minutes, there was no opportunity of looking over the mill which is said to be one of the most uptodate in Bolivia, the plant including stamps, sand and slime tables and Hardinge mill for regrinding.

The train should have arrived at Potosí at 4:30 p.m., but owing to various delays on the line, was more than an hour late. On arriving a coach conveyed the passengers up to the main part of the town, which is about 1½ mi. from the station. The hotel was safely reached, though the state of the roads and the united efforts of the driver and his mules at times made this appear in the light of

*General manager, Poderosa Mining Co., Ltd., Mina Poderosa, Collahuasi, Antofagasta, Chile.

an impossible undertaking. The Hotel Splendide had previously been recommended as the best in the town, and here the food and attendance were good and the charges reasonable—5 bolivianos per day.

The next day—Sunday—was spent in looking over the town, which is most interesting, being one of the oldest in Bolivia. There are three principal mining companies in operation here, controlled respectively by English, French and Bolivian capital.

The English company is situated highest up the valley, but at the time was only working in a restricted manner. The plant is badly arranged for economical working and a new one is under consideration. The ore is partly sulphide containing about 10% tin, and is also rich in silver. It is first broken to about 1 in. and then crushed to 1 mm. in a ball mill from which it passes to a classifier feeding a jig, four tables and a Deister slimer. The concentrates average about 20% Sn, the seconds 10% Sn and are retreated. The tailings average 2.5% and go to storage dumps for future retreatment. The concentrates are calcined in hand-rabbled furnaces of the reverberatory type, fired by a small amount of *taquia* (llama dung). After calcining, the silver and any copper in the ore is leached out and the calcined concentrate is treated on four Wilfley tables, where concentrates are obtained running about 55% Sn, the tailings assaying about 2%. Power is obtained from two water turbines, each capable of transmitting 60 hp. Wages at present average about 2.50 bolivianos per day of 12 hr., while before the war they were from 4 to 5 bolivianos.

The French company is operating lower down the valley and is close to the railway station. The ore is brought to the plant by an aerial tramway, 3 km. in length, and contains about 15% Sn. It is crushed in rolls to 2 mm. and the silver and copper leached out. It is then passed over jigs and tables, the concentrates from which are calcined in hand-rabbled furnaces. After calcination the concentrates are further reduced to 1 mm. in rolls, the product from which is classified and passed to jigs and Wilfley tables. The first concentrates run about 60% Sn; these are shipped. The second assay about 30% Sn and are smelted to about 9?% Sn, while the third product contains about 10% Sn, and is crushed by stamps. From the stamps the pulp runs to more Wilfley tables, from which the first two products have the same destination as the previous concentrates, while the third product is reground in a Huntington mill. The feed to this mill assays about 5% Sn and the discharge runs to a classifier feeding more Wilfley tables and a Humboldt slimer. These tables make four products, the third assaying about 2% Sn and being retreated, while the tailings run about 0.5% Sn and are stored for future retreatment. Any oxidized ore mined is smelted with the low-grade concentrates, the tin for shipment assaying about 9?% tin.

The plant is run partly by water power and partly by a gas engine driving a generator. The workmen here in a great many cases work for 24 hr. on end for which they are paid 5 bolivianos against 8 to 9 bolivianos before the war. Living here is cheap as meat, fruit and vegetables are obtained from the neighboring villages. Some of the prices ruling in March were: Meat 30 centavos per lb., eggs 50 centavos per doz., oranges and bananas 10 for 20 to 30 centavos, grapes, peaches and figs 20 centavos per lb. Onions, beets, cabbages, lettuce, etc., were correspondingly cheap.

STREET SCENES IN BOLIVIA'S PRINCIPAL CITIES—ORURO, POTOSI AND LA PAZ

Potosí was left on Tuesday morning at 7:30 a.m. and Rio Mulato was reached about 5 p.m. the train being half an hour late. A dining car is attached to this train, the charge being 3 bolivianos for lunch and 50 centavos for tea, both of which meals are excellent. Tickets can be obtained direct from Potosí to Oruro, the fare being 24 to 40 bolivianos; the journey is broken at Rio Mulato for the night.

The Oruro train leaves Rio Mulato at 11:30 a.m. and does not reach its destination until 6:30 p.m. and as there is no dining car, due to some contract with a refreshment room at a small station en route where the food is not attractive, it is advisable to obtain provisions before leaving Rio Mulato. The country between Rio Mulato and Oruro is well watered and cultivated. Llamas and donkeys are seen in great numbers along the route.

At Challapata, the Llallagua company ships most of its products and this is, therefore, an important town. The company is controlled by Chileans and owns one of the largest and most profitable mines in Bolivia. Some of the ore is rich enough to be shipped straight from the mine. The company has a concentration plant for the poorer grades, but this was not visited.

The next station of importance is Machacamarca, from which Señor Patiño has built a branch line of 1-m. gage that runs up to his mines which adjoin those of the Llallagua company. These mines are the most productive in Bolivia. At Machacamarca there is a branch line to the Oruro company's mill which was seen at a later date.

The best hotel at Oruro is the Quintanal; the charge was only 5 bolivianos per head and the accommodation most comfortable. The most important mines here belong to the Oruro Mining Co. and, by the courtesy of the manager the main workings were visited.

Oruro Ore Treated at Machacamarca

The tin ore being extracted from the chief mine runs from 2 to 3% Sn and the present workings are 300 m. deep from shaft collar, this being about 50 m. above the railway. There are seven levels, the ore being hoisted by a vertical shaft, which at present only goes to the third level, but this will eventually be continued to surface. Now the ore is trammed from the shaft to an inclined shaft which hauls to the surface. It is then crushed, passed over picking belt and trammed to loading station of a ropeway that carries it to another crusher station with small trommel, reducing the ore to 1 in. and automatically loading railway trucks for transit to the company's concentrating plant at Machacamarca.

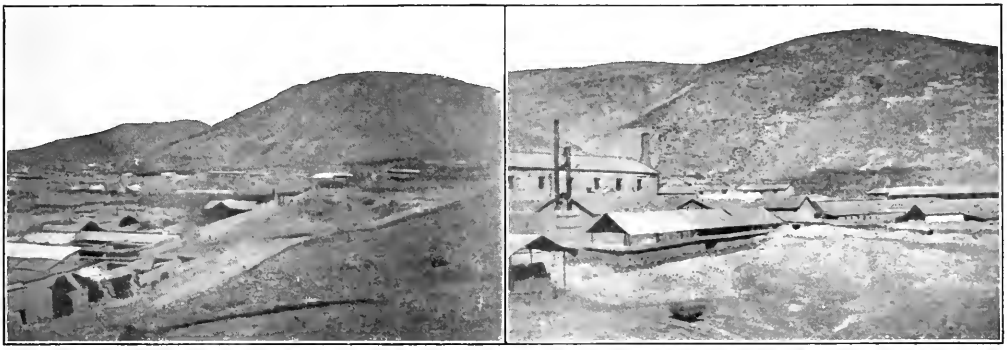
Jackhamer drills are in operation in the mine. The air pressure at surface is 80 lb. per sq.in., the air being supplied by an Ingersoll-Rand compressor driven by motor. The atmospheric pressure here is about 9½ lb. per sq.in., the altitude being roughly 14,000 ft. above sea level. Timber is not much used. When mine supports are necessary stone walls are built wherever possible. Little water is encountered and it is taken out by bailing. Electric power is used for hoisting, lighting, and other power purposes, the generator being direct coupled to Sulzer oil engines, which are entirely satisfactory. The power plant has a capacity of 250 hp., but only 100 hp. is at present being used.

The aërial tramway which connects another mine belonging to the same company was supplied by Messrs. Pohling, of Cologne, the hauling-rope system with fixed cable being used. That the war has been in many ways beneficial to Bolivia is well exemplified by this mine. Before the war it was necessary to mix the poorer ores from the Oruro mine with the richer ores from the company's mine across the hill, in order to make a profit at the mill. Now, on account of reduction in wages and various other general economies the company has been forced to make, it can operate on the low-grade ores alone at a profit. The miners earn about 3 bolivianos per day against 5 to 6 bolivianos previously.

Oruro a Gay City

Oruro is a gay city and the chief commercial center of Bolivia. The band plays every Thursday and Sunday, when the plaza is an interesting spectacle, everyone promenading, exchanging greetings and inspecting costumes. There is a native market where meat, fruit and vegetables can be obtained cheaply, though they are a little dearer than at Potosi.

Oruro was left at 8:30 a.m. and La Paz reached about 5 p.m., a change of trains being necessary at Viacha, where another company runs to La Paz. Just before reaching La Paz the steam locomotive is taken off and an electric one takes the train down the 1000-ft. hill into the city. The journey from Oruro to La Paz is interesting, and a good dining car is attached to the train.



SAN JOSE MILL ON THE OUTSKIRTS OF ORURO

The railway runs on a plateau between ranges of hills, and the whole plateau is more or less cultivated, while herds of llamas and donkeys are continually seen and occasionally a small troop of vicuñas is visible.

La Paz is the center of government but there is little other business done there. The principal factories are for the manufacture of Bolivian beer, which is doubtless due to the flow of excellent water through the valley. The chief hotel is the Guibert, but the prices are higher and the rooms less comfortable than those at Oruro.

The charges here were 7 bolivianos per day in spite of the fact that there is a plentiful supply of vegetables and fruit in the neighborhood. La Paz is probably one of the prettiest places to visit in Bolivia, but is of little interest from a mining point of view. The nearest mines of any consequence are those of the Corocoro United Copper Mines, the ore being chiefly native copper finely disseminated in a sandstone gangue. They are about 100 km. from La Paz, but I did not have time to visit them. Electric trams are running in La Paz and a long trip can be made down the valley to a place called San Jorge. La Paz was left at [illegible] p.m. for

the down to Oruro, which was reached at 9 p.m. the same day.

Having received an invitation to see the concentration plant of the Oruro Mining Co. at Machacamarca, this was done on Saturday in company of the manager. The ore as it comes from the mines is crushed to pass in two 16x36-in. crushing rolls, the oversize from the first being returned by means of a trommel to the second. It is then passed to calcining furnaces, rabbled by hand, the silver and copper leached out and the calcined ore passed through grinding pans, which, in turn, deliver to classifiers, feeding tables, vanners and Deister slimer. From these, 60% concentrates are obtained and this product is brought up to 65% by hand.

The oxidized ore is treated in another section of the mill, stamps being the crushing machine, the pulp from which flows to a Richards-Janney classifier, the different spigots feeding tables and vanners, the concentrates from which run about 50% Sn.

McDougal Furnace Volatilizes Silver

A new sulphide mill is being erected equipped with Hardinge mill, thickeners, Deister concentrators and slimers, the plant having a capacity of from 80 to 100 tons per day, and the concentrates are expected to assay from 67 to 68% Sn. Edwards roasting furnaces are also to be tried, as the labor cost on the present furnaces is excessive. A McDougal furnace has been tried, and although successful on straight tin ores, the losses are high where silver is also contained. This furnace, therefore, is not at present in use. The plant is run by gas engine, though the present management would prefer oil engines, direct coupled to generators, were a new plant contemplated. The new mill when completed should be one of the most uptodate and economical in Bolivia.

Labor is plentiful. During working hours, the natives are continually chewing the leaves of the coca plant, from which the well-known drug cocaine is extracted. This habit has descended from the days of the ancient Incas, and is supposed to satisfy all pangs of hunger as well as supplying the eaters with remarkable powers of endurance.

The fuel chiefly used is yareta and taquia. Yareta is a resinous moss of a fibrous nature found locally. The Indians collect and bring in these fuels from varying distances and the price varies accordingly from 60 centavos to 1 boliviano per Spanish quintal—100 lb. These fuels are worth about one-third their weight in coal as regards calorific powers.

Oruro was left on Monday morning at 7:45 a.m. and at 6 p.m. Uyuni was reached, where it was necessary to stay for the night as the train went no farther that day. Next morning Uyuni was left at 7:30 a.m. and Ollague reached at 1 p.m., and then on through Chile to the coast at Antofagasta.

The total trip lasted for practically three weeks at a cost of approximately $100 per head, including all expenses. Bolivia is undoubtedly a country well worthy of further development from a mining standpoint, and with the decreased cost and wages now obtaining, together with uptodate power plants, mining and milling machinery, there should be a profitable return on carefully expended capital, provided the prospects of any mining enterprise embarked upon are thoroughly gone into by a reliable mining engineer, well acquainted with the country and the people.

Anaconda and the Unions

Special Correspondence

On the occasion of their picnic at Anaconda a few days ago C. F. Kelley, vice-president and managing director of the Anaconda Copper Mining Co., addressed the members of the Mill and Smeltermen's Union and took occasion to paint in proper color the labor disturber, the soap-box agitator and the demagogue who fatten on honest labor; commended the honest leader of labor, and spoke of the necessity of reciprocal relations.

"It is my opinion that the greatest mistake that can be made is to view this relationship exclusively from the standpoint of one side or the other," he said. "The relation, together with its duties, is reciprocal, and inasmuch as there may be abuses and grievances on the part of one, so there may, and have been, on the part of the other. Unlimited and unrestricted power is the greatest cause of the abuse of power. Men are human, no matter in what capacity they act, and what may create injustice and oppression in one capacity will do so in another. There is no distinction in injustice, whether it be practiced by a corporation, an individual, or a labor union, nor should it be more excusable in one instance than in another.

"No single institution created by man is perfect. Corporations, inasmuch as they are governed by individuals, possess the same frailties and incur the same mistakes as men. Much has been said in criticism of the Anaconda company, and much of that criticism has been unfounded. One thing can be asserted as a fact—that throughout its entire industrial career it has been characterized by an unfailing spirit of fairness to its employees.

"I feel that I have an extraordinary right to make that statement, for its policy in this respect I have known from the time when I was employed by it in the humblest capacity until charged with more or less responsibility for its action. That such a policy of fairness will characterize its future conduct I have no doubt, and whatever may be said by the demagogues, I trust that the feeling of mutual confidence which has been built up will continue to prevail. Such a foundation furnishes a more satisfactory assurance that mutual obligations will be fulfilled than can the words of any written contract characterized by the distrust of the parties to it."

Tin Smelting at Pittsburgh

The Standard Smelting Co., Pittsburgh, has been organized with a capital of $100,000, and has installed in the works formerly occupied by the R. D. Nuttall Co. two Wile electric furnaces for smelting Bolivian tin concentrates, says *Iron Age* of Aug. 26, 1915. Another furnace of the same type is now being installed. The works will then have a capacity for smelting 20 tons of concentrates every 24 hr., from which it is expected to recover 12 to 14 tons of tin. The company expects to sell the greater part of its tin output to consumers in the Pittsburgh district. The incorporators of the Standard Smelting Co. are H. S. Glenn, C. E. Glenn, C. R. Buchheit and R. S. Wile.

Swiss Prohibition of Exports—The Swiss Federal Council has issued a decree extending the embargo on contraband articles to tubes made of the following metals or their alloys: Copper, lead, zinc, tin and nickel.

Ore Dressing at Clausthal

By E. Mackay Heriot*

SYNOPSIS—In describing the operation of concentrating lead and zinc ores at Clausthal, emphasis is placed upon the satisfactory results secured through the use of old-fashioned machinery, much of which can be built at any mine. Harz jigs and buddles are used, as are also spitzkasten and other well-known types. The ore and the treatment system are described.

Many years ago when I was a student at Clausthal I took the opportunity of working through a practical course at the state concentrator. The plant was a large one and in every way uptodate, employing 450 men and boys. It had the ordinary rockbreakers and rolls and 176 stamps for fine crushing. There were a number of jigs and Harz buddles for the ore concentration. The capacity was about 270 metric tons of crude ore in 10 hr.

A New Concentrator Erected in 1905

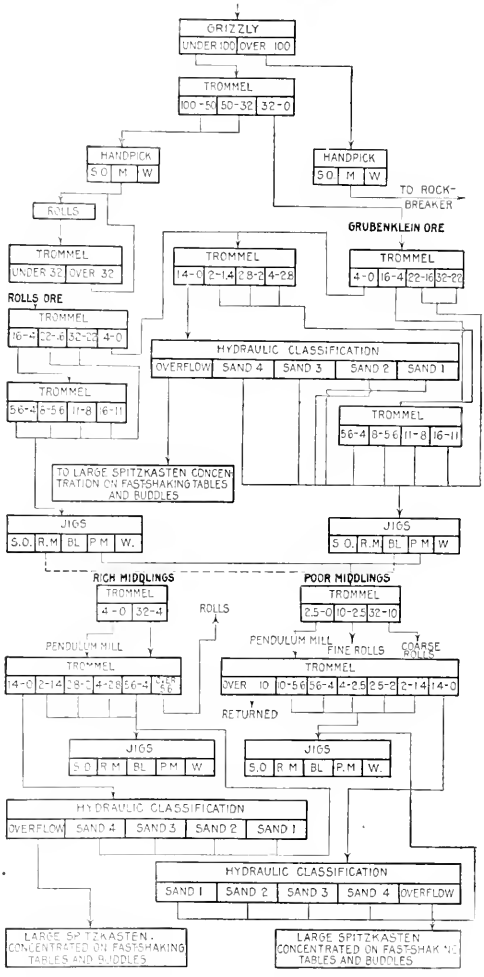
This installation was completely scrapped in 1905 and a new concentrator erected by the Humboldt firm. It takes up less room than the former one, employs only 250 men and boys and has a capacity of 360 metric tons of crude ore per 10-hr. day. It is in every sense of the word a model plant, as is proved by the results achieved, and anyone interested in this class of dressing would do well to visit it. In this model plant there are 96 Harz jigs working. The old type of spitzkasten has taken the place of patent hydraulic classifiers. There are 14 specially constructed Harz buddles for concentrating the finest slimes. Since the installation was laid down many improvements have been carried out.

In these days, when it is thought by many that a modern dressing plant must have some special patented system or a combination of systems, it is a pleasure to see the old-fashioned apparatus doing such excellent work and holding its own so easily. There is one particular reason why one should be pleased, and that is because jigs, spitzkasten and buddles can be made at almost any mine with the help of a local foundry. I do not mean to suggest that a concentrator should in all cases be made locally, especially if the plant be a large one. There are firms who can carry out the very best arrangements. However, it often happens that a mine cannot afford to put up a large plant at the outset, but could, with the aid of a good dressing expert, rig up a reasonably good installation. It often happens that after a small plant has been put up one sees the mistakes and in the construction of the large plant these mistakes are guarded against. I shall refer later on in some detail to the old-fashioned apparatus, and hope that the notes I give will have a practical value.

Composition of the Clausthal Ore

The ore treated at the Clausthal plant is of an ordinary kind. The minerals are galena, blende and copper pyrite in small quantities. An average analysis is: 4.17 to 7.83% PbS; 10.51 to 20.95% ZnS; and in some cases, 0.23% $CuFeS_2$.

The gangue is composed of calcspar, quartz, graywacke, thonschiefer and, in the Rosenhofer district, spathic iron ore in small quantities. The composition of the ores is much the same, but the structure shows considerable variations. At the Unterer Burgstaedter Revier con-



FLOWSHEET, CLAUSTHAL ORE-DRESSING WORKS

centrates of 11-mm. size can be obtained, whereas at the Rosenhof, 4 mm. is the largest. On this account the ores are not mixed, but held apart in large reserve bins.

The plant consists of two parallel installations. From the bins on the ground floor the ore is hoisted by an electrically driven lift to the top story of the main

*Mining engineer, Rio Tinto, Huelva, Spain.

building. Each truck passes over a self-registering weighing machine and is dumped on a grizzly with bars 100 mm. apart. All material over 100 mm. is hand-picked. The middlings are broken in a crusher and hoisted again to the grizzly. Stuff under 100 mm. falls into a bin, from which it is mechanically fed into a trommel, which classifies 100-50, 50-32 and 32-0 mm. sizes. The first two are hand-picked on revolving tables. The middlings, called rolls ore, are crushed in rolls. The 32-0 mm. size is called *grubenklein* (fines). It is richer than the rolls ore and is therefore treated separately. The *grubenklein* is classified by trommels into sizes 22-16, 16-11, 11-8,

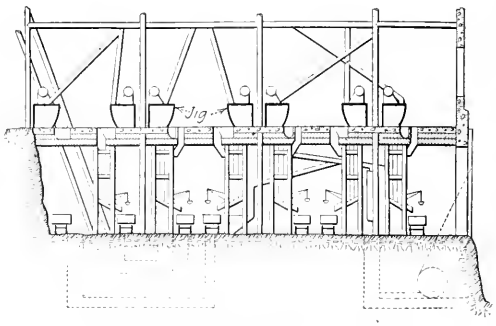


FIG. 1 JIGS AND CONCENTRATE BINS

8-5.6, 5.6-4, 4-2.8, 2.8-2, 2-1.4, 1.4-0. The last-named size passes on to a sand spitzkasten; all the former are treated on Harz jigs. The middlings are divided into two classes, rich middlings and poor middlings, and each is treated separately. The overflow of the sand spitzkasten passes on to a large spitzkasten system. This material is concentrated on fast-shaking tables and Harz buddles.

Treatment of Rich and Poor Middlings

The "poor middlings" referred to are sorted in trommels. The size above 10 mm. goes to the coarse rolls and 10-2.8 to the fine rolls. Material under 2.8 is crushed in *pendelmühlen*, whence it goes to sand spitzkasten. These products are jigged. The overflow of the sand spitzkasten goes to a large spitzkasten system.

The "rich middlings" contain a considerable amount of ore that is really clean, therefore the sizes from 4-1.4 mm. are jigged again. The middlings from this process, together with the larger sizes, are crushed in the mills, but the 2.8-0 is ground in a *pendelmühle*, whence it flows into a sand spitzkasten. These products are treated similarly to those of the "poor middlings," but of course separately.

The blende ores are soft and are therefore not suitable to stamps, as too much powder would be the result; thus material under 2.8 mm. crushed in *pendelmühlen*, using 1-mm. screens. This mill is an improved Huntington type. Its capacity, working through a 1-mm. screen, is 1600 kg. per hr. The mill ring lasts for from about 3500 to 4000 tons.

As regards the rolls, I noticed that the application of a corundum wheel kept the shells in order. The corundum wheel is driven by a belt and does not disturb the working of the rolls. The milling is all done on one floor, but the rockbreakers are on a different level. Each machine has its foundation separate from that of the building.

The jigs are the well-known Harz machines and are built of wood. Material of 22-11 mm. is dressed on 3-compartment jigs, 11-2.8 on 4-compartment jigs and 2.8-1.4 and sand on 5-compartment jigs. The jigs are placed in one large room. There are 96 of them, and here I observed a great improvement which cannot be too strongly recommended. The jigged products are run into small deposits in the floor and emptied from time to time into bins which lie alongside. The tops of these bins are on a level with the ground floor of the hall. On the floor below, the bins are emptied into trucks. All the bins are arranged in neat parallel lines. The jig hall is clean from end to end—there is no water and no sand about the place. One man can attend several machines, as he has very little to do except control the working and move the material one or two feet from hole to hole. The jig room is shown in Fig. 1.

I think in many cases where Harz jigs have not been found practical it is because they have not been properly operated. An expert hand is required to control these machines. So much depends on the class and height of the bed, the height of the bridge, the number and length of strokes, amount of fresh water, etc. With so many items to look after, one can make any number of combinations which may prove disastrous. On the other hand, by small alterations, great advantages may be gained. I give a case in point. The jigs in the old plant were

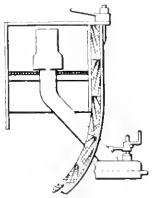
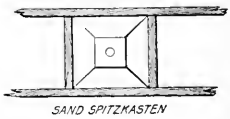


FIG. 2



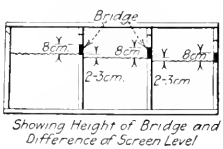


FIG. 3

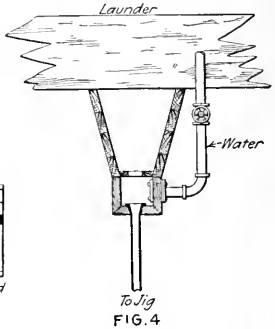


FIG. 4

FIGS. 2 TO 4. DETAILS OF CLASSIFYING APPARATUS

so constructed that the bridge between the screens was 10 cm. high. In the new plant the bridges are 8 cm. high. By this alteration the capacity has been increased 64%, or from 600 to 986 kg. per hour. Each machine uses about 1½ hp.

Details as to Work of the Clausthal Jigs

I now propose to give some detail of the jigs working in the Clausthal installation. The screens are 0.85 m. long by 0.48 m. broad. Sizes from 8 mm. to sand No.

4 are concentrated through a bed. In a four-compartment jig the first product is lead concentrate; the second, rich middlings; the third, blende concentrate; the fourth, poor middlings, and the overflow, in most cases waste.

DATA OF THE CLAUSTHAL JIGS

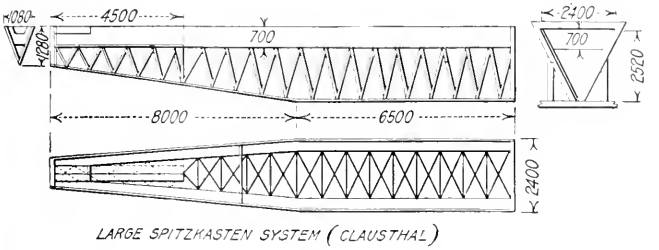
Size of Material, Mm.	Number of Strokes per Min.	Length of Stroke, Mm.
22–16	120	46
16–11	140	30
11–8	160	30
8–5.6	180	25
5.6–4	200	20
4–2.8	220	15
2.8–2	240	13
2–1.4	260	8
Sand No. 1	280	5
Sand No. 2	300	5
Sand No. 3	300	5
Sand No. 4	300	5

Another interesting item is the size of hole in the jig screen. Some examples are shown in the accompanying table.

SIZES OF HOLES IN JIG SCREENS

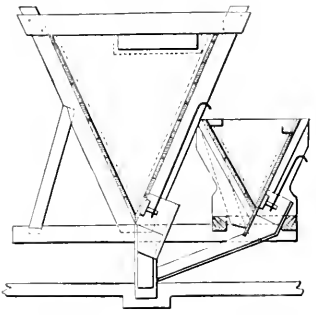
Size of Material, Mm.	Diameter of Hole in Screen, Mm.
Sand	1
1–4	2–3
2–8	3–4
8–11	2
11–16	4
16–22	4
22–32	8

It must be here stated that all material over 8 mm. is not concentrated through the screen, but worked on the Rohraustrag system—that is to say, the concentrates



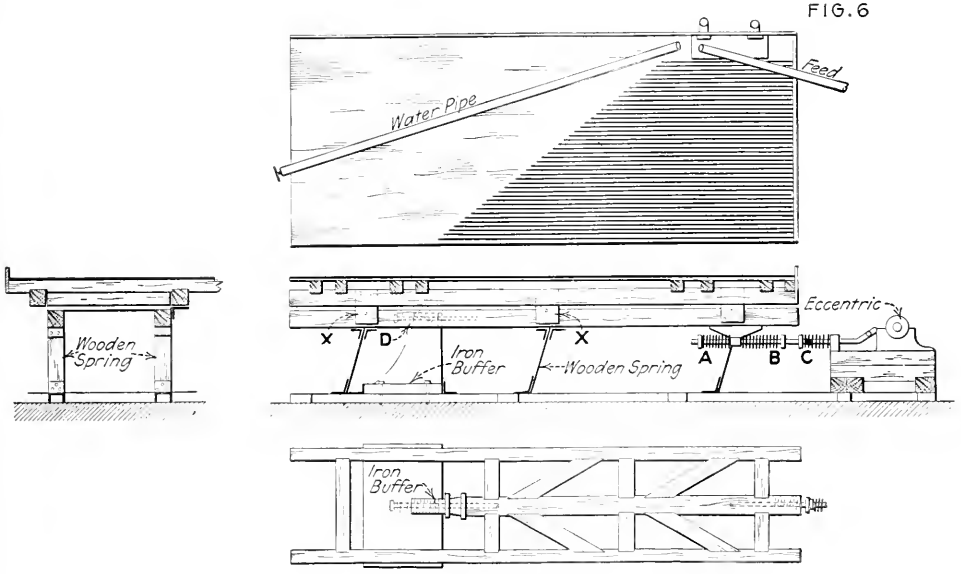
LARGE SPITZKASTEN SYSTEM (CLAUSTHAL)

FIG. 5



SPITZKASTEN AND VORSPITZKASTEN

FIG. 6



SHAKING TABLE AS USED AT CLAUSTHAL

FIG. 7

FIGS. 5 TO 7. DETAILS OF CONCENTRATING MACHINERY

In the poor-middlings department the bed of the first compartment is galena; the second and third, galena and blende; the fourth, blende with gangue. In the rich-middlings department the third and fourth are blende, but otherwise the same as previously mentioned.

are extracted from the top of the screen through a pipe. An outline of this method is illustrated in Fig. 2.

As has been already stated, the height of the bridge is an important factor in the working of a jig; so is also the difference of level from screen to screen. In general

the bridge is 8 cm. high and the difference of screen level 2 [illegible] as shown in Fig. 3.

The present iron hydraulic classifiers that were originally used have been removed and the ordinary rising-current spitzkasten put in their places. They are arranged in sets of four and their products are concentrated on jigs. There has been much argument about working spitzkasten products on jigs, but even where six of these are placed together the result has been in every way good. It is well known that any material under 1 mm. cannot be successfully sorted in a trommel. I will not argue the point as to whether the rising current should enter the spitzkasten at the bottom or side. Here it is at the side, and Fig. 4 shows a sketch of one drawn to scale.

The Spitzkasten System

The overflow from the sand spitzkasten is led to a large spitzkasten system. The spitzkasten are placed in two rows of 19 each, with a platform all around. The width of the first is 1030 mm., and it is 1280 mm. high. For the first 8 m. the machines grow larger and larger, but during the last 6500 mm. the size is the same, namely, 2400 broad and 2500 mm. high, as shown in Fig. 5. Most of the products of the spitzkasten are concentrated on fast-shaking tables, but the very finest are treated on Harz buddles.

The large spitzkasten are fitted with so-called vorspitzkasten. These are smaller ones placed in front and serve to take off the superfluous water before the concentration takes place.

The vorspitzkasten is 1300 mm. high by 1750 mm. broad, and 1100 mm. long. The drawing, Fig. 6, shows the system. From the excellent work the tables do there is no doubt that this method is well worth copying.

Humboldt Fast-Shaking Tables

The fast-shaking tables, of which there are 39 in use, are of an improved Humboldt model. The improvement was made by Mr. Northdurft, the plant manager, and has increased the capacity from 200 to 500 kg. of crude fines per table per hr. The working results are excellent. The supervision can be carried out by boys and the repair costs are practically nil. The table works any class of slimes except the finest. The amount of water used per minute is about 45 liters and the machine makes 360 r.p.m. Each revolution gives the table a backward and forward movement by aid of an eccentric on the driving shaft. When the table is moved toward the machine, three steel springs are tightened, and then let loose in the opposite direction with a jerk. The eccentric rod is not joined to the table but to a central beam. The further end of this beam fits into an iron buffer. By altering the tension of the springs *A* and *B* (Fig. 7) the shake movement can be modified at will. The incline from the vertical given to the wooden springs—six in number—depends on the fineness of the material to be worked, but it varies from 5 to 10 mm. By the aid of the three plates marked *N* and the hinges *E*, the slope of the table can be regulated. Several sketches of this table are given, because I think the results it has achieved make it worthy of being better known.

The Harz buddles are practically the same as those used in days gone by. The construction will be seen from Fig. 8. The face is cement and rests on wood. There

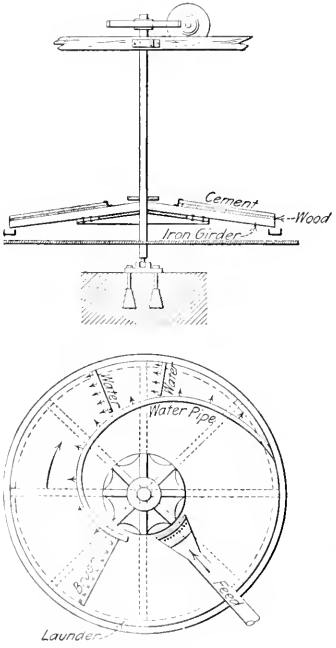


FIG. 8. MODERN ROUNDHEAD BUDDLE

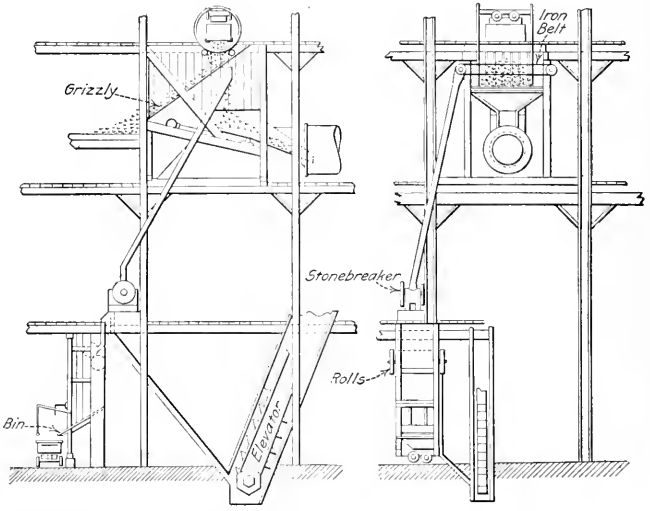


FIG. 9. CLAUSTHAL SAMPLING PLANT

are eight iron bearers or girders. The diameter is 5 m. and the incline of the face varies between 1.10 and 1.15. It makes about 0.6 r.p.m. The whole plant as it works today gives satisfaction; 76.56% of the lead is saved and 81.54% of the zinc. The lead is concentrated to 73% and the zinc to 54.60%. The marketable lead ores have 3% of zinc and the marketable zinc ores 2% of lead.

Electrically driven pumps are employed to pump back the water after it has been cleared in large tanks. Two cu.m. of fresh water is used per minute. The total power used in the dressing plant is 688 hp. Like other modern installations, the Clausthal plant has a mechanical sampler. This was erected in 1911. Under the 100-mm. grizzly, where the crude ore from the mine is first treated, there is an endless belt. This takes about 20 kg. from each truckload and passes it down a pipe into a small crusher, which breaks it to 16 mm. This crushed material falls in equal parts into two launders. One part is returned to the floors by aid of an elevator, while the other part is crushed in a small mill and falls into a bin. After each shift the bin is emptied and the sample reduced to 1 kg. A monthly average sample of this material is analyzed. It is taken into consideration that the material over 100 mm. does not enter the sample. The plant uses 7 hp. In Fig. 9 is shown a sketch of the sampler.

At the Silbernal mine, near Grund, the middlings from the wet concentrator are being treated by the Murex magnetic method. This is a combination of the oil-flotation and magnetic processes. It has been described by Messrs. Achenen and Jungst in their book on ore dressing. Grund lies about five miles from Clausthal. The ores contain a considerable amount of heavy spar. The material under 3-4 mm. is mixed with water to a thin pulp. To this is added a composition of magnetite, paraffin oil, goudron and colophonium. The whole mixture is deposited in a cylinder, 1240 mm. in diameter and 2780 mm. long, which is revolved at the rate of 50 r.p.m. The cylinder contains 150 kg. of steel pieces of 4-6 mm. diameter and 150 kg. of pebbles (10-15 mm.), which serve to mix the oil and ore more intimately. The mixture flows from the cylinder through a 2x4 mm. screen on to a shaking table which has a magnet at the bottom end. The magnet lifts the magnetite and with it the oil and galena. The heavy spar and gangue remain on the table.

It is interesting to note that the difficulty of clearing the water of slimes has to a great extent been overcome at Clausthal and Lautenthal by adding magnesium chloride to the water. At Lautenthal a 7% magnesium-chloride solution is used, one liter in 10 min. for every 3 cu.m. per min. slime water. The amount of insoluble matter in one liter was reduced from 0.35 to 0.14 by this method.

Civilian Engineers to Aid Army

Plans for having immediately available for the nation's service in time of war associations or societies of engineers, bridge builders, electricians, telegraphers and other trained experts in civil life, are being worked out at the Army War College in connection with the general reorganization scheme now being studied.

Secretary Garrison said on Aug. 30 that he had received suggestions from the American Institute of Mining Engineers, the Electrical, the Civil and the Mechanical Engineers that the organizations might be of use to supplement the army engineer corps, should the need arise. William Barclay Parsons, of New York, and Elmer L. Corthell, of Massachusetts, representing many engineering societies, called upon the secretary on Aug. 30 to tender formally the services of the organizations.

Mr. Garrison obtained from them written suggestions as to ways in which the engineers in civil life could be useful, and the whole matter was turned over to the War College for the framing of a definite plan. The War College will submit a detailed report on the scheme, which probably will be included in the Secretary's report to Congress this winter.

Montana Power Construction Progress

Special Correspondence

John D. Ryan, president, and officials of the Montana Power Co., which is owned by interests closely allied with the Anaconda Copper, have made an inspection of the different power plants of the company. The party arrived at Great Falls in time to see water turned over the big dam built across the Missouri River by the power company, the dam having just been completed. The company is practically ready to furnish the energy to the St. Paul R.R. for its electrified system, the contract calling for the delivery of the power by Oct. 15; but the company could have delivered it Sept. 1. The transmission line between Great Falls and Anaconda was connected a few days ago, and the work on the line to Two Dot is going on satisfactorily.

The big power dam at Great Falls is 1340 ft. long and its construction required 216,000 cu.yd. of concrete, to make which 1,000,000 sacks of cement was used. Three million feet of lumber, board measure, was used, and 6,000,000 lb. of reinforcing steel and 1,250,000 brick went into the structure. In all, 11,000 carloads of material went into the river to make the dam.

At Thompson Falls, in the western part of the state, work on the power plant is making rapid progress and will be in full running order by next winter. Two of the six units are already generating power. "When completed we expect to produce with our six units at Thompson Falls 50,000 hp.," said Mr. Ryan. "The main use of the electricity will be of course that of supplying the new electric system of the St. Paul R.R. Then we will supply the Cœur d'Alene mines, which we are already doing in part. We are, however, still in the market with our power, since we will have a great deal to spare." The Montana Power Co. owns practically all the important power plants and light plants in Montana, and under the plans of Mr. Ryan, the late John G. Morony, and the company's efficient managing expert, the late Max Hebgen, the power system in the state is being developed to a point where it will be second only to mining in industrial importance. It is already supplying power and light to Butte and all the Butte mines.

At a Conference of Representatives of the Russian Gold-Mining Industry on May 7 it was decided to address a petition to the government for the establishment of a concern to manufacture cyanide of potassium.

The Steel Headframe at No. 9 Shaft, Republic Mine, Vulcan, Mich.—II

By Floyd L. Burr*

SYNOPSIS—Continuation of description of a modern steel headframe. Details of steel work and foundation taken up in this section. Complete costs of erection are given.

The height of the structure depended upon the necessary elevation of the skipsheave, and this was fixed by considering the elevation of the extreme top of the skip at its "full dump" position and allowing for about 12 ft. overwind. The position of the top of the skip depended of course upon the horizontal east-west position of the inadequate in capacity and height, so the design of a larger and improved type of skip in use at one of the shafts at Vulcan was adopted as the basis of design for the headframe and the old skip was reconstructed to fit the new dump.

The elevation of the skipsheave, as determined by the conditions previously outlined, was 73 ft. The cagesheave was about 10 ft. higher. Allowing for plenty of headroom for tackle and handling of sheaves brought the lower flange of the trolley-beam crane up to an elevation of about 97 ft. The ladders extend up to an elevation of about 102 ft.

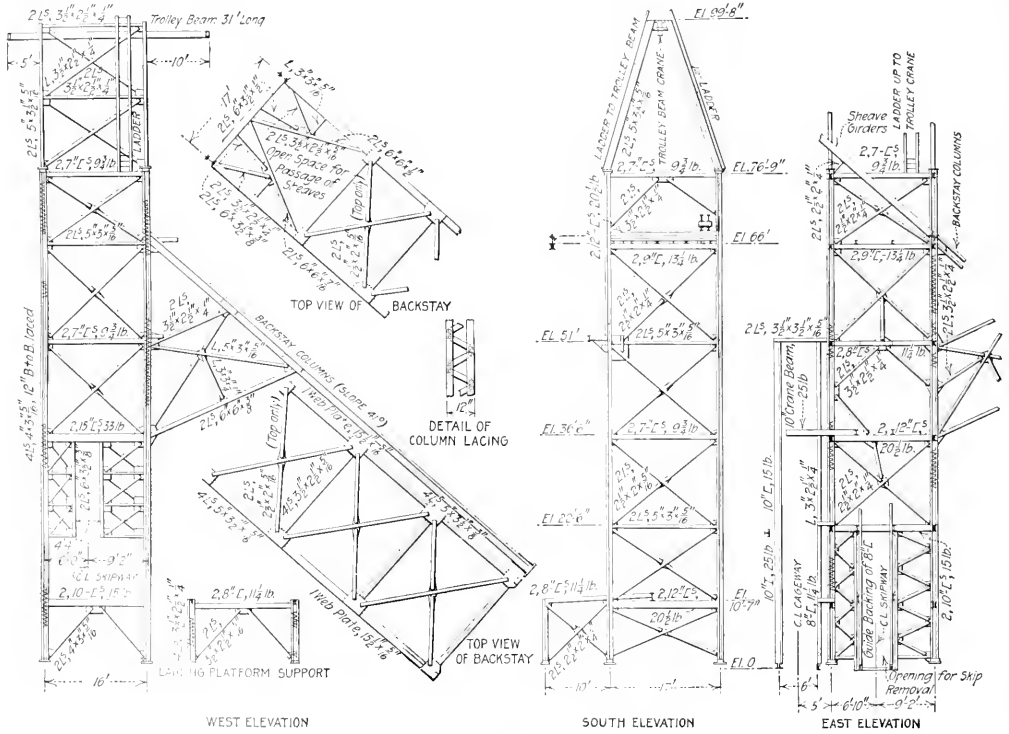


FIG. 7. DETAILS OF STEEL HEADFRAME REPLACING WOODEN STRUCTURE AT VULCAN, MICH.

car (or the discharge from the hopper); the height of the car; the necessary steepness of slope for the bottom of the hopper or chute; the profile of the dumping guides; the necessary steepness of slope for the bottom of the skip box in "full dump"; and the height of the frame and other features of design of the skip.

It was thought that the old skip, which was and is yet in use, might at some time in the future prove

The dump hopper or chute was given careful consideration and required a large quantity of steel. Its construction is of $\frac{7}{16}$-in. steel plates stiffened by 6-in. 8-lb. channels and provided with lining or wearing plates of hard steel $\frac{3}{4}$ in. and $\frac{1}{2}$ in. thick. These plates are in narrow units to promote economy in replacement when worn out. Two small platforms are supported at the outer end where a workman may stand with tools to reach into the chute in case large chunks of ore should choke the opening. The opening is so ample, however,

*Vulcan, Mich. Formerly structural engineer, Republic Iron Co.

that such choking should seldom occur. The platforms are reached by means of ladders from the landing floor. The lower portion of this chute is made so that it may be readily removed to allow for a larger and higher car in case such a car should be needed in the future. The weight of this hopper or chute and its live load is supported largely by suspension from the heavy girt-girder just above. This girt is made up of two 15-in. channels and the suspenders are each two angles 6x3½x⅜ in. attached to the web of the girt by means of gusset plates. The whole affair is thoroughly braced.

The wooden guides of the cageway and skipway are attached to vertical supporting members consisting of an 8-in. channel with an angle riveted to its web for stiffening in the plane normal to the web.

A clear opening about 20 ft. in height is left in the lower panel on the east side opposite the skipway to allow handling the skip in and out.

To avoid danger on the ground around the shaft from falling chunks of ore as well as the usual dangers of an open shaft, the skipway is inclosed for about 36 ft. of its height in a sort of box made of $\frac{3}{16}$-in. steel plate. The lower 20 ft. of plate on the east side is removable for taking the skip in or out.

To furnish necessary clearance for the take-on ropes the diagonal braces were replaced by knee braces in the middle panel on the east side. The take-on balance guides consist of two 6-in. I-beams standing on the south side of the tower and tied to the various girts. They reach from the ground up to an elevation of about 70 ft., where small headsheaves are located. From these sheaves the ropes lead horizontally in a diagonal direction over to small vertical sheaves. Going over these sheaves they descend vertically to elevation about 37 ft. where they pass under vertical sheaves and cross horizontally over the center of the skipway to their fixed-end support on the west side of the headframe. The sheaves mentioned are supported by various cantilevered beams.

The large headsheaves are supported upon a series of girders made up each of two 12-in. 20½-lb. channels, ¼ in., back to back. All the girders are in the one inclined plane, are laterally tied together and braced by plates riveted to the top and bottom flanges. These plates extend across wherever they may do so without interference with the sheave wheel or ropes.

It should be mentioned that an error was made in the calculations whereby insufficient allowance for eccentricity was given and consequently these sheave girder struts as designed were too light and weak, and do not possess the same liberal factor of safety that the rest of the headframe has.

For the support of the bearings, plates are riveted to the top and bottom flanges of the girders and the usual bolts pass through the pillow-block casting and through the two plates, thus clamping the bearing to the girder. For the purpose of resisting the principal stress, which is of course longitudinal or parallel to the girders, other plates are riveted on the top of the upper plate, forming by their edges an end bearing for the castings. Of course the riveting of these plates had to be calculated to resist maximum stresses. An open space of about 1½ in. was left at each end of the bearing casting to be filled up by steel wedges for adjusting purposes.

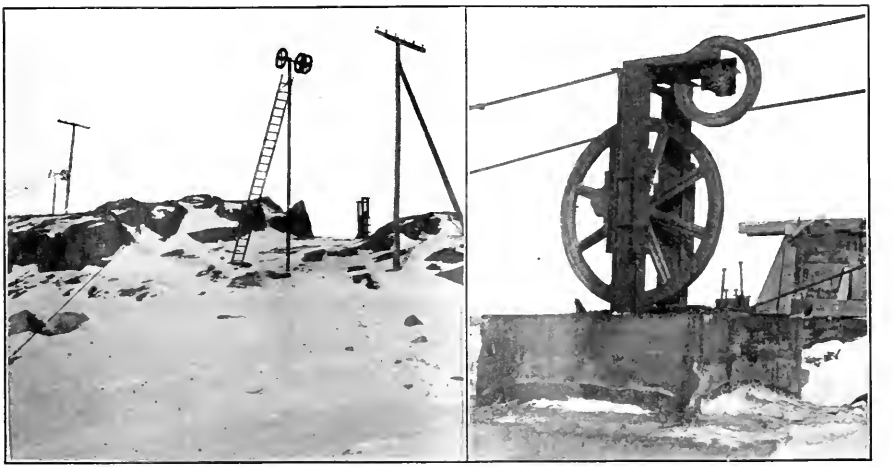


FIG. 5. ANGLE-SHEAVES AND IDLER PULLEY SUPPORTS

The bearings of the sheaves are 45° angle boxes of a special design (see Fig. 6). They are peculiar in that they are so designed as to retain all excess oil and deliver it through a hole tapped for 1½-in. gas pipe into whatever receptacle is desired. This feature was suggested by our experience with other headframes where all the upper portion of the structure is fairly drenched with oil that has dripped and blown away from the sheave bearings.

The trolley crane consists of two 12-in., 20½-lb. channels rigidly suspended from the framework by plates riveted between the two webs.

The power transmission ropes lead down through the south side of the tower portion of the headframe to a small concrete structure which contains and supports the haulage machinery. One man, called the lander, exercises the necessary supervision incident to receiving the skip loads of ore and operates the haulage drum. The operating floor of the lander's house is at the same level as the landing floor and is in immediate proximity to it.

This building rests upon the ground and in its lower story is a small space where the timber lander may go to keep warm or to avoid the weather. A stove in this lower room heats the whole building.

The building is constructed with a reinforced-concrete frame and floors cast monolithically, with hollow or air-spaced cement-plaster-on-metal-lath curtain walls. Plenty of large steel-sash windows admit light and ventilation and enable the lander to see in daytime the various points of destination of the transfer car. The machinery is provided with an indicator dial, however, so that sight of the car is not essential for its operation.

Loads and Stresses

In the design of the various parts of the structure for strength, the backstays and their bracing were given first place in view of their carrying the greater part of the hoisting stresses. In general the idea was to produce with consistent economy a structure of ample strength to withstand safely such extreme conditions as might reasonably be expected. Steel was used freely in the backstay members, lavishly in the dump-hopper region and rather sparingly in the four vertical columns and diagonal bracing.

The skip, which was and is yet in use, was of about three tons capacity and was handled by a 1⅛-in. hoisting rope. It was thought possible that at some future time a larger skip, possessed of some weight-adding and height-increasing improvement features, might be wanted and so the headframe was designed to provide for such a condition.

Accordingly, the backstays were designed to withstand the stress produced by the breaking of any one of the four ropes while the other three ropes were carrying their working loads. For the skip and for the cage there was assumed a 1¼-in., 6-strand 19-wire "extra strong cast steel" rope of 116,000 lb. ultimate strength; for each of the two balances, skip balance and cage balance, a ⅞-in. similar quality rope of 60,000 lb. ultimate strength. A maximum working load of 27,000 lb. was assumed for the skip made up as follows: Empty skip 8000 lb., load of ore 12,000 lb., weight of rope 7000 lb. The working load for the balances were taken each as 12,000 lb. The ultimate strength of the ropes was taken as 104,000 and 56,000 lb. net after reduction for bending stresses.

The resultant loads from the four ropes were found to be: 137,000 lb. for breaking the 1¼-in. rope; 74,000 lb. for breaking the ⅞-in. rope; 36,000 lb. for working load on the 1¼-in. rope, and 16,000 lb. of working load on the ⅞-in. rope. For the severest conditions arising from the possible combinations of these stresses there was allowed for the purpose of design a stress of 121,000 lb. for the east and 84,000 lb. for the west column.

No allowance was made in the columns for wind stresses. The following was taken for the basis of design: Allowable per square inch compressive stress 16,000 lb. $-70\ \frac{l}{r}$, allowable tensile stress 16,000 lb; maximum $\frac{l}{r} = 100$ for primary compression members and 140 for secondary compression members.

In determining upon the section for these columns, consideration was given to the fact of the long unsupported (in vertical plane) span which would put some bending load upon the columns because of their own dead weight. To give them stiffness in the vertical plane, the plate and angle section was chosen and a depth of 16 in. allowed. They are made up of a $\frac{5}{16}$x16-in. web plate and four 5x3½-in. angles. The thickness of these angles was made $\frac{5}{16}$ in. for the west column and ⅜ in. for the east column. In order to give lateral support and stiffness to both flanges of these columns, latticed angle girts were used. On account of the prime importance of this backstay portion of the structure, the minimum thickness of material was limited to $\frac{5}{16}$ in. The bracing in the upper panel was designed to transfer the sheave-girder stress to the two columns, thus largely relieving the lateral girder from bending stress.

The design of the vertical tower portion of the headframe involved the dead weight of the structure itself, including the considerable weight of the concrete floors, loaded car, the non-measurable but serious pounding effects of ore dumping, the wind load, and various minor loads. From the combination of these various loads, the four vertical columns were designed to resist at their lower ends each a load of about 90,000 lb.

It was recognized that the operations of the hoisting, dumping of the skip and running the transfer car would tend to produce much jar or vibration—particularly the dumping. The effect of this might be very pronounced on account of the small width of the structure. It was accordingly decided to introduce a considerable amount of vibration-absorbing mass by inclosing the lower 40 ft. of the length of the columns in prisms of concrete. No computation was attempted for this feature, but the prisms were made as large in section as available space would permit, being cast 30 in. square; 36 yd. of concrete was required. Lengths of old wire rope were stretched up in each, near the faces, to act as longitudinal reinforcement.

In view of the incidental reinforcing effect of these prisms the section of structural steel for these columns was made rather light and consisted of four angles 4x3x$\frac{5}{16}$-in. latticed 12 in., back to back with 2¼x$\frac{5}{16}$-in. bars.

Many of the girts act also as girders and were designed for their local load conditions. The other girts were designed to suit the specification by which the value of l/r must not exceed 140, the stresses to be resisted being usually too small to require so large a section.

Foundation

The foundation conditions for the structure were good. Solid rock ledge came nearly to surface at the site of the backstay piers. Excavation of loose material was made and some holes drilled down into the rock. Into these holes were anchored some steel rods reaching up into the pier. Four 1¼-in. anchor bolts, bearing against a suitable anchorage grill near the bottom of the pier, attach the base plate of the column firmly to the pier. These piers were made 4 ft. square at the top, with vertical sides and front faces, and with back sloping at about 40° with the horizontal slightly flatter than the columns. These two piers were cast after the erection of the steel structure. It was intended to cast them in preparation for erection, but unexpected conditions prevented. As far as the erection of the steel backstays was concerned there was no disadvantage in thus casting the piers after erection of the steel.

The ground sloped so rapidly upward to the south of the shaft as to bring the top of the backstay piers some 15 ft. higher than the tower piers, thus saving materially in the length of the backstay columns.

The rock ledge was covered in the region of the shaft to a depth of from 6 to 11 ft. with a mixture of boulders and fine ore. The piers for the four main vertical columns were made 4 ft. square and, in case of three of them, reached down with the same section to a rock bearing. The other pier rested at 10 ft. depth on a compact broken rock material of good bearing value and was spread out at the bottom to a footing 5 ft. square. In connection with this concrete work it was planned to line the shaft from ledge up to surface with concrete and to construct a concrete pavement to extend in all directions for a considerable distance from the shaft. It is to slope away from the shaft and is intended to do away with the unsightly mud hole so often found around shaft collars.

Erection of Headframe

The fabricated steel arrived in April and on July 7 work was begun to dismantle and demolish the old wooden structure (see Fig. 1), the regular mine surface force doing the work. After moving sheave wheels, dump plates, and a few other movable parts, the posts on the west side were sawed through and those on the east were actually removed for a few feet in height. Next the skip rope was made fast to certain members in the heart of the structure and the hoist started to wind up the rope, pulling the structure over toward the east.

Meanwhile the foreman of the erection gang and some of his men began the preparation of tackle, gin pole, etc. The first column piece was grappled July 10, at 9:30 a.m. By Aug. 1, all of the tower portion and the upper section of the backstays had been erected (on bolts). The steel headframe during construction and completed is shown in Fig. 9. On Aug. 4 the gin pole was taken down for good after having erected the lower section of the backstays from a new position on the ground. No work was done on Sundays.

After the removal of the gin pole there were still some hand railing, "take-on" members, floor beams, guide-backing channels, etc., to put up. These were all in place by Aug. 6, with the exception of some hand railing which required refitting. Aug. 7 and 8 were spent in installing sheaves.

This erection work was done by a force organized and described as follows:

One foreman, four sky men, three ground men, one hoist man. Steel members were hauled to the site slightly ahead of erection by five men and a team. The steel had previously been unloaded from the cars and spread out systematically over available areas at some distance from the shaft. The foreman and two sky men belonged to the "trestle gang" at the Vulcan mine and were possessed of the advantage gained from their general experience in wooden headframe work and in addition, the special experience of employment in the erection of two large steel headframes at Vulcan. They did excellent work. The remainder of the gang were local men who were handicapped by entire lack of experience in such work.

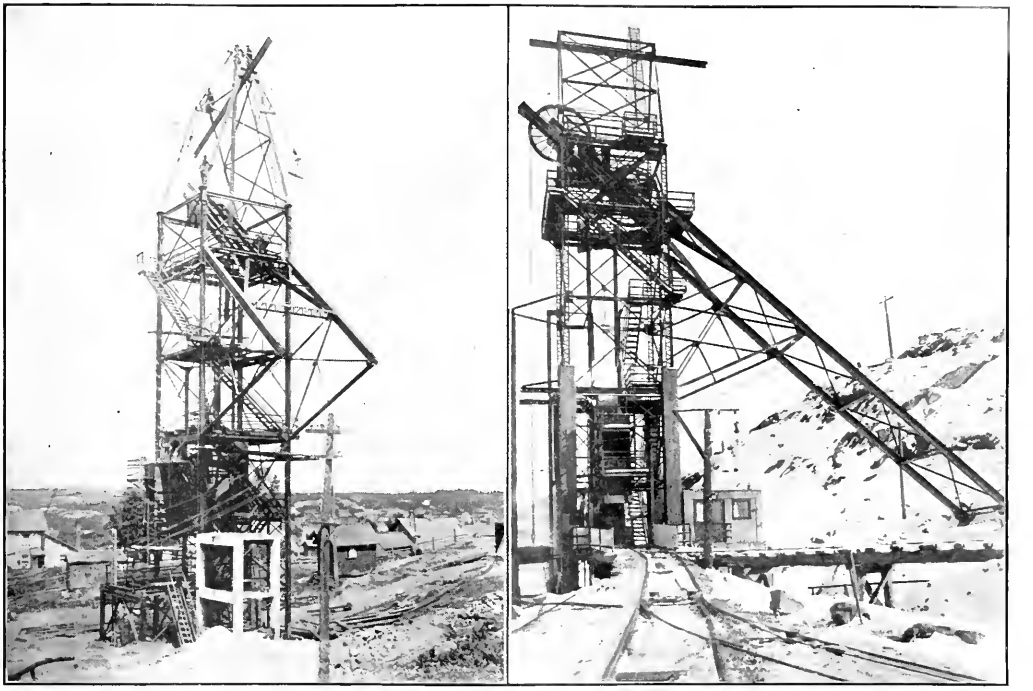


FIG. 9. NEW STEEL HEADFRAME DURING CONSTRUCTION AND AFTER COMPLETION

However, their spirit was most commendable and they became very valuable as they gained experience. An electric hoist was used during erection for all hoisting purposes and was found to be very satisfactory.

The wooden treads of the stairs were assembled with stringers on the ground and the completed flights installed as soon as the supporting framework was ready for them, thus helping greatly to facilitate safe travel up and down during erection.

Riveting was begun July 15 with two gangs of three men each, using pneumatic riveting hammers. On account of the entire inexperience of these men, progress was not at all satisfactory and from Aug. 11 to 15 a third gang was put on to hurry the work along. All riveting was completed by Aug. 20. This work, as well as the erection proper, was under the direction of the foreman above mentioned.

The foreman was on the job from July 7 to Aug. 20, while his two sky men from Vulcan were there from July 8 to Aug. 8. The local force continued after Aug. 20 to adjust sheaves, install wooden guides, construct concrete floors, rebuild tram-track trestle, complete lander's house, etc. Resumption of ore production began Aug. 25 with much finishing-up work still undone. The shaft was thus closed for seven weeks.

As soon as it was convenient, the structure was given two coats of paint—first coat, green; second coat, black.

Idler-Pulley Frames and Small Angle-Sheave Frames

The change in the line of the ropes from the headframe to hoisting house, explained earlier in this article, involved the construction of many new idler-pulley frames for supporting the weight of the ropes and several angle-sheave frames for carrying the ropes through small vertical angles at the various humps on the hill. It was desired to construct them in a substantial and permanent manner.

For the angle-sheave frames, simple steel structures embedded in ample bases of concrete were constructed and seem to serve the purpose well. The deflection angle being small, very little load is exerted by the ropes upon the angle-sheaves, thus allowing the structure to be a very simple and light affair. The illustration (Fig. 8) shows one of these structures carrying an angle-sheave for the skip rope and an idler wheel for the cage rope. This structure is located at the brow of the hill and the hoisting ropes have no intermediate support between this structure and the headframe—a span of about 220 ft. On page 312 of the *Journal* of Feb. 14, 1914, there was published a photograph and a short description of another one of this series of angle-sheave frames.

For the idler-pulley frames (see Fig. 8), masts of scrap boiler tubes were set in holes dug into the rock ledge or in small concrete piers where the rock was not in evidence. Wheel axle shafts of 2-in. double strength pipe were put through holes in these tubes and carried the idler wheels. Where high masts were needed, they were stiffened by guys made of discarded wire ropes. A number of different details are possible in this general design. There was also a view shown in the *Journal* of Feb. 21, 1914, p. 415. Some of these structures made use of old 4-in. boiler flues, while in other cases discarded drill columns were used. In case of the boiler flues, advantage was taken of the fact that a 4-in. standard pipe just telescopes over a 4-in. boiler flue, and the axle shafts were attached to the short lengths of 4-in. pipe instead of to the flue itself. Then the pipe was slipped over the flue, being made rigid by means of setscrews.

Costs of Head Frame

An attempt to give a complete and intelligible record of classified costs of all the features mentioned in this description would not be very satisfactory since the conditions would not be readily understood by the reader.

UNLOADING AND STORING FABRICATED STEEL READY TO HAUL TO ERECTION SITE

222½	hours laborer labor	@	$0.22	$48 95	
72	hours team labor	@	.50	36 00	
294½	hours total miscellaneous labor	@	.288 av.		$84 95

HAULING FABRICATED STEEL TO ERECTION SITE

273½	hours laborer labor	@	.22	$60 17	
57	hours team labor	@	.50	28.50	
330½	hours total miscellaneous labor	@	.268 av.		$88 67

ALTERATIONS DUE TO ERRORS AND INACCURACY OF FABRICATION

26	hours blacksmith-shop labor	@	$0 55	$14 30	
14	hours foreman labor	@	.375	5 25	
100	hours sky-man labor	@	.35	35 00	
24	hours riveter labor	@	.324	7 80	
11½	hours riveter's helper labor	@	.30	3 45	
10	hours brakeman labor	@	.26	2 73	
19	hours machine-shop labor	@	.25	4 75	
30½	hours laborer labor	@	.22	6.71	
235½	hours total miscellaneous labor	@	.34 av.		$79.99

ALTERATIONS DUE TO CHANGES IN PLANS

3	hours autotruck labor	@	$1 00	$3 00	
44	hours blacksmith-shop labor	@	.55	24 20	
50	hours sky-man labor	@	.35	17 50	
11	hours riveter labor	@	.325	3.58	
5½	hours riveter's helper labor	@	.30	1 65	
85	hours laborer labor	@	.22	18 70	
198½	hours total miscellaneous labor	@	.346 av.		$68 63

ERECTION PROPER

3	hours blacksmith-shop labor	@	$0 55	$1 65	
4	hours mason labor	@	.425	1 70	
301	hours foreman labor	@	.375	108 88	
1069	hours sky-man labor	@	.35	374 15	
30	hours painter labor	@	.30	9 00	
210	hours brakeman labor	@	.26	54 60	
4	hours machine-shop labor	@	.25	1 00	
67	hours laborer labor	@	.25	14 75	
635½	hours laborer labor	@	.22	139 81	
2323½	hours total miscellaneous labor	@	.303 av.		$705 54

RIVETING

50	hours foreman labor	@	$0.375	$18 75	
5	hours sky-man labor	@	.35	1 75	
1195	hours riveter labor	@	.325	388 38	
623	hours riveter's helper labor	@	.30	186 90	
90	hours laborer labor	@	.22	19 80	
1963	hours total miscellaneous labor	@	.314 av.		$615.58

PAINTING HEADFRAME AFTER ERECTION

466	hours painter labor	@	$0 30	$139 80	
5	hours machine-shop labor	@	25	1 25	
471	hours total miscellaneous labor	@	.30 av.		$141.05

SUMMARY OF ERECTION LABOR

5816½	hours total miscellaneous labor	@ $0 307 av.	$1784 41

SUPPLIES

140,035 lb.	fabricated steel for original design	@ $4 60	$6441.61
2,236 lb.	fabricated steel for alterations and additions	@ 4.43	99 08
	Paint and brushes		70 50
	Total supplies		6618 03
	Total labor and supplies		$8402 44

Accordingly I shall confine myself to the structural steel frame proper and its erection, leaving out entirely such related matters as administration and engineering costs, traveling and boarding expense, cost of tools, tackle, electric power, new sheave wheels, concrete foundations, floors, lander's house, etc.

The items covered will be the structural steel delivered by the steel company, steel used in alterations, paint,

and the labor of unloading, hauling, erecting, riveting and painting.

It is not to be understood that the items left out are of small importance. On the contrary they are very considerable, but by reason of their indefiniteness to one not familiar with local matters they would not be of much value for purposes of comparison or estimate. No special economy is claimed, but the cost figures are given rather as a simple statement of the actual cost of work done under average local mine conditions by mine forces of average ability.

The detail drawing and fabrication of the steel work were done by the structural department of the Cambria Steel Co. Erection of the steel headframe was carried on under the direction of P. Sala, foreman. The general design of the headframe and the accessories were made by the writer, who also exercised a general supervision over the erection, aided by R. B. Wallace, the local engineer for the Republic Iron Co.

Quartz Mining in Fairbanks District, Alaska

SPECIAL CORRESPONDENCE

The revival of interest in quartz mining, especially in the Fairbanks Creek portion of the district, is, aside from the Tolovana, the most important development of the year. The erection of the Heilig custom mill was largely responsible for this improvement. The little Huntington mill has proved to be too small, however, and it is planned to install a 7-ft. Lane chilean mill during the summer. This, it is hoped, will give the plant a capacity on the soft Fairbanks Creek ores of about 40 tons a day.

Huddleston Bros. & McNeil have a 100-ft. shaft on a 4-ft. vein at the head of Too Much Gold Creek; in order to avoid the necessity of pumping at greater depth they plan to drive a 600-ft. cro-scut adit. The vein has been traced on the surface for nearly a mile. The operators are building a road to the Heilig mill and will crush 375 tons of ore as soon as the mill is in condition to handle it. Previous runs on picked ore returned about $10 a ton. The richest ore in the Fairbanks Creek belt is at the Mizpah mine, owned by Thompson, Geis & Hess. The last mill-run returned $80 a ton. Most of the ore is free-milling, but rich silver-bearing lead carbonate is reported to have been found at one point. The mine has recently been equipped with boiler and hoist and is prepared to yield a good tonnage as soon as provision can be made for milling operations.

Shaeffer, Golden & Van Orsdale, on placer claim No. 16 Above Discovery, have sunk on what is thought to be the extension of the Mizpah vein. Although the ore is very rich the vein is smaller than at the Thompson-Geis-Hess workings. Stevens, Boyd & Kleinschmidt, lessees on the Mayflower claim, have more than 300 tons of ore ready for milling. The shaft is down 60 ft. Owing to the decomposed nature of the rock, both vein and country, no powder has yet been used, three men mining and hoisting 15 tons of ore a day with ease. The operators estimate that they have exposed between 4000 and 5000 tons of ore of an average grade of $15. The Crites & Feldman 5-stamp mill on Moose Creek is running 10 hours a day. The most important vein on the group of claims embraced in the Crites & Feldman holdings is developed by two adits, one 100 and the other 700 ft. long, most of the ore now coming from the longer tunnel. Foss & Farvin have driven 500 ft. on the McDonough & Mathews ground, lying at the extreme head of the creek. A 75-ton shipment crushed at the Burns mill showed the ore to be of a fair milling grade.

Although the most important recent developments are those on Fairbanks Creek, there is considerable activity in lode mining in other parts of the district. The Rhoads-Hall mine on Bedrock Creek, which is credited with a total production of considerably more than half a million dollars, is employing 25 men and the mill is running night and day. Martin Harris plans to build an arrastre, run by water-wheel, on the Moonlight claim, near Skoogy Gulch. Tyndall & Finn, in the Ester Creek belt, are driving a crosscut adit to tap an 8-ft. vein at a depth of 350 ft. About 700 ft. of driving is required, of which over 600 ft. has been completed. If values at depth are comparable with those found nearer the surface, a mill will be installed on the ground. Some prospecting has been done by contract at the Newsboy, but nothing of value appears to have been found.

Talc and Soapstone in 1914

The United States produces more talc and soapstone than all the rest of the world combined, this industry having nearly doubled in this country in the last decade. According to J. S. Diller, of the Geological Survey, the marketed production in the United States in 1914 was 132,296 short tons, of which 118,479 tons were ground, 17,824 tons were manufactured into various articles, such as crayons, gas tips, laundry tubs, etc., 2913 tons were sawed into slabs and 3080 tons sold in the rough state. The production in 1914 decreased about 2% from that of 1913 when 135,833 tons were produced.

New York, by reason of its large output of fibrous talc for paper making, continued to lead all other states with a production of 86,075 tons valued at $821,286. Vermont was second in point of production with 50,698 tons, but Virginia's output of 21,687 tons exceeded it in value, because the Virginia production is principally manufactured soapstone products. The output in New Jersey and Pennsylvania declined to 7732 tons and in North Carolina to 1198 tons. There was a small production in Georgia, Maryland, Massachusetts, Rhode Island and California.

Prices in the United States averaged $5.83 per ton in the rough, but some of it sold as low as $2 per ton; ground talc brought from $5 to $10 per ton; manufactured articles in 1914 averaged $27.98 per ton. Imports of ground or manufactured talc in 1914 amounted to 15,734 tons as against 13,770 tons in 1913. The principal importing countries were: Italy, 5535 tons; Canada, 5006; France, 4398. Smaller quantities were received from Austria-Hungary, England, Germany, and Japan. The imported talc is chiefly of the higher grades, ranging from $5. for the cheapest French talc to $112 for a special shipment from Germany.

Oil Possibilities near Vicksburg, Miss., forms the subject of a recent press bulletin of the U. S. Geological Survey which has made an investigation in Warren and Yazoo counties. The attitude of the rock beds is obscured by the recent deposits in this region and while no anticlines were noted, there are two monoclinal folds that offer favorable areas for the accumulation of oil or gas. A detailed report, with maps, is now in preparation by the Survey.

Details of Practical Mining

Improved Safety Door for Dump

By H. H. Hodgkinson*

The safety door illustrated in the accompanying sketch has proved to be an improvement on the one described in the *Journal* of Dec. 12, 1914, though it is operated in the same manner. As will be seen from the illustration, the advantage lies in the fact that this door, on account of its construction, opens at each end, thus permitting a car to dump in the chute from either direction without the use of a second door or the necessity of unfastening the hemp rope.

By means of the rope *A* the door is opened and closed for cars approaching in that direction, while the rope *B* operates the door for cars from the other direction. Fig. 1 shows the door being opened by rope *A*, Fig. 2 by rope *B*.

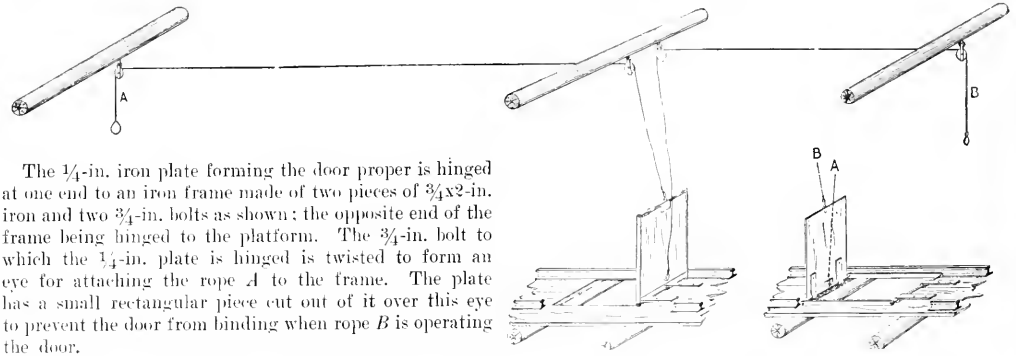


Fig. 1 Fig. 2

FIGS. 1 AND 2. CHUTE DOOR FACILITATING DISCHARGE OF CAR FROM EITHER DIRECTION

The ¼-in. iron plate forming the door proper is hinged at one end to an iron frame made of two pieces of ¾x2-in. iron and two ¾-in. bolts as shown; the opposite end of the frame being hinged to the platform. The ¾-in. bolt to which the ¼-in. plate is hinged is twisted to form an eye for attaching the rope *A* to the frame. The plate has a small rectangular piece cut out of it over this eye to prevent the door from binding when rope *B* is operating the door.

The frame measures 22x36 in. over all, which permits the door to work nicely between the rails of a 2-ft. gage track.

The two hemp ropes *A* and *B* hang down from their respective pulleys about 5 ft. to permit enough slack rope for the door to fall back on the platform when opened from either direction.

*Mining engineer, Franklin Furnace, N. J.

Turbo-Blowers and Turbo-Compressors

Basically considered, turboblowers and turbo-compressors are similar machines, except that the former are used for low pressures and the latter for high pressures. Both classes of machines are therefore constructively different with reference to the number of stages and the delivery volume. Usually the turbo-blowers and compressors of today are built on the principle of the centrifugal pump; that is, the gas to be compressed is conducted in radial paths. Among the few designs that depart from this arrangement is the Parsons, in which the flow direction, as in steam turbines, is axial.

It is difficult to define the boundary between turbo-blowers and turbo-compressors. All turbo machines used to supplant reciprocating blowers should be called turbo-blowers.—*Power.*

Stripping with Dragline Excavators

The Balkan pit of the Verona Mining Co., at Alpha, Mich., is oval in shape. When the stripping is completed its long axis will be about 1200 ft., its greatest width about 700 ft. and the depth will run from 86 ft. to 107 ft.

The machines used are a Bucyrus class-24 dragline excavator with an 85-ft. boom and a 4½-yd. bucket and a Marion model 261 of the same size. Both machines are mounted on skids and rollers. They travel on 4x12-in. planks 12 ft. long, placed 4 wide on each side of the machine. Dragline operation was started in 1914, and is approaching completion at the present time.

The two dragline excavators have been used on opposite sides of the pit, for the most part on different levels. The incline is a continuous spiral, the grade being about 2.6 per cent. with 35-deg. curves and slopes at 2 to 1.

The sharp curves, as well as the heavy grades from the lower levels which have been necessitated by the small diameter of the pit, have rendered it impossible to use standard-gage equipment. Consequently narrow-gage, 4-yd. cars are used. Inasmuch as the large buckets of the draglines could not load cars of such small capacity without a considerable amount of spilling and the consequent danger of derailments, large hoppers are used under which the trains are run. This method has proved most satisfactory. Instead of lining these hoppers with sheet iron, hard maple has been used, as this has been found to offer a better sliding surface for the sticky material encountered.

On the first or top lift, each dragline was served by three trains made up of ten 104-yd. cars each, but at the present time the contractors are using 9 trains and 12 locomotives, three of which are used as pushers on grade out of the pit.

The output of the draglines has been most satisfactory and has compared very favorably with steam-shovel operation on the Mesabi range. The material, however, is ideal for dragline work. The upper portion of it is a quicksand which when drained is easy to dig. Before operations were started, a small creek ran across the pit. The waters of this creek have been diverted, but the bed contains a rather heavy gravel formation. On the northern end of the pit deposits of blue clay, gravel and hard-pan have been found, while gravel and hard-pan exist under the sand at the southern end. The machines are swinging through an arc of about 180 deg. and making a cycle in about 40 sec. The output of the draglines depends of course to a great measure on the car service. The best monthly output for both machines, working two 10-hr. shifts, was 207,184 cu.yd.; the best daily output for both machines working two 10-hr. shifts is 2670 4-yd. cars. The best record for one 10-hr. shift was 800 4-yd. cars, made by the Bucyrus machine.—*The Excavating Engineer,* August, 1915.

Proportion of Fatal Accidents in Metal Mining

In an investigation as to the best means of insuring a diminution in the number of accidents in the mines of Australia, particularly in New South Wales, the 1914 report of the Royal Commission on Mining Industry at Broken Hill states that the fatal accidents in metalliferous mines, in the year 1911, in New South Wales, were 1.81 per thousand of men employed, which was only exceeded in Australia by the number of fatal accidents in Western Australia, which were 2.33 per thousand men employed. Comparing these with the fatal accidents in metalliferous mines in other countries for the years 1909 and 1910, it is stated that only four countries had a larger number of fatal accidents in metalliferous mines per thousand men employed than these noted. These are: France, 3.16; Spain, 3.35; Transvaal, 4.29; and the United States, 4.19.

Oregon and Douglas Fir and Redwood

The term "fir" is applied to the most common wood of the Pacific Northwest. Scientifically it is a bastard spruce, first named by Douglas. Locally it is known as fir or Douglas fir, and distinction is sometimes made between yellow and red fir. These come from the same kind of tree, the yellow fir being most common. The large trees yield yellow fir, while the wood from smaller trees is apt to show a reddish tint. Sun exposure also appears to affect the color to some extent. In California the wood is termed Oregon pine. This wood is strong, and can be obtained in long lengths. Mill run of commercial sizes probably averages over 20 ft. in length. It contains pitch, which forms in seams and pockets, normally occurring even in commercially clear wood within certain limits. The trees usually yield less than 25 per cent. of wood free from sap and knots.

Redwood grows on the Pacific coast from Santa Cruz north into southern Oregon. By reason of the average large diameter of the trees, the logs are cut shorter than in the case of fir, and the commercial mill run averages about 16 ft. in length. The wood is not so strong as fir. About 50 per cent. of the wood cuts up clear and free of sap.—D. C. Henny in *Engineering News,* Aug. 26, 1915.

Keeping Conveyor Belt Records

A new method of recording the cost of various conveyor belts in operation has been worked out by the B. F. Goodrich Co., of Akron, Ohio, in the interest of all belt users.

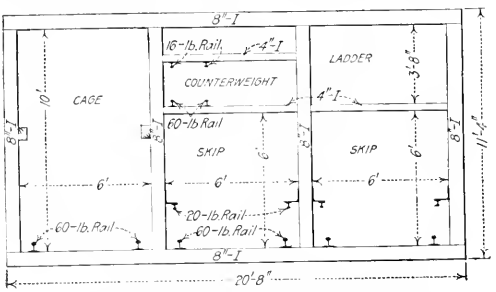
Ordinarily, accurate costs are rather difficult to determine, and many people have not the time to work out an adequate system for making computations. The use of various belts, however, is an important factor, and many a dollar can be saved when it is known where to cut down the tonnage cost.

The card record in question, which is mailed free on application by the Goodrich company, is simple, but most efficient. It will help to stop the small leaks where profit continually slips out.—*Coal Age.*

Sinking New "C" Shaft at the East Norrie Mine

By B. G. Best*

Several years ago the Oliver Iron Mining Co. decided to sink a new shaft on the East Norrie property at Ironwood, Mich. As finally accepted the plans called for a shaft to meet the following requirements: Size, outside timbers, 11 ft. 4 in. by 20 ft. 8 in.; number of compartments, 6; sets, steel, placed 5 ft., center to center; lining,



PLAN OF "C" SHAFT, EAST NORRIE MINE

reinforced-concrete lath; inclination, 64 deg. from the horizontal.

The shaft was located about 250 ft. back of the foot wall in the quartz slates, which dip at an angle of about 64 deg. at this point.

On Dec. 2, 1912, work was started with the following crews: Three gangs of shaftmen—6 miners and 2 helpers—working 8-hr. shifts, 17 shifts per week; 4 fixers, or timbermen, working 10 hr. day-shift only; 4 landers—2 on each 12-hr. shift; 2 hoisting engineers; such men as were necessary from time to time making concrete lath.

The miners drilled, blasted, mucked, placed the steel sets, lath and bearers, cut hitches for the bearers and cut and timbered the stations. The timbermen took down the

*Care of Oliver Iron Mining Co., Ironwood, Mich.

concrete-lined steel, drilled bolt holes in rails and back runners and placed them and assisted the miners in placing the sets.

The rock was hoisted through the middle compartment on a 1-ton sinking bucket on a trolley. The timber and rails were lowered on a truck in the cage compartment. The smoke was drawn out of the shaft through a 10-in. galvanized-iron pipe by an exhaust fan on the surface.

The drilling equipment included 12 jackhamer machines and 12 sets of 72-in. by 7/8-in. diam., 4-point drills. Six of these machines were used in the shaft at one time, while the remaining six were being overhauled. The repairs on the machines were light, however, and during the greater part of the time the six reserve machines were ready for instant use. There were also four No. 3 Ingersoll-Rand machines used for cutting hitches and bearers.

The ideal cut consisted of fifty 6-ft. holes, but at times it was necessary to drill as many as 58 holes. The average time required to drill a round of holes under an air pressure of 65 lb. was 3 hr. At times, however, this work has been accomplished in 2½ hr. This is at an average rate of 16⅔ ft. per machine per hour, and a maximum rate of 20 ft. per machine per hour. A cut broke five linear feet of ground, or 1171 cu.ft. Thus, in 1 hr. one machine, under average conditions, drilled holes to break 64.9 cu.ft. of ground, and under the most favorable conditions 77.6 cu.ft.

The charge per hole was five or six sticks of 80 per cent. 7/8x8-in. Giant gelatin dynamite, or about 1¼ boxes per cut. Firing was done by battery. The first fired were the sink holes in the center of the foot-side of the shaft; after these the holes adjacent to the outer edge of the sink were fired. From four to six blasts were necessary to break the entire cut. Under average conditions 20 min. was required to charge and fire the holes for each blast and 20 min. for the smoke to clear out. By this method after the sink holes had been fired there were always two free faces, and the rock was thrown up against the foot-side of the shaft, making the mucking a great deal easier. The mucking of the dirt from a full cut required about 8 hr.

In sinking the shaft, 14 sets of bearers—four 12-in. by 17-ft. I-beams and two 12-in. by 35-ft. I-beams per set—were placed. The time required to drill hitches and place a set of bearers was 4½ eight-hour shifts.

Five stations, 10x22x17 ft., were also cut and timbered. Jackhamers were used on this work. A station was cut and timbered in 14½ eight-hour shifts, or at the rate of 35.7 cu.ft. per shift.

On Dec. 2, 1913, at a depth of 843 ft., the shaft met a 5x7-ft. raise from the 17th level—1213 ft. below the collar of the shaft. In 12 months the shaft had been sunk 803 ft. through quartz, slates and hard dike. During this time the miners and helpers had worked 5821 shifts in sinking and timbering the shaft, and had removed 188,063 cu.ft. of rock. This is at the rate of 32.3 cu.ft. of rock per man per shift of eight hours, and 13.1 cu.ft. per machine per shift. The average sinking speed per week, based on actual working time, was 18.8 lin.ft. In 713 shifts the men had placed 10 sets of bearers and cut and timbered three sections.

Stripping was commenced immediately and continued to a depth of 1198 ft., 15 ft. above the 17th level. The three crews of shaft men did the stripping, using jackhamers and No. 3 drills. Because of the inability to handle the rock on the 17th level, the stripping was delayed to some extent; but in spite of this the average weekly progress (actual working time) was 34.17 lin.ft., or 5.7 ft. per drill per week. Including lost time, time required for cutting hitches, placing bearers, cutting and timbering stations, the average speed was 25 lin.ft. per week.

The greatest progress for one month was made in March, 1913, when the shaft was sunk 105 ft. and one set of bearers placed. The men worked 589 shifts sinking and timbering, and 32 shifts placing bearers. This is at the rate of 24.2 lin.ft. per week; 5680 cu.ft. per week; 1.426 lin.ft. per gang per shift; 9.47 cu.ft. per drill per week; 41.75 cu.ft. per man per 8-hr. shift; and 55.7 cu.ft. per drill per 8-hr. shift.

The accompanying table shows the number of shifts worked on the different parts of this job, and also the average progress for the different operations:

Month	Sinking	Bearers	Stations	Stripping
December, 1912	244.0	.....	.....	.....
January, 1913	515.0	37.50	.....	.....
February	519.0	32.00	.....	.....
March	589.0	32.00	.....	.....
April	530.5	72.00	.....	.....
May	476.0	.....	165.00	.....
June	490.0	70.50	.....	.....
July	537.5	.....	79.00	.....
August	586.0	25.00	.....	.....
September	449.0	41.00	96.00	.....
October	577.0	25.00	.....	.....
November	522.5	44.00	.....	.....
December	30.0	43.25	130.25	334.00
January, 1914	.....	72.00	75.00	473.00
February	.....	29.75	.....	517.75
March	.....	.....	.....	88.00
Total number of shifts	5821.5	524.00	539.25	1,412.75
Linear feet	803	.....	.....	355
Cubic feet	188,063	.....	19,250	83,141
Lin.ft. per gang per wk.	18.8	.....	.....	.....
Lin.ft. per gang per shift	1.1	.....	.....	2.01
Cu.ft. per man per shift	32.3	.....	35.7	58.8
Cu.ft. per machine per shift	43.1	.....	.....	78.6

The first month there was 40 ft. of overburden. This is not included in calculating rate of progress; the figures represent rock work only.

Engineer's Emergency Level

Every engine room has the means at hand for the construction of the convenient and accurate level described herewith. It is so simple to make as to appeal to anyone (*Power*, Aug. 31, 1915).

It consists of a regular gage-glass, nearly filled with water, and with its ends plugged with putty or other suitable material of a cementing nature. The bubble can

LEVEL MADE FROM GAGE GLASS

be made as long as desired, depending on the work for which the level is to be used; and as the glass is straight the bubble will go the whole length of the glass if slightly elevated. The glass being round and usually reasonably straight, it can be turned over without affecting the location of the bubble or the accuracy of the level. Any suitable mark can be used at the middle to indicate when the instrument is level. This is not intended to supplant the regular level, but to serve in an emergency or to go into limited spaces.

The Assayer and Chemist

Analysis of Spelter

Methods of spelter analysis are the subject of a report from a subcommittee, which has been approved by the Supervisory Committee of the American Chemical Society on Standard Methods of Analysis.

Spelter ordinarily used for brass and similar alloys is usually considered in three grades: (a) "High-grade"; (b) "intermediate"; and (c) "brass-special," according to the amounts of lead and other impurities present. A fourth grade (d) "prime-western," principally used for galvanizing, contains more impurities than the three grades preceding. These grades are covered by the specifications of the American Society for Testing Materials.

The methods of sampling and analysis described below are those generally accepted in the United States for standard analysis in all the larger laboratories of both producers and consumers of zinc and zinc products. The methods of analysis are those originally proposed by Elliott and Storer and Price, whose work has been checked and elaborated by the members of the committee.

Sampling Slabs

Select 10 slabs at random from a carload, and saw each slab completely across from the middle of one long side to the midde of the other, and use the sawdust as the sample; or drill three 9-mm. holes along one diagonal of each slab, boring completely through and taking care to make fine drillings; the holes should be drilled as nearly as possible at the middle and half way between either end and the middle of such diagonals. Go over the drillings or sawings with a powerful magnet to take out any iron which may have come from the drill or saw, and mix the sample thoroughly. The drill or saw must be thoroughly cleaned before use, and no lubricant shall be used in either drilling or sawing.

Methods of Analysis

Lead—The committee considers the electrolytic and "lead-acid" methods described to be of equal merit, so far as accuracy is concerned, but where laboratories are equipped for electrolysis the electrolytic method is preferred as a time-saver.

Lead by Electrolytic Method—Place 8.643 grams of the sample[1] in a 400-c.c. beaker and add sufficient water to cover the sample. Then add gradually and cautiously 30 c.c. of concentrated nitric acid (sp.gr. 1.42); when the action is complete boil the solution for a few minutes to expel nitrous fumes. Wash the watch glass and sides of the beaker, and transfer the solution to a 200-c.c. electrolytic beaker. Dilute to 125 c.c. and electrolyze with a current of 5 amp. The time required for the electrolysis is from one-half to three-quarters of an hour, depending upon the amount of lead present in the sample. Test the solutions for complete precipitation of lead by washing the watch glasses and sides of the beaker, so that the depth of the solution is increased about 12 mm. Then continue the current for 15 min., and if the newly exposed surface is still bright, the lead is completely deposited. Wash the anode three or four times with distilled water, once with alcohol, and then dry in an oven or on a hot plate, at 210 deg. C. for half an hour, and weigh.

The weight of the PbO_2 in milligrams, divided by 100, will give the percentage of lead. The PbO_2 deposit can be readily removed by covering the anode with dilute nitric acid and inserting a rod of copper.

The electrodes are cylinders of platinum gauze with 400 meshes per sq.cm. The anodes are 30 mm. in diameter by 30 mm. high, with a stem 105 mm. long of No. 16 B. & S. gage wire (1.29 mm.), making the total height 137 mm. The cathodes are 12 mm. in diameter by 30 mm. high, with a stem 105 mm. long of No. 16 B. & S. gage wire, making the total height 137 mm.

Lead by "Lead-Acid" Method[2]—Place in a 350-c.c. beaker 25, 15, 10, or 5 grams of the drillings or sawings, according to whether the spelter is of grade (a), (b), (c), or (d) respectively, and add, according to the size of the sample taken, 300, 180, 120, or 60 c.c. of "lead acid" (prepared as indicated in footnote). After all but about 1 gram of the zinc is dissolved, filter on a close filter and wash out the beaker a couple of times with "lead acid" from a wash bottle. Wash the undissolved matter from the filter into the original beaker with water, and dissolve with a small amount of hot 1:1 nitric acid. Add 40 c.c. of "lead acid" and evaporate until strong fumes of sulphuric acid escape. When cool, add 35 c.c. of water (which is the quantity of water evaporated from the "lead acid"), and heat to boiling. Add the first filtrate (containing the greater part of the zinc, and possibly a small amount of lead sulphate), stir well, and allow to stand for at least five hours, preferably over night. Filter on a Gooch crucible, wash with "lead acid," then with a mixture of equal parts of alcohol and water, and finally with alcohol alone. Set the Gooch crucible inside a porcelain crucible in order to avoid reduction of lead by flame gases and mechanical disintegration of the asbestos mat. Ignite for five minutes at the full heat of a Tirrell burner. Cool and weigh as $PbSO_4$.

Iron—Place 25 grams of zinc in a tall 700-c.c. beaker and dissolve cautiously in 125 c.c. of nitric acid (sp.gr. 1.42). Boil, dilute to about 300 c.c., add 10 grams of ammonium chloride, and then ammonia until the precipitated zinc hydroxide has redissolved. Boil, let settle, and filter on an 11-cm. S. & S. "Black Ribbon" or similar filter paper. Wash with dilute ammonia and with hot water. Dissolve the precipitated ferric hydroxide with

[1] The empirical factor weight (8.643) is used instead of the theoretical one (8.66), as the dried dioxide is liable to contain some adherent and included water, expelled with difficulty.

[2] "Lead acid" is a solution of one volume of sulphuric acid in seven volumes of water, saturated with lead sulphate. It is prepared as follows: 300 c.c. of sulphuric acid (sp.gr. 1.84) is poured into 1800 c.c. of water; 1 gram of lead acetate is dissolved in 300 c.c. of water and is added to the hot solution with stirring. The solution is allowed to settle for several days, and is siphoned off through a thick asbestos filter for use. When "lead acid" is used it is unnecessary to consider the solubility of the lead sulphate, since the solution is always brought back to the same volume as the volume of "lead acid" originally added; consequently, when the lead sulphate is filtered, no more lead remains in the filtrate than was originally added in the "lead acid."

hot 1:1 sulphuric acid, add 40 c.c. of 1:1 sulphuric acid, pass through a Jones reductor,[3] wash first with 150 c.c. of dilute sulphuric acid, and then with 100 c.c. of water and titrate with potassium permanganate. The potassium-permanganate solution contains approximately 0.2 gram of the crystals per liter. One cubic centimeter of permanganate solution will equal about 0.000334 gram of iron. Run a blank with the same amounts of acid and water, and correct accordingly.

Standardize the potassium permanganate against sodium oxalate. Weigh duplicate samples of sodium oxalate, 0.0200 gram each, an amount which may require between 49 and 50 c.c. of the permanganate solution. To convert sodium oxalate to iron, use the factor 0.833.

Cadmium—Place 25 grams or drillings in a tall 500-c.c. beaker; add 250 c.c. of water and 55 c.c. of concentrated hydrochloric acid, and stir. When the action has almost ceased, add more acid with stirring, using about 2 c.c. at a time, allowing it to stand after each addition of acid, until finally all but about 2 grams of the zinc has been dissolved. About 60 c.c. of acid in all are usually required; it is best to allow the first 55 c.c. of acid to act over night. Filter, first transferring one of the undissolved pieces of zinc to the filter, and wash a couple of times with water. Discard the filtrate. Wash the undissolved matter on the filter paper into the 500 c.c. beaker, cover and dissolve in nitric acid. Transfer to a casserole, add 20 c.c. of 1:1 sulphuric acid, and evaporate until fumes appear; take up with about 100 c.c. of water, boil, cool, and let settle for several hours (best over night). Filter off the lead sulphate on paper, wash with water, retain the filtrate, and discard the lead sulphate. Dilute the filtrate to 400 c.c., add about 10 grams of ammonium chloride, and pass hydrogen sulphide for one hour. It is occasionally necessary to start the precipitation of the cadmium sulphide by the addition of a drop or two of ammonia to the dilute solution. Allow to stand until the precipitate has settled, and then filter off the impure cadmium sulphide in a loose-bottomed Gooch crucible; remove the cadmium sulphide by carefully punching out the bottom into a tall 200-c.c. beaker. Wipe off any cadmium sulphide remaining on the sides of the crucible, using a little asbestos pulp, add 60 c.c. of 1:5 sulphuric acid, and boil for one-half hour. In case of spelters carrying large amounts of cadmium it may be necessary to add more acid. The dilute acid dissolves cadmium and zinc sulphides, but not lead sulphide. Filter and dilute to 200 c.c., add about 5 grams of ammonium chloride, and precipitate with hydrogen sulphide again in order to get rid of traces of zinc. In case a large amount of cadmium is present, a third precipitation may be necessary. After the final precipitation, let settle, filter, and transfer to a weighed platinum dish, cover, and dissolve in 1:3 hydrochloric acid. Also dissolve the sulphide remaining on the filter paper in hot 1:3 hydrochloric acid, and add it to the solution in the platinum dish. Add a little sulphuric acid, and evaporate the solution until copious fumes escape. Dilute with water, add a few centimeters of concentrated nitric acid to oxidize any filter paper shreds, and again evaporate the solution until fumes of sulphuric acid come off freely. Remove the excess of sulphuric acid by heating the dish cautiously and finally heat to between 500 and 600 deg. C. or to dull redness, and weigh the cadmium as sulphate.

Alternate Method for Cadmium—Proceed as above until the cadmium sulphide has been dissolved in hydrochloric acid. Oxidize with nitric acid, and filter from sulphur. Transfer the solution to a 200-c.c. electrolytic beaker, add a drop or two of phenolphthalein, and then pure sodium- or potassium-hydroxide solution until a permanent red color is obtained. Add a strong solution of pure potassium cyanide with constant stirring until the precipitate of cadmium hydroxide is completely dissolved. Avoid using an excess of the potassium cyanide. Dilute the solution to 150 c.c., and electrolyze with a current of 5 amp., using gauze electrodes of the same size as in the lead determination. The time required is from 1 to 2 hr. The solution should always be tested for cadmium as follows: Raise the liquid in the beaker, and then note after 20 min. the newly exposed surface of the electrode. If it is still bright, the cadmium is completely deposited. Next wash the electrodes with distilled water, and then with alcohol. Dry at 100 deg. C., cool, and weigh. The increase is metallic cadmium.

[3] If, before passing the solution through the reductor, a large amount of lead sulphate is present, it is well to filter it off so as to prevent it from clogging the reductor.

Methyl Red as an Indicator

Methyl red gives a sharper end-point than methyl orange when the two indicators are tested in water with acid or alkali, according to R. T. Thomson (*Analyst*, 1914, p. 518; abstr. *Journ. Soc. Chem. Ind.*), and its sensitiveness, unlike that of methyl orange, is not greatly affected by the presence of neutral salts, such as sodium chloride or sulphate. When methyl red is used as the indicator in the titration of carbonates with acids, the solution must be boiled after each addition of the acid in order to expel free carbon dioxide.

Acid-Proof Table Finish

The following formula for an acid-proof table finish is published by the Bureau of Chemistry of the Department of Agriculture, according to the *Chemist-Analyst:*

Solution A—125 grams of copper sulphate and 125 grams of potassium chlorate are dissolved and diluted to 1000 c.c.

Solution B—60 grams of aniline hydrochloride and 90 cc. of hydrochloric acid, sp.gr. 1.20, are dissolved and diluted to 500 c.c.

Paint the wood first with "A," and as soon as it dries sufficiently, apply a coating of "B," and let dry for several hours. Wash with hot water and repeat operation, until the color is a dark green. Finish by rubbing with raw linseed oil until a jet-black surface is secured.

To Bore Holes in Rubber Corks

The following kink is from the *Chemist-Analyst:* Wet the cork and borer with water before starting and occasionally during the operation. This reduces the friction and makes the cutting easy and smooth. The core will come out in one piece. Corks should be bored from the little end toward the large end. This makes the glass tubing fit tightly, as the hole where started is always bigger than where it ends, and when put in a bottle the neck of the bottle incloses the smaller end of the cork and hence tends to close the hole.

National Exposition of Chemical Industries

When America's first National Exposition of Chemical Industries opens at the Grand Central Palace, New York City, on Monday, Sept. 20, it will mark an epoch in the history of the industries dependent on chemistry, and cannot fail to be far-reaching in its results. It will bring into closer contact than ever before the manufacturers, financiers, dealers and consumers. Elaborate exhibits are arranged, many of them working units, giving visitors the opportunity of seeing for the first time the processes or apparatus at work.

It is expected that President Wilson will be present and participate in the opening of the exposition, an invitation from the advisory committee, composed of well-known chemists and chemical engineers, having been sent to him. The committee is as follows: Raymond F. Bacon, Charles H. Herty, Henry B. Faber, A. D. Little, R. P. Perry, William Cooper Procter, E. F. Roeber, G. D. Rosengarten, T. B. Wagner and Utley Wedge.

Among the institutions which have coöperated to make this exposition a success are the American Chemical Society, the American Electrochemical Society, the American Institute of Mining Engineers, the American Institute of Electrical Engineers, the American Pulp and Paper Association's Technical Section and the Bureau of Commercial Economics.

Program of the Exposition

The program of the exposition will be as follows: Monday, Sept. 20, opening day.

Tuesday, Sept. 21—R. P. Pierce (Barber Asphalt Co.), "Work with the Ultra Microscope"; Howard H. Gross (President Tariff Commission League) will lead a discussion on the tariff question, in which other members of the league will participate; R. S. Frinck (President Frinck Pyrometer Co.), "The Relation of Chemistry and Mechanical Manipulation to the Evolution of the Glass Industry"; Harrington Emerson (The Emerson Co.), "Efficiency," and a meeting of the New York Section of the American Electrochemical Society will also be held.

Wednesday, Sept. 22—Thomas H. Norton (U. S. Department of Commerce), "Foreign Markets for American Chemicals"; F. W. Keough (President American Exporters Association), "Transportation and Shipping Facilities with Foreign Countries"; I. F. Stone (President National Aniline and Chemical Co.), "The Aniline-Dye Situation"; J. L. Lightner (Hershey Chocolate Co.), "The Manufacture of Chocolate."

Thursday, Sept. 23—J. L. Taylor (United States Bureau of Mines), "Explosives"; H. A. Huston (German Kali Co.), "Potash"; Linn Bradley (The Research Corporation), "Solution of Smoke, Dust and Fume Nuisances by Electrical Precipitation"; Percy Wilson (Secretary Association of American Portland Cement Manufacturers), "The History of Cement," followed by a meeting of the American Paper and Pulp Association.

Friday, Sept. 24—S. P. Sadtler (S. P. Sadtler & Sons), "American Contributions to Industrial Chemistry"; W. D. Coolidge (General Electric Co.), "The X-Ray"; L. H. Backeland, "Chemical Industry," followed by a joint meeting of the New York Section of the American Chemical Society and the American Institute of Chemical Engineers.

Saturday, Sept. 25—John Barrett (Director Pan-American Union), "South American Opportunities"; George Frank Lord (du Pont de Nemours Powder Co.), "Farming with Dynamite"; C. B. Heckel (New Jersey Zinc Co.), "Zinc"; besides many other important papers and addresses.

Many Moving Pictures Arranged For

A partial list of films to be shown during the exposition is as follows:

Waterman Fountain Pen Co., "Hard-Rubber Manufacturing"; National Lead Co., "Manufacturing Uses of White Lead"; Lipton Tea Co., "Tea Industry in Ceylon"; National Tube Co., "From Ore to National Pipe"; Henry Disston & Sons, "Making of Saws"; Rogers, Brown & Co., "Steel Industry"; People's Natural Gas Co., "Boring and Piping Gas"; Hershey Chocolate Co., "Chocolate Industry"; Barrett Manufacturing Co., "Tarvia"; Barber Asphalt Co., "Asphalt from Lake Trinidad to Street"; American Cyanamid Co., "Fertilizer from Air"; German Kali Works, "Mining of Potash"; Association of American Portland Cement Manufacturers, "Uses of Cement on the Farm"; General Roofing Co., "Roofs from Rags"; Follansbee Bros., "Tin Industry"; Cheney Silk Co., "Silk Industry"; National Association of Manufacturers, "Crime of Carelessness," "The Man He Might Have Been," "The Workman's Lesson," "An American in the Making"; Printz Biederman Co., "Wool to Clothing"; City of Baltimore, "Sewage Disposal and Filtration"; Ed. Pinaud (Klotz & Co.), "Perfumery"; United Shoe Machinery Co., "Tanning Hides to Shoes"; Rice & Adams, "Cow to Consumer"; Reed & Barton, "Making Silver"; Larkin Co., "Soap"; Sherwin-Williams, "Paint"; Westinghouse Electric Co., "Electricity in a Home"; Universal Portland Cement, "Application of Cement"; The Research Corp., "Consuming Smoke"; Frasche Estate, "Sulphur Mining (Louisiana)"; H. K. Mulford Co., "Hog Cholera," "Nitro-Germ"; General Electric Co., "Electricity in the Mine," "Electricity on the Farm," "The X-Ray," "Electric Lighting," "Motor Application," "Electric Power Transmission"; Bureau of Mines, "Mine Explosion and Rescue," "Safe Method of Bituminous Coal Mining," "Zinc Mining, Milling and Smelting," "Copper Mining, Milling and Smelting"; Starrett Mfg. Co., "Manufacturing of Files"; District of Columbia Paper Mill, "Manufacture of Paper."

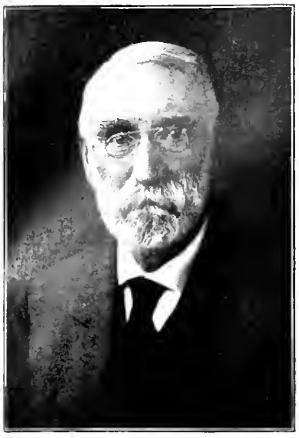
The motion picture program given above has been arranged for the Exposition by the Bureau of Commercial Economics at Washington.

Many of the exhibitors will also have speakers in the auditorium, who will lecture and display by motion and slide pictures the work of their respective companies.

Under the auspices of the Bureau of Foreign and Domestic Commerce, about eight bureaus in the Departments of Commerce, Interior and Agriculture are now arranging noteworthy and instructive exhibits, each of which will be typical and demonstrative of the work of that bureau.

Rutile Exports from Norway in 1913 were 50,730 kg.; in 1914 they were about 50,000 kg., according to a recent consular report. The exports are all to European countries. In 1915 the production is believed to have decreased, as Norwegian firms have been trying to buy rutile in the United States to fill their orders. The demand has increased owing to the use of titanium carbide in electric lamps.

International Engineering Meeting



DR. JAMES DOUGLAS

CHARLES W. MERRILL

E. P. MATHEWSON

Dr. Douglas will receive the John Fritz Medal at the International Engineering Congress on Sept. 20, 1915. Mr. Merrill edited the symposium on gold and silver, while E. P. Mathewson edited that on copper metallurgy

Photograph by Underwood & Underwood, New York City

EASTERN FACADE, PALACE OF MINES, PANAMA-PACIFIC EXPOSITION

Added interest is given the mining and metallurgical exhibits by the meetings of the International Engineering Congress and various technical societies in San Francisco

Lake Superior Iron Conditions

EDITORIAL CORRESPONDENCE

Ore is moving out of the Lake Superior district at a rapid rate at the present time and it is certain that there will not be any let up until navigation comes to a close when the cold weather sets in. All of the lake fleet are now in active operation and it is believed that the total shipments from the district for the season will reach close to 45,000,000 tons. The Oliver Iron Mining Co., the mining branch of the Steel Corporation, will move about 20,000,000 tons, very nearly the amount that was shipped in 1913, the banner year in the ore business. Some of the independents are not doing so well, but a few of the properties that have not shipped a pound of ore all year may still be able to send out some of their product, as the ore-buying movement has not stopped as yet. Most of the railroads that handle iron ore from the mines to the docks are working all of their equipment, and most of them have handled more ore to date this year than they did during the corresponding period of 1914. The Lake Superior & Ishpeming, which handles most of the ore from the Marquette range, is using every car it possesses and the management wishes that it had the 500 steel cars which were ordered in the spring and which have not been delivered. One day last week a new loading record was made at the Lake Superior & Ishpeming dock at Marquette, when eight ore carriers were loaded and discharged during 20 hr. All of these boats were taken care of at the new steel-concrete dock of the company, which was constructed two years ago.

STOCKPILES MOVING WELL

In spite of the fact that ore is being moved at a lively rate, the mines are not working so strong as they might. This is because of the large stocks at the mines, which must be moved before the operators can take chances on loading up again. Some of the ore that is going down the lakes this year has been in stock for years. In fact, vegetation was growing on the piles of some that is going out and it had the appearance of waste rather than ore. The Cleveland-Cliffs Iron Co. alone had about 3,000,000 tons of ore in stock on the Marquette range in the spring, but over two-thirds of this will be gone by the time winter sets in. Although some of the mines are working with small forces, others are working to capacity in order to keep up with their contracts. The Breitung interests changed their working hours at their Negaunee mines this week, putting on three shifts instead of two, in order to increase the output. This company had considerable ore in stock a few months ago, but the management has stated that there will not be a ton in stock when the boats stop.

As stated previously, it is believed that there will still be some buying this year, as the furnace men are advancing the price of pig iron, which usually means that iron ore will command a higher price in the market, and many of the consumers may want to make a few more contracts before the prices are raised. It is also thought that the vessel rate in 1916 will be higher than it is at the present time, which may lead some to take advantage of the present carrying rates. Some of the operators are rather skeptical about the ore business, as they do not know what is going to happen to the iron and steel markets when the war is over. Others believe that the revival of business that will result in this country will more than compensate for the falling off of war orders. However, the outlook is far from gloomy, and the coming winter should see considerable activity. When the ore piles are shipped the operators are always willing to take a chance on stocking, and they will be more than willing to take risks this winter, with the prospect that prices will be higher in 1916.

Little development work has been carried on in the district this summer, only a few of the companies having diamond drills in operation. There is still some drilling being done on the Cuyuna range, and a few drills are in operation on the Mesabi. The Cleveland-Cliffs Iron Co. has stopped most of the drills that it had working a few miles to the west of Ishpeming, and the conclusion is that ore in commercial quantities was not encountered. This company has a drill working in the City of Negaunee, and it is now down about 2400 ft., but no results are obtainable. A hole was put down a short distance from this one to a depth of about 3000 ft. Luther Brewer and associates have discontinued their drilling on the eastern extension of the Gogebic range, without finding ore. Several hundred feet of formation was found in some of the holes, but the ore was not present. However, it is believed that another campaign will be mapped out in the near future. A little drilling is being done on the Menominee range; but not many drills are working compared with the number that was employed a few years ago.

TAXATION SYSTEM STOPS DEVELOPMENT

Since the Michigan State Tax Commission made its revaluation of all of the iron properties in the state, placing the mines on the assessment rolls at much higher figures than before, the companies have been very backward about looking for new deposits except when they are actually in need of the ore. They do not care about proving up orebodies and paying heavily in taxes unless the product can be disposed of. It is certain that the actions of the commission has greatly retarded new work in the state. Some of the companies have lands which they believe contain bodies of iron ore, but they are not going to start development work until they know that there is a demand for the ore. With an advance in prices and an increased demand it is quite likely that development work will be given a decided impetus.

With the higher taxes and the low price of iron ore the operators have had to economize in every possible way in order to make both ends meet; and some of them have had a difficult time getting a fair return on their investment. Some of the managements have been able to make substantial reductions in their costs by the use of new drill machines, lower-grade powders, electric power, etc. Electric power is becoming very popular on the Marquette and Menominee ranges and more of it is being utilized all the time. The Peninsular Power, which has a large power plant on the Menominee River, has recently closed a contract with the M. A. Hanna Co. to supply its Carpenter and Ravenna mines at Crystal Falls with current. A pole line is also to be extended to the Alpha district to supply the mines in that vicinity. A new 2400-hp. generator is to be installed in the company's steam auxiliary station at Iron River, a contract having recently been awarded to the Westinghouse Electric Co. to make the installation. The Oliver Iron Mining Co. and the Penn Iron Mining Co., on the Menominee range, and the Cleveland-Cliffs Iron Co. on the Marquette range, now have their own power plants. The last named company is not developing

enough current for its needs and is now planning to add another plant on another stream.

Among the mines that have entered the shipping list this year are the Wakefield and Palms-Anvil, on the Gogebic, the Isabella, on the Marquette, and the Carpenter and Balkan, on the Menominee. The Isabella shipped its first cargo of ore on Aug. 14. This property is owned by the Cascade Mining Co., of which O. B. Warren, of Hibbing, Minn., is president. Many of the officials of the company were on hand when the first train left the property, and the miners were given a half holiday with a picnic in a nearby grove. The first ore was taken from the Balkan pit this week by the contractors who are doing the stripping. The ore is taken out in the dump cars, which are run onto a trestle and dumped into the railway cars. Only a small tonnage will be taken out in this way, although it was thought at first that about 200,000 tons would be so mined this year. The Wakefield is the largest of the new mines to start shipping, and will mine about 800,000 tons this year, contracts having been closed for that tonnage. The Palms-Anvil has about 15,000,000 tons blocked out at present and will be a heavy shipper when the ore is required. The Carpenter is working with a full force and will ship steadily all season.

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International Engineering Congress

A general notice of the meeting of the International Engineering Congress was given in the *Journal* of Sept. 4, 1915. Fuller details are now available. The general sessions of the congress are to be held in the Auditorium Building. The opening session will be held Monday, Sept. 20, at 10 a.m., at which an address of welcome will be made by the mayor of San Francisco. General Goethals, honorary president of the congress, will then address the convention, and the John Fritz medal will be presented to Dr. James Douglas, past president and honorary member of the American Institute of Mining Engineers.

Papers will be presented by eminent engineers from all over the world at the following sectional and parallel sessions: Waterways; irrigation; municipal engineering; railway engineering; materials of engineering construction; mechanical engineering; electrical engineering; mining engineering; metallurgy, naval architecture and marine engineering and miscellaneous. The programs of the mining and metallurgical sections are as follows:

Mining Engineering

Tuesday, Sept. 21, 10 a.m.—"Economic and Social Influence of Mining," W. H. Shockley; "Valuation of Metal Mines and Prospects," T. A. Rickard; "The Valuation of Oil Lands and Properties," M. E. Lombardi; "Valuation of Anthracite Mines," R. V. Norris; "Valuation of Coal Lands," Samuel A. Taylor; "Evaluating Coal Properties in Western Canada," R. W. Cockburn; "Status of Coal Mines in France," E. Gruner; "Workmen's Compensation and Mine Safety," H. M. Wilson.

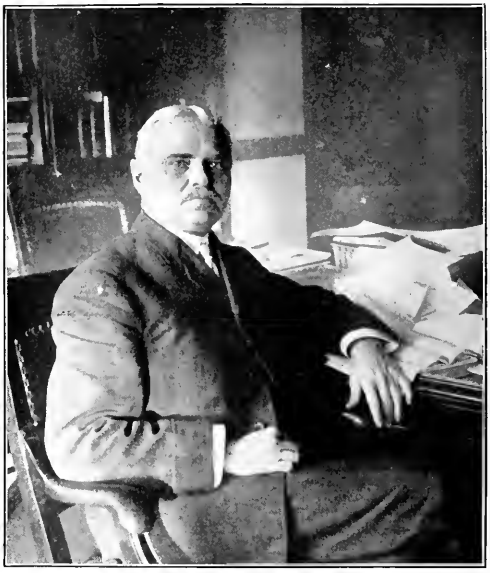
Wednesday, Sept. 22, 10 a.m.—"Functions and Work of Exploration and Development Companies," H. W. Turner; "European Mining Finance," J. L. Gallard; "The Financing of Mines in the United States," Lucius W. Mayer.

Thursday, Sept. 23, 10 a.m.—"Organization and Staff of Mining Companies," W. H. Shockley, also R. E. Cranston; "Relation of Governments to Mining," Horace V. Winchell; "Mine Inspection," J. W. Paul.

Metallurgy

Tuesday, Sept. 21, 2 p.m.—Symposium on Iron and Steel, edited by Henry M. Howe: "Iron and Steel Castings," John Howe Hall; "Metallography and the Hardening of Steel," Albert Sauveur; "Case-Hardening of Steel," F. Giolitti; "The Duplex Process of Steel Manufacture," F. F. Lines; "Methods of Preventing Piping in Steel Ingots," Emil Gathmann; "Steel Alloys," George L. Norris; "Electro-Metallurgy," E. F. Roeber.

Thursday, Sept. 23, 10 a.m.—Symposium on Copper, edited by E. P. Mathewson: "Process in Copper Metallurgy," Thomas T. Read; "Advances in Copper Smelting," Frederick Laist; "Metallurgy of Copper in Japan," R. Kondo; "Copper Metallurgy of the Southwest," Dr. James Douglas; "Reduction Works—Copper Queen Consolidated Mining Co., Douglas, Ariz.," Forest Rutherford; "Advances Made in the Metallurgy of Copper, Globe District, Arizona," L. O. Howard; "Improvements in Design and Construction of Modern Copper Plants," Charles H. Repath.



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MAJ.-GEN. G. W. GOETHALS, U. S. A.

General Goethals is honorary president of the International Engineering Congress

Thursday, Sept. 23, 2 p.m.—Symposium on Copper (Continued): "Leaching Copper Ores," W. L. Austin; "The Metallography of Copper," William Campbell; "Boronized Cast Copper," Dr. E. Weintraub; "Electrolytic Refined Copper," A. C. Clark; "The Development of Electrolytic Copper Refining," Lawrence Addicks; "Physical Properties of Copper," Carle R. Hayward; "Metallography and Technology of Nonferrous Alloys," William Campbell.

Friday, Sept. 24, 10 a.m.—Symposium on Gold and Silver, edited by C. W. Merrill: "Coarse Crushing Plant;

1000 Tons Capacity," G. O. Bradley; "Crushing and Grinding," L. D. Mills, also M. H. Kuryla; "Solution of Gold and Silver, Including Classification," M. H. Kuryla; "Filtration or Separation of Metal-Bearing Solution from Slime Residue," L. D. Mills; "Precipitation," G. H. Clevenger.

Friday, Sept. 24, 2 p.m.—Symposium on the Metallurgy of Zinc, edited by Walter Renton Ingalls: "Some Main Points in the Economics of the Metallurgy of Zinc," Walter Renton Ingalls; "The Development of Zinc Smelting in the United States," George C. Stone; "The Smelting and Refining of Lead," Dr. H. O. Hofman.

Symposium on the Utilization of Fuels in Metallurgy, edited by C. H. Fulton: "Pulverized Coal in Reverberatory Furnaces," D. H. Browne; "Burning Pulverized Coal in Copper Reverberatories," E. P. Mathewson; "Gas Producer Development," Z. C. Kline; "Surface Combustion (What Is It?)," C. E. Lucke; "Ore Dressing," Robert H. Richards.

State Assistance to the Mining Industry in Australia

Recognizing the great public value of mineral discoveries, and knowing that it was the discovery of gold in large quantities which attracted population to Australia and laid the foundation of its nationhood, the state governments are prepared to assist in various ways all attempts made to discover and open up new mineral areas.

In New South Wales up to the end of 1913 the total sum distributed for the purpose of assisting prospectors amounted to £443,661. During one year £10,302 was advanced and £15,169 was paid by the government of that state as subsidy to the Miners' Accident Relief Fund. In Victoria, under the Mining Development and Surplus Revenue Acts, £417,257 was expended from revenue and £200,000 was provided out of votes during the period 1897 to 1913. In Queensland state assistance to mining during 1913 amounted to £21,698. This was spent in deep sinking, grants in aid of prospecting, construction of roads and bridges to mineral fields, and advances under the Mining Machinery Advances Act.

In South Australia aid is given to the mining industry under the terms of the Mining Act of 1898. Up to 1913 £58,309 had been distributed, a portion of which had been repaid to the government. The government also has a number of batteries at work in the state. In Western Australia advances are made by the government in aid of mining work and equipment of mines, erection of crushing plants, in aid of boring and providing transport. Over £1,200 was expended in one year on water supply, roads, cartage and subsidies for development below the 100-ft. level in small mines. In this state there have been 40 state-owned batteries or reduction plants in operation, the total cost of these being £332,378. Last year the receipts amounted to £47,981 and the working expenditure £55,362. These state-controlled plants have recovered gold and tin to the value of £4,189,955, resulting from the treatment of 960,989 tons of gold ore and 64,920 tons of tin ore.

In Tasmania state aid is also given under the Aids to Mining Act, and in one year £9,847 was expended in prospecting and development work. In the Northern Territory prior to 1912 prospectors were helped by grants of rations and some monetary assistance, but it was found that these privileges were occasionally abused, and now provision is made for generous grants to discoverers of metalliferous ores. Aids granted to prospectors in 1913 amounted to £2,373, of which £633 was paid in respect of gold, £1,865 for copper, and £55 for other minerals. There are immense areas in Australia which have not yet been properly tested for mineral values, and genuine parties prepared to take up this work may, as is shown in the foregoing, expect encouragement from the state or Commonwealth authorities.

The Situation in Mexico

SPECIAL CORRESPONDENCE

Affairs in Mexico during the past few months have been very badly mixed and conditions "intolerable," and yet they do not appear just at this time to be any nearer a definite settlement than in the past. Obregon has developed a strength that is surprising and has driven Villa back through Leon, Aguascalientes and Zacatecas into Torreon, where he is preparing to make another stand. In consequence of these defeats, added to the fact that the printing press is providing a never-failing supply of currency, Villista money has dropped to 1c. to 2c. per peso. Corn is scarce in Chihuahua and Durango and when to be obtained is quoted at a price that makes it almost impossible to obtain by the Mexican laborers. Other food supplies are also scarce. The crops in consequence of a lack of rain will be much less in amount than in previous seasons, added to which is the fact that less of the land has been planted. In Sonora the Carranzistas have apparently been making considerable headway. The states now in part or entire control of the Villistas are Chihuahua, Durango, Coahuila, Sonora, and Sinaloa, the other states being largely controlled by the Carranzistas. Various decrees of Villa have been very inadvisable from a political standpoint, and have injured his prestige immeasurably. Villa's campaign against Guadalajara, instead of concentrating his strength in taking Matamoras and Tampico, may have been largely the reason for his late defeats, in consequence of which the important cities of Queretaro, San Luis Potosi, Saltillo, Monterey, Guanajuato, Aguascalientes and Zacatecas have been taken by the Carranzistas.

Carranza's strength appears to rest largely with Obregon. Gonzales is not considered a very heavy factor, although he has lately taken Mexico City from the Zapatistas. There is considerable speculation as to whether Carranza has any control over the forces under him, except such as they wish to extend to him, and many are of the opinion that should Obregon win out against Villa with his forces he will upon some pretext or other decide to ignore Carranza. Carranza's ideas are so impracticable and his sympathies so obviously antiforeign that it is considered very unlikely he will be recognized by the United States. If he should be recognized, many appear to think it will lead to the gravest trouble with one or more of the European powers when peace has there been declared.

Mining interests have been greatly disturbed by the decree of Carranza raising taxes on mining properties to amounts that range from at least twice to six or seven times the normal amount, and many of the foreign interests have refused to pay. Appeal to the Secretary of Hacienda through the United States State Department's

represented to restore taxes to the normal rate resulted in acquiescence on one day, followed in a few days by a complete reversal of position. In fact, no dependence can be placed on the promises or assurances of the various heads of departments under Carranza.

The appeal of the State Department to the various chiefs of opposing factions that they get together and elect a president has elicited favorable replies from the Villistas and unfavorable replies from all of the Carranzista chieftains that have so far been heard from. If such a movement could succeed, it would be the ideal arrangement and obviate the necessity of any foreign intervention. Whether the United States will recognize the provisional president selected by the various Villa and Zapata delegates and place an embargo on all arms and ammunition going to the Carranzistas is yet to be seen. Vasquez Tagle, the only member of Madero's cabinet who did not resign, has been favorably mentioned as acceptable to the Villistas and Zapatistas. Villa has announced his willingness to retire from the field in order to induce many to come into the convention who would not otherwise appear, yet whether he will do so is another question.

In the meantime nearly all of the mines in Mexico are closed. The only smelters now in operation are those at Chihuahua, Torreon, Mapimi and Cananea. Freight conditions are becoming so bad that it would not be surprising to see the Mapimi and Torreon smelters soon obliged to close.

There is daily train service between Nuevo Laredo and Monterey, and between Juarez and Torreon. Trains operate between Monterey and Tampico about twice a week. Military trains have been in operation between Tampico and San Luis Potosi, and possibly regular passenger trains are now in operation. Service is also established between San Luis Potosi and Aguascalientes, and between San Luis Potosi and Matehuala. The service between Torreon and Durango is interrupted owing to the fact that the city of Durango was lately captured by the Carranzistas. The railroad between Piedras Negras, Paredon and Torreon was, at last accounts, in the hands of the Villistas, with irregular train service.

Copper Production in Russia

Recent official returns give the production of refined copper in Russia for two years past as follows, in metric tons:

	1913	1914	Changes
Urals	17,283	16,790	D. 493
Caucasus	10,003	7,123	D. 2,880
Siberia	5,656	5,616	D. 40
Chemical and refining works	1,380	1,415	I. 35
Total	34,322	30,944	D. 3,378

The decrease in 1914 was chiefly because of war conditions in the latter part of the year. In the Urals the falling off was caused chiefly by shortage of labor. In Siberia there was only a very small change. In the Caucasus, where the loss was greatest, mining and smelting were stopped for a time by actual military operations.

Chronology of Mining for August, 1915

Aug. 1—Workmen's compensation law went into effect in Colorado.

Aug. 5—Dredge of the Empire Gold Dredging Co. in the Leadville district, Colorado, launched, this being the first dredge to operate in that district—Holdings of Mogollon Gold and Copper Co. sold to the Socorro Mining and Milling Co.

Aug. 13—Stocks of Belcher, Crown Point and Yellow Jacket dropped from the official list of the San Francisco Stock Exchange, these companies having been merged as the Jacket-Crown Point-Belcher Mines Co.

Aug. 15—Fire destroyed portion of the town of Upper Rochester, Nev.

Aug. 26—Zeila mine, Jackson, Calif., sold to Kennedy Mining and Milling Co.

Aug. 27—Vannoy H. Manning appointed director of the United States Bureau of Mines.

Aug. 31—Explosion at Orenda mine of Merchants' Coal Co., at Boswell, Penn.; 16 killed.

Lake Superior Mining Institute Twentieth Annual Meeting

EDITORIAL CORRESPONDENCE

The general program of the Lake Superior Mining Institute's meeting was published in the *Journal* of Sept. 4, p. 403. It has been rigidly adhered to up to the time of going to press. The first-aid contest on Monday at the ball park, Ironwood, Mich., included four problems unknown to the contestants until the time of the meet. Results were watched more carefully by spectators this year than last on that account. They were as follows: First prize, a trip to the Cuyuna range and the Minnesota State Fair, Minneapolis, Minn., won by team No. 4, Verona Mining Co., seven men, J. G. Williams, captain; score, 95.25; the prize was donated by the Gogebic Range Mining Association. Second prize, $50, donated by the Du Pont powder company, won by team No. 1, Oliver Iron Mining Co., Mesabi Range, eight men, H. C. Lawry, captain; score 92. Third prize, $30, donated by Lake Superior Mining Institute, won by team No. 3, Odanah Iron Co., seven men, M. Menestrina, captain; score 86.7. Fourth prize, $20, donated by the Institute, won by team No. 2, Montreal Mining Co., seven men, Tim Kirby, captain; score, 86.5. The judging was done by Dr. A. F. Knoefel, a last year's judge, and seven physicians from Terre Haute and vicinity.

In the afternoon automobiles took the party to points of interest on the Gogebic Range. These included: "G" Pabst shaft of the Oliver company, Newport mine; permanent stock trestle at Colby mine; Anvil and Wakefield mines. At the last, the openpit and electrical installation are of particular interest. They are fully described in the *Journal* of Aug. 28. The first business session was held at 7:45, Monday night, in the New Central School, Ironwood, and was called to order by President L. M. Hardenburg. Edwin Higgins then presented the final report on first-aid meets recommending the appointment of a committee on rules and regulations governing such contests. Papers were then given as follows: "Sinking of the Woodbury Shaft at Newport Mine," read by title only, by J. M. Broan. William Kelly called attention to the great record made in sinking this shaft.

"Mining Methods on the Gogebic Range" was read by co-author O. E. Olson, who pointed out the differences developed in the last five years in transportation underground, safety devices, etc. Heavier rolling stock had

necessitated heavier rails and from 7- to 8-ton skips are now used. The paper on "The New Stockpile Trestle at the Colby Iron Mining Co." was read by G. S. Barber. A new type with one-leg bents has reduced the difficulty with alignment. "Opening of the Wakefield Mine" was commented on by the author, W. C. Hart. It was devoted principally to the opening of the pit. A paper on "Grouting at the Francis Shaft of the Cleveland-Cliffs Iron Co." was commented upon by the author, J. R. Reigart. Edwin Higgins pointed out the problems presented in mining sheet ground in the Joplin zinc district. Little timbering is necessary, the shafts are shallow, mining methods are simple and there are comparatively few accidents. Fast hoisting is done without signals. He read some of their costs by way of comparison with those in the Lake Superior district. The principal points of the paper on the use of gunite in steel shafts were pointed out by Stephen Royce, the author. The nomination of the committees followed.

At the Monday evening business session the following committees were appointed: Nominations—J. M. Bush, Marquette; W. J. Richards, Crystal Falls; G. L. Woodworth, Iron River; W. P. Chinn, Virginia; F. W. Denton, Painesdale. Auditing Committee—Frank B. Goodman, Montreal, Mich.; J. E. Jopling, Ishpeming; C. H. Baxter, Loretto, Mich. Resolutions Committee—William Kelly, Vulcan, Mich.; C. Brewer, Ironwood; J. H. Hearding, Duluth; Charles D. Lawton, Hancock; J. C. Barr, Crosby. The Institute was met at Crosby Tuesday morning, Sept. 7, by George N. Crosby, the pioneer operator on the Cuyuna Range. A train of flat cars equipped with seats took the party through the North Range. The initial stop was the Kennedy mine, the first to be opened on the range. Following that the Croft mine was inspected. Here a large tonnage of bessemer ore is opened by a circular concrete shaft in course of sinking. This shaft went 11 ft. out of alignment, but this was corrected and sinking in the ledge is now in progress. The train then went to Armour Nos. 1 and 2 shafts of the Inland Steel Co. and to the Pennington openpit orebody, here 250 ft. wide. It is now stripped and steam shovels are loading ore.

The new hydraulic stripping operations at the Hillcrest mine in charge of W. R. Van Evera were especially interesting. About noon the train went through the openpit of the Rowe mine of the Pittsburgh Steel Ore Co., situated at Riverton, Minn. This property is in charge of J. C. Barr, who last year stripped the ore with hydraulic giants, the first to be used on the Lake Superior ranges. A buffet lunch was served at the Rowe Mine Club, where the Institute members were the guests of Mr. Barr. After this an inspection was made of the Rowe concentrator. This contains the usual log washers and trommels over strong double-deck tables and settling tanks. Raw ore is dumped from the railroad cars on to elevated traveling-chain grizzlies, the oversize crushed, and all elevated by an inclined traveling-belt conveyor to the concentrator bins. The concentrates are elevated in a similar manner and dumped into loading bins which deliver to railroad cars.

The final business session was held in the Crosby High School. A paper on "Some Aspects of Exploration and Drilling on the Cuyuna Range," by P. W. Donovan of the E. J. Longyear Co., was read by title, as was also "Rock Drilling in the Morris-Lloyd Mine of the Cleveland-Cliffs Iron Co.," by J. E. Hayden. Carl Zapffe pointed out important parts of his paper on "A Survey of Developments and Operations in the Cuyuna Iron-Ore District of Minnesota," and laid emphasis on the mines of the South Range not visited by the Institute. He pointed out that in the district as a whole water has caused practically no trouble, contrary to expectations, and notwithstanding the number of lakes adjacent to the mines. Mr. Zapffe also discussed the need for careful magnetic work brought out in Mr. Donovan's paper. "The Mining School of the Cleveland-Cliffs Iron Co.," by C. S. Stevenson, was read by title, and "Experiments in Concentration of the Cuyuna Ores," by Mr. Newton of the University of Minnesota was read in abstract. "Hydraulic Stripping at Rowe and Hillcrest Mines" was read in part by its author, Professor McCarthy of the Minnesota School of Mines.

The business was then taken up of sending a delegate to Washington in December to consider changes in the mining laws discussed and the Institute Council given absolute power to act. All applications for membership since the last meeting were granted. The thanks of the Institute were extended to the railroads, the Pittsburgh Steel Ore Co., J. C. Barr, George M. Crosby and others at Ironwood, Mich. Officers were elected for the ensuing year as follows: President, Charles E. Lawrence; secretary, A. J. Yungbluth. Tuesday evening a barbecue was given at Crosby Farm.

Mineral Exports of Chile

The mineral exports of Chile during 1914 are reported by the *Boletin de la Sociedad Nacional de Mineria* as follows:

Products	Units	Quantity
Gold bars	Kilograms	14,704
Silver bars	Kilograms	4,843,272
Auriferous silver bars	Kilograms	221,850
Gold and silver precipitate	Kilograms	667,100
Copper bars	Metric tons	25,790.515
Copper matte	Metric tons	15,987.030
Cement copper	Metric tons	10.000
Gold ore	Metric tons	32.742
Gold-silver ore	Metric tons	869.328
Gold-copper ore	Metric tons	1,764.831
Silver ore	Metric tons	138.394
Silver-copper ore	Metric tons	493.302
Silver-lead ore	Metric tons	13.155
Gold-silver-copper ore	Metric tons	710.818
Copper ore	Metric tons	68,892.545
Copper-zinc ore	Metric tons	8.000
Molybdenum ore	Metric tons	2.704
Lead ore	Metric tons	105.251
Iron ore	Metric tons	63,505.600
Coal	Metric tons	266,972.000
Nitrate	Metric tons	1,846,783.000
Perchlorate	Metric tons	55.430
Borate	Metric tons	34,203.600
Iodine	Metric tons	488.952

The total fine copper contained in the exports was 45,682 metric tons, this figure being the greatest ever reached, due to the increased production of the Braden Copper Co. The nitrates and borates suffered a loss, owing to the closing of the European market, the exportations of the last half of the year being only about one-half of those of the first semester.

Lake Freight Situation

The following information supplements the short article in the *Journal* of Sept. 4, p. 397.

Both grain brokers and ore shippers continue to call for more vessel capacity. During 10 days recently upward of 2,000,000 tons of ore were sold, with prospects for an additional 2,000,000 to follow. Grain brokers have placed several million bushels at 3c. and are offering more. Prominent vessel owners aver that a large proportion of the total vessel capacity is tied up for the remainder of the season.

Editorials

Accident Prevention in Smelting Works

The American Smelting and Refining Co. has joined the ranks of the concerns publishing monthly magazines with the view of reducing the accidents among their employees. The newcomer is *The Safety Review*. It is not so showy as some of its forerunners, but it is fully as spicy. Some of the statements in No. 1 of Vol. 1 are worthy of remark and comment.

In 11 plants of the company there was a decrease of 19% in the accident rate for the first quarter of 1915, compared with the corresponding period of 1914. In the Durango plant the reduction was 64%; in the Baltimore plant it was only 13%. It would be interesting to know whether these figures indicate anything important with respect to the differences among the works, their character, geography, etc. During the first six months of 1915 the Federal plant worked 136,400 hours, and the Durango plant 93,618 hours without an accident.

The company finds that in blast-furnace work and in the handling of hot metals, in which the men are frequently victims of hot splashes, the nature of the shoe worn is important. Consequently, the men are urged to wear congress shoes, which can be removed instantly, whereby many serious burns are prevented. As for the clothing worn, experiments are being made with treatment by a fireproof liquid. Heavy hot-metal splashes will char cloth so treated, but will not burn it, and there is ample opportunity to remove the metal in time to prevent burns of the person. Experiments with this fire-proofing liquid—"Antignite"—are being continued. The matter of shoes, however, is regarded as settled. In the works of the United States Zinc Co. foot-burns have been reduced 50% by the use of congress shoes.

Special emphasis is put upon the use of goggles by men working at the tap-holes of the furnaces, and attention is drawn to the importance of a proper choice of the goggles. "Care should be taken in selecting a measurement that will conform to the nose of the workman. In addition to this the frame should be bent so it will conform to the shape of the face and the temples, adjusted so they will rest easy back of the ears." Goggles are obtainable in assorted sizes complying with these specifications.

All of the foregoing advice is simple, obvious and helpful, but this great industrial company finds it worth while to dwell upon such minor points. Turning to some of the major matters, the great step in advance, without any doubt, is going to be in the more rigid enforcement of discipline. The following is from a report of certain officials of the American Smelting and Refining Co. who visited the works of the Illinois Steel Co. at South Chicago, Ill.:

> Their discipline is of a strict nature, in the case of accident, as well as in all cases of disorder. The plant is policed, which is a necessity with such a large organization, and every man found guilty of disorderly conduct is compelled to appear before Mr. McKenney (assistant to the general manager), who sits on these cases each morning at 9 o'clock. The man is given a hearing, as in regular court, and reprimand given, which might be discharge in severe cases, or a lay-off of one or more weeks.
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> Mr. McKenney spoke of the men, and particularly of the way the fellow-workmen would reprimand a man who is seen violating any of the rules or putting himself in unnecessary danger, and it has gotten to the point where the offender is more severely taken to task by his fellow-workmen than by the safety committee. We were told of the case of one foreman, only lately, injured by some bonehead act, and he was ashamed to return to work and face his men.

A similar policy appears to be developing in the American Smelting and Refining Co. The story is told of a foreman in the Tacoma plant who directed a man that had received a little cut to go to the doctor. The man refused. "After repeated urgings the foreman told Joe he was fired if he didn't go and see the doctor." A short time after this incident—probably there had been others of like nature—the Executive Committee of the company adopted a recommendation of the Committee on Safety and Labor that all general managers, managers, superintendents, and particularly foremen, be notified that each and every one would thereafter be held strictly accountable for accidents to employees under them, and that discipline, even to the extent of dismissal, would be administered when necessary in order to further the work of accident prevention. It is that kind of policy that will be more effective in reducing accidents than will be the idea of trying to make everything fool-proof.

Civilian Engineers and Military Service

A movement has been started, and is now well under way, for the organization of a reserve corps of civilian engineers, to be available for use in the country's defense in case of war. This movement, which is indorsed by Major-General Leonard A. Wood, has been taken up systematically by the large engineering societies of the country, including the civil, mechanical, electrical, chemical and mining engineers. All of these organizations working in harmony have appointed members to a joint committee now in touch with the War College at Washington, which is formulating a plan whereby the services of the various engineers shall be promptly available to the greatest advantages to the Government in case of need.

The United States at the present time has in its entire army only 212 engineer officers, most of whom are engaged on purely civil-engineering work in connection with river and harbor improvements. A number are too old, and still others are too young, to undertake some of the difficult problems presented by the necessities of the country's defense, and this work will necessarily fall largely to the civilian engineers who will enter the service when the time comes.

To no group of engineers do the military engineering problems appeal more than to the mining engineers, who are accustomed to working under trying frontier conditions and who are called upon to execute at short notice and in very great haste many difficult engineering

feats. In addition, the mining engineer's daily familiarity with explosives makes him a valuable adjunct to the engineer force of the army.

The mining engineer is also an organizer, and his familiarity with administration and handling men in bodies makes him particularly amenable to the requirements of the service.

Civilian engineers, however, must necessarily have some military training in order to be efficient at the start in their new work. It is not at all unlikely that when Congress convenes and takes up the question of military preparedness—as it undoubtedly will—considerable attention will be focused upon some means for getting the mining engineers into camp for a few weeks to give them the rudiments of military training in a way similar to what is being done in Plattsburg, N. Y., at the present time, where more than 1000 business men are in camp under the tuition of United States Army officers. This business-men's camp follows directly on the heels of a college men's camp at the same cantonment, conducted along similar lines, and will probably be followed by others.

In case of sudden necessity for mobilizing an army in the United States, 1,200,000 men would be required and 40,000 officers would have to be commissioned. At present it is utterly impossible to pick 40,000 men from our entire list of states who are adequately equipped to accept those commissions.

The opportunity which this offers to the mining engineer, both for work congenial to himself and valuable to the country, is entirely unappreciated by the engineer himself. The joint committee of the national engineering societies will, on a plan approved or laid out by the War College and now under consideration, take the lead in preparing the engineers of our country for military training.

Consumption of Zinc for Brass-Making

In the *Journal* of June 19, 1915, it was remarked that it was then assumed that the buying of spelter for ammunition purposes was endless, and in this connection it was suggested: "The brass-making capacity of America, if nothing else, imposes a limit. Assuming the brass-making capacity to be 450,000 tons at the outside, the spelter requirement would be 150,000 tons at the maximum. It is doubtful if in any year previous to 1915 any more than 75,000 tons of spelter was ever used for brass-making."

Since then the brass-making plant of the United States has been put fully into use, and important additions have been, or are being, made. It is now estimated that American brass works will soon be turning out about 45,000 tons of brass per month. This indicates a consumption of about 15,000 tons of spelter, or at the rate of 180,000 tons per annum, figuring on the ratio of copper and spelter in ordinary brass. This is a little in excess of the previous estimate, sufficiently explained by the additions to capacity.

We can begin to get an idea of how things stand. The exportation of spelter during the fiscal year ended June 30, 1915, was about 110,000 tons. Take 12,500 tons per month as the deficiency in Great Britain, France and Russia that must be supplied from here. Add 9,000 as the increased demand for brass-making here. The total is 21,500 tons. The excess over production as compared with the rate of 1914 is somewhat between 15,000 and 25,000 tons. Something like the latter figure is in sight, but it will not be attained until 1916. The approach to it will probably be gradual.

On the other hand, domestic peaceful consumption has been enormously curtailed. But disregarding this, it is probable that production is coming into equilibrium with consumption—indeed, has begun to swing the scale the other way. This is indicated by the behavior of the market. A large, sudden buying demand turns it upward. Having been satisfied, the steady weight of production forces it downward again. We shall probably have a declining tendency that will each time carry the market to a new low level and then a rally that will take it to a point not quite so high as the previous one, until there begins to be a positive accumulation of unsold stocks, when there will no longer be any resiliency and consequently there will be no immediate rebound.

Copper in Germany

According to an American bulletin published in Berlin the German authorities estimate that there are available in Germany 2,000,000 metric tons of copper in one form or another, which quantity will meet the military requirements for upward of 10 years. Shall we then estimate the German use of copper in warfare at 200,000 tons per annum and that of the Allies at as much more, or a total of 400,000 tons—40% of the world's production in 1913? Probably no printed statement of this kind would be allowed in Germany if it were not correct, for certainly there would be no object in exaggerating the rate of consumption, although there might be with respect to the supply.

As to the latter, the reports do not read so comfortably as the bald statement of the huge quantity that is available. A registry of all the copper in the Empire has been made, and nobody is permitted to sell any copper article without permission of the authorities. For copper goods that were voluntarily deposited before Sept. 25 a price of 43.3c. per lb. is being paid. That figure, together with news coming privately, indicates that copper in Germany is becoming very scarce.

Several months ago the *Journal* intimated that zinc ore might be imported into the United States from Sardinia. A cargo is now on the way to Baltimore, whence probably it will go to Langeloth, Penn., for smelting. This will be the first time that Sardinian calamine has crossed the Atlantic Ocean. At the outbreak of the war the Sardinian zinc-ore producers suffered severely, being cut off from their usual market with Belgian smelters. Now, however, they are operating profitably again, selling their ore to England and France.

The United States Bureau of Mines has published a technical paper on "The Buying and Selling of Ores and Metallurgical Products," by Charles H. Fulton. Professor Fulton is an experienced metallurgist and is well qualified to write authoritatively upon this subject. His contribution is one of the best and most useful things that the Bureau of Mines has published and will be helpful in spreading knowledge respecting the conditions of buying and selling ores, especially such ores as go to the silver-lead and copper smelters.

BY THE WAY

The dumps of the old copper mine about four miles from Bristol, Conn., are attracting the attention of some local men, who hope to get some copper out of them by modern methods. This mine, which was first opened in 1836, is said to have a shaft over 400 ft. deep. Connecticut does not rank as a mining state, and it will be a surprise to most people that there is a mining shaft 400 ft. deep within its boundaries.

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Patrick Clark, the well-known mining man who died recently in Butte, left an estate of about half a million dollars, consisting largely of loans on real estate. Stocks in different mining concerns of unknown value are listed, and among stock of apparent worth are listed the following: Butte-Bullwhacker Copper Co., 128,450 shares; Standard Silver Lead Co., 15,739 shares; Amy Silversmith, 15,214 shares; balance on "Gotem-now" option, $8961; one-quarter interest in Stack Supply Co., estimated at $2500.

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In discussing the recent disclosures respecting alleged German activities in the United States, one of the New York dailies said: "For instance, a man who was connected with the German financial policy in the United States is responsible for the assertion that a shipload of 10,000 tons of copper had been sent straight to Germany, under cover of a manifest on Copenhagen." The American copper producers would like to know how this was managed. Any or all of them would like to sell some copper to Germany.

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Australian miners are digging for gold in the trenches on Gallipoli Peninsula, says a dispatch to the Chicago *News*. They were surprised at the similarity of the Gallipoli ground to the Australian gold fields, and their sharp eyes soon discovered traces of the yellow metal. In their spare time the miners built rude placer outfits on the seashore and began washing for gold. They found it, and now the Australian troops with mining experience are passing every minute when not fighting the Turks in washing clay, which is brought to the shore from half a mile inland. One soldier thus made $5 in four hours.

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According to a newspaper item, when nitroglycerin was invented extraordinary precautions had to be taken to prevent accidents, but notwithstanding this so many disasters occurred that there seemed to be strong probabilities that its manufacture and use would have to be prohibited. One day when Nobel, the chemist, was at work on the problem he cut his finger, and to stop bleeding painted some collodion (a liquid preparation akin to guncotton) over the cut. Having done this he poured some of the collodion, by way of an experiment, into a vessel containing nitroglycerin, when he noticed that the two substances mixed and formed a jelly-like mass. He at once set to work to investigate this substance, and the outcome was blasting gelatin, a mixture containing 90% of nitroglycerin and 10% of soluble guncotton.

The metal markets as reported in Wall St. are often about as follows:

> Boston—Electrolytic copper has been selling during the week at 18c. per lb., although not in large quantities. Smaller producers have adopted the same tactics that were in evidence up to a fortnight ago and have offered the metal down to and made sales at 17¾c.
>
> There has been no difficulty in making sales of lead at 4.90c. per lb., according to the larger producers, in spite of concessions offered by smaller interests and dealers.

Why anybody should pay dearly for what he can buy cheaply deponent saith not. But here is another report:

> New York—One of the leading copper producers is still making sales of electrolytic at 18c., despite the fact that quotations in the outside market rule a half-cent or more below this figure. This is taken as confirming the view that dealers have little copper to offer, and that consumers will look to larger concerns for any considerable amount of metal. Offerings at lower level are being made, it is asserted, not so much for purpose of selling copper, as to depress price in order that dealers may buy.

The logic seems to be a little wabbly.

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"My kingdom for a horse!" said a king one day in a moment of excitement—but mules are worth real money. About three millions per mule is the value figured by Virginia City's "Oldest Inhabitant." The earliest official record of the boom days on the Comstock Lode is found in a dog's-eared memorandum book in the courthouse at Virginia City, Nev., according to Charles E. Van Loan in the *Saturday Evening Post* of July 31, 1915. In this book appears the formal notice of a transfer of one-third of the famous Ophir mine, the consideration being two mules and the labor necessary to construct two arrastres. One traces the hand of Henry Comstock in this trifling avoidance of labor, but the price paid by the original locators for mules will probably stand for all time a world's record. "You don't need to figure the arrastres at all," says the Oldest Inhabitant, interviewed by Mr. Van Loan. "They were just thrown in with the mules, like. And those mules now; maybe they weren't even good ones, but do you know what they cost? The Ophir was the first of the bonanzas, and before they get through with her they took out twenty millions. Roughly speaking, that's three millions a mule. Oh, well, none of the old boys got much of anything out of the camp. It was the men who came along afterward and put in the machinery." This remarkable transaction foreshadows the fate of the original locators on the lode. Their luck began and ended with the tapping of the vein. "There was McLaughlin now," says the Oldest Inhabitant. "He sold out for less than four thousand and had quite a time while the money lasted. The last I heard of him he was cooking for a mine crew. Comstock got ten thousand for his interest and went over to Carson and bought a store, but he trusted everybody and didn't keep any books. They broke him in a couple of years and he went to prospecting again. He shot himself up in Montana somewhere. O'Riley had a little better luck—for a while. He hung on longer than the others, and when he sold out he started a hotel here. He would have made money if he hadn't got to gambling in mining stocks. He walked out of town one day, flat broke, telling everybody that he was going to make a bigger strike than the Comstock ever dared to be. He stuck to that idea until they put him in an asylum over in California. Yes, the old-timers didn't get the millions. They found 'em, that was all."

PERSONALS

Wilber Judson is at Dolores, Chihuahua, Mex.

John Gross recently returned from Mexico and has opened an office as mining and metallurgical engineer at 523 McPhee Building, Denver, Colorado.

Charles M. Coats, formerly of Taylor, Tex., is now at Collinsville, Okla., where he is employed as a chemist for the Bartlesville Zinc Co.

Frank Bauer announces his retirement from active service on Sept. 1, after many years of continuous service as manager of the Columbia Gold Mining Co. at Sumpter, Oregon.

Robert A. McKean, formerly superintendent of the Keystone works of the Jones & Laughlin Steel Co., Pittsburgh, has been appointed structural engineer to succeed William C. Coffin.

W. McC. Cameron, who has been employed for several years past as consulting engineer to A. Goerz & Co., Ltd., in South Africa, and to several of the Witwatersrand mines, is leaving that country and returning to America early next year.

Dr. J. A. Udden, geologist of the Bureau of Economic Geology in the University of Texas, has been appointed acting director of the bureau, the former director, Dr. Wm. B. Phillips, having resigned to become president of the Colorado School of Mines.

W. R. Farquhar, for many years associated with the United Metals Selling Co., and Russell A. Cowles, vice-president of the Ansonia Copper & Brass Co., have resigned their respective positions to ally themselves with the Metals Trading Corporation, a new concern that is doing an export business.

R. D. Fetherstonhaugh, of Vancouver, B. C., has returned from a visit of several months to the mining districts of the Peace River country in the interests of the Hinterland Resource Co., an Edmonton enterprise, which has taken up several claims on Peace River. He is satisfied as to the occurrence of free milling gold in large quantities.

George T. Holloway, of London, chairman of the Ontario Nickel Commission, has arrived in Toronto, having before leaving England been engaged in collecting data as to the nickel market. He states that one of the first steps of the Commission will be an examination of the Sudbury nickel industry which will be followed by an inspection of the New Jersey refining plants.

R. P. McLaughlin, the California state oil and gas supervisor, has appointed the following deputies: M. J. Kirwan in Fresno and King counties and part of Kern county, stationed at Coalinga; E. B. Latham in Kern, Santa Barbara, and Ventura counties, head-quarters at Santa Barbara; R. B. Moran in Orange, Los Angeles, and Ventura counties, with Los Angeles as head office; and Chester Naramore in charge of work in Kern and Ventura counties.

Herbert M. Wilson, director of the Department of Inspection and Safety of the Associated Insurance Companies, formerly of the Bureau of Mines, will be in San Francisco, Sept. 16 to 25, participating in the various engineering congresses. He will be actively concerned in the first aid and mine rescue demonstrations and contests of the Board of Managers, of which he is chairman. He is also scheduled to read papers on mine safety and on workmen's compensation before the mining sections of the International Engineering Congress, The American Mining Congress, and the World's Insurance Congress.

OBITUARY

A. H. Borman died in New York Aug. 20. He was largely interested in Idaho mining property and for a number of years owned the Jay Gould mine, near Bullion.

William Moorehead died Aug. 13 at Angels Camp, Calif. He was in early days foreman of the Sierra Nevada mine at Virginia City, Nev. Later he was manager of the International Hotel at Virginia City during the bonanza days at that camp.

M. D. Howell died at San Francisco, Aug. 16. Mr. Howell went to California from New Jersey by the way of Cape Horn, arriving at San Francisco Oct. 27, 1849. He was one of the original owners of the Plumas-Eureka gold mine, which was one of the richest ever developed in the state. He was years old.

Benjamin F. Hall died Aug. 25 in Denver, Colo. He was well known among Colorado mining men and had lived in Denver for ten years. He was interested in mining in the Breckenridge and Idaho Springs fields and was commonly understood to be wealthy. He was one of the men primarily responsible for the development of the Breckenridge placer mines, although for the last few years he had not been connected with any of the companies operating there.

SOCIETIES

Iron & Steel Institute—The Autumn meeting will be held in the rooms of the Institution of Civil Engineers in London, England, Sept. 23 and 24. The following is the list of papers that are expected to be submitted for reading and discussion:

1. Wesley Austin: "Influence of oxygen on some properties of pure iron."

2. T. H. Byrom: "Note on the carburization of iron at low temperatures in blast furnace gases."

3. Professor E. D. Campbell: "Influence of heat-treatment on the specific resistance and chemical constitution of carbon steels."

4. Professor C. A. Edwards, and H. Kikkawa: "Effect of chromium and tungsten upon the hardening and tempering of high-speed tool-steel."

5. W. H. Hatfield: "Phosphorus in iron and steel."

6. Professor K. Honda and H. Takagi: "The magnetic transformation of cementite."

7. R. H. Smith: "Sulphur in malleable cast iron."

8. Professor N. Tschioschewski: "Iron and nitrogen."

Institute of Metals—The following is a list of the papers that are to be submitted at the meeting of the institute in London, Sept. 17: 1, "The Corrosion of Gun-Metal," by Dr. C. H. Desch; 2, "Metallic Crystal Twinning by Direct Mechanical Strain," by Prof. C. A. Edwards; 3, "Notes on the Copper-Rich Kalchoids," by Professors Brinton and S. L. Hoyt; 4, "The Constitution of Brasses Containing Small Percentages of Tin—A Contribution to the Study of the Ternary System, Copper-Zinc-Tin," by Dr. O. F. Hudson and E. M. Jones; 5, (a) "Structural Changes in Industrial Brasses," (b) "Hardness of Copper-Zinc Alloys," by Dr. D. Meneghini; 6, "Specifications for Alloys for High Speed Superheat Steam Turbine Blading," by W. B. Parker; 7, "The Physical Properties of Metals as Functions of Each Other," by H. H. Stuart; 8, "Detection of Internal Blow-Holes in Metal Castings by Means of X-Rays," by C. H. Tonamy; 9, "A Thermostat for Moderate and High Temperatures," by J. L. Haughton and D. Hanson.

INDUSTRIAL NEWS

The Canadian Brakeshoe Co., Ltd., of Sherbrooke, Quebec, Canada, has just placed an order for the installation of a Snyder electric furnace to melt steel for the manufacture of 4-in. rounds to be forged into shells for the British Government.

V. A. Stout, Balboa Building, San Francisco, has recently been appointed representative of the Traylor Engineering and Manufacturing Co. for the Pacific Coast States, working under the direction of the western manager, John A. Traylor, of Salt Lake City, Utah.

The Braun laboratory appliances, consisting of crushers, pulverizers, samplers, furnaces, burners and other equipment which are used in all parts of the mining and industrial world, have been awarded a gold medal at the Panama-Pacific International Exposition at San Francisco.

The Mine & Smelter Supply Co. has recently received at its New York office, 42 Broadway, an order from the New Jersey Zinc Co. for 68 Wilfley No. 6 tables; 20 of these tables will be installed at Ogdensburg and 48 at Franklin Furnace, N. J. Supplementing a preliminary order, the Mine & Smelter Supply Co. has shipped to Japan 15 Wilfley No. 10 tables, with special riffling. It has also recently received an order from the Beatson Copper Co. of La Touche Island, Alaska, for one No. 86 Marcy ball mill, 8 ft. in diameter by 6 ft. long. A trial order has also been received for a No. 86 Marcy mill for the Braden Copper Co., Sewell, Chile. The Mine & Smelter Supply Co. has recently shipped to Aguacate Mines, San Mateo, Costa Rica, a 2-stage vertical sinking pump with motor, capacity 350 gal. per min, against 200-ft. head.

Editorial Correspondence

SAN FRANCISCO—Sept. 1

The United States Made the First Payment of $500,000 on the purchase of the Alaska Northern R.R. on Aug. 26. The purchase price was $1,150,000. This action followed the dismissal of the suits brought in Washington and in Alaska, under which the proceedings for purchase had been delayed for the past two months

Convention of Mining-Stock Brokers — The chief object which it is expected will be attained through the first national convention of mining-stock brokers in San Francisco, Sept. 21 and 22, will be the formation of an organization which will provide more adequate protection for the public investing in mining stocks and give a wider market for mining and metal stocks of merit. The latter purpose will be reached through the establishment of a common list of mining stocks to be called and traded in all exchanges which deal in mining stocks.

The Sale of the Zeila Mine in Amador County to the Kennedy Mining & Milling Co. has been confirmed by the filing of the deed for record, on Aug. 26, indicating purchase price of $35,000. The property consists of three mining claims and a mill site situated on what is known as the East belt of the Mother Lode. At this point the distinction between these two divisions of the Mother Lode region is not clearly marked geographically nor topographically. But the geological line of demarcation is plain and the geologists consider the Zeila on a separate vein series from the Mother Lode proper. The Kennedy mine is situated at about the center line of the Mother Lode, about one-half mile west of the center line of the Zeila. The Zeila is situated about 1½ miles south of the Kennedy. The old hoist is of no value for underground operation and would be useful only for the drawing of water from the mine. The Zeila is completely worked out down to the 450-ft. level and while new orebodies have been disclosed and sampled below the old workings it would be necessary to sink a new shaft and install new equipment in order to operate from the Zeila surface. The grade of the new ore so far has not exceeded an average of $4 per ton. The property is now in the hands of men who are not likely to make any mistakes in operation and who are so situated as to be able to mine and mill the ore economically and at a profit. The purchase by the Kennedy will mean much for the advancement of the town of Jackson, where the mine is situated and will strengthen the reputation of the Mother Lode mines and influence other probable investors in the region.

DENVER—Sept. 1

Mining, Metallurgical and Geological exhibits will be prominent at the International Farm Congress and Soil Products Exposition to be held in Denver's auditorium two weeks in September and October. The geological surveys of Wyoming and Colorado will have collections of minerals; the U. S. Bureau of Mines will demonstrate safety and first-aid methods and will explain its accomplishments in the metallurgy of radium; the Colorado School of Mines will operate a flotation unit and an assay office; machinery houses will display their latest contrivances; while various mining counties will be represented by collections of representative ores.

Local Freight Rates on Ores between points within the Cripple Creek district are unjust. Judge E. A. Colburn, owner of the Ajax mine and mill at Victor, has won his contention before the state public-utilities commission. Freight on ore valued at $20 or more between local points—i. e., practically switching—has been the same as from points in the district to Colorado City, the exhibition center. The newly announced rates are 25c. less per ton on local than on outside shipments and this will favor the selling of custom ores to the district's mills such as the Ajax mill. With this point gained, Colburn will remodel his plant for handling custom in addition to his own ores.

The Mary Murphy Mine at Romley, Colo., reëntered the list of dividend payers last October when, after a lapse of many years, it furnished funds for the distribution of 5c. per share among stockholders. In July, 1915, the profits had been such that a dividend of 7c. was again warranted. Under the management of George E. Collins, of Denver, this mine of low-grade, complex ore is upon a profitable basis. The production for 1914 was $397,000. This rate was largely increased during the first half of 1915 when the following sales of mine products were made: Crude ore to smelteries, $47,032; zinc concentrate, $135,637; lead concentrate, $83,807; iron-copper concentrate, $19,674; total, $286,150. The profit for this period was approximately $130,000.

BUTTE, MONT.—Sept. 2

A Union Organizer in Butte is trying to induce miners holding cards in the United Mine Workers of America to join the Western Federation of Miners. This organizer was sent to Butte by the United Mine Workers executive board which has recognized the federation local in Butte as the union affiliated with the American Federation of Labor. The results of the organizer's efforts in bringing about a revival of unionism among Butte miners are not known. It is doubtful, however, whether in the face of past experience any Butte miner now at work will ever join a union again.

The Payrolls of the Butte District at present are the largest in the history of the companies. The Anaconda company alone is employing approximately 10,000 men, in addition to the several thousand employed in Anaconda and Great Falls. The wage scale for miners continues at an average of $4 per day, the monthly disbursement of the Anaconda company in Butte alone being very close to $1,000,000 for labor. The Butte & Superior employs about 1,200 men, the East Butte 600, the Elm Orlu 250, and other smaller operating companies an additional 500. The daily wage paid to miners in Butte is therefore between $46,000 and $50,000. All of the old companies are operating now practically at capacity, though the total copper production is not yet so high as it was a few years ago.

Unwatering the Lexington and Nettie Mines is being pushed by the Anaconda company but it will still be some weeks before all the water is out and the underground workings put in condition for development work. As soon as the Alice properties have been resold on Sept. 10, under the decree of the courts, the Anaconda company, which will no doubt be the successful bidder at the sale, will take up the work of unwatering and developing that property again. At the approaching sale the Anaconda company will be required to pay cash, the previous consideration paid having been in Anaconda stock. The new work in improvements at the Washoe and Great Falls smelteries, on which several million dollars will be spent, is being rushed, and President John D. Ryan, who just completed an inspection of all the properties in the state, expressed himself well satisfied with the progress and the results already achieved by some of the new features in the plants.

SALT LAKE CITY—Sept. 2

A Topographic Survey of a portion of the Oquirrh range is being made by the U. S. Geological Survey. This will include the camps of Stockton, Ophir, and as far as Mercur. Geologic work is to be done later, and has been assigned to B. S. Butler, who worked out the geology and ore deposits of the San Francisco and adjacent districts in Beaver County, published in Professional Paper No. 80.

The Flotation Section of the Utah Apex Mill at Bingham is operating and making a good saving. Magma machines, obtained from the Utah Copper Co., are used. These are 12-compartment machines of which the last four are cleaners. By running the machines in series it has been possible to dispense with the last four sections. The tailings run 0.2 to 0.3% lead. Flotation costs are about 15c. a ton. During July the mine produced 5738 tons of shipping ore and 9270 tons of milling ore. From the latter 2375 tons of concentrates were obtained. The operating profit was $17,620 for the month.

SEATTLE, WASH.—Sept. 1

Four Ships Unloading Copper Ore from Alaska at one time was a spectacle offered at the ore bunkers of the Tacoma smeltery of the American Smelters Securities Co. recently. The four ships had 7100 tons of copper ore from the Ellamar, Latouche and Kennecott mines. So heavy are the shipments of copper from the North that announcements have been made that the plans have been approved and considerable of the equipment has been ordered for the doubling of the capacity of the smelting and refining plant.

Broad Pass May Be a Grave Disappointment, according to Stephen Birch, president of the Kennecott Copper Corporation, who is credited with the following statement in an interview by local reporters on his return from Alaska recently: "We had an expedition in the Broad Pass region all winter and the properties we had under option failed to stand up under investigation. The members of the expedition did not find enough shipping ore to load a packhorse. There may be some tonnage in that country, but the members of our expedition failed to discover it." This statement coming from the head of the Guggenheim syndicate in the North is regarded as counteracting the effect of the original story published about the time of Mr. Birch's return from Alaska last season. Whatever the reason for the latest announcement, Alaskans generally are inclined to take it with a grain of salt. Nevertheless it has caused considerable speculation and some uneasiness in the cites of the Alaskan coast that expect to profit by development of the district.

WALLACE, IDAHO—Sept. 4

The First "First-Aid" Contest in the Coeur d'Alenes will be held at Wallace, Sept. 12, under the direction of Supt. J. L. Boardman of Mine Safety Car No. 5 of the U. S. Bureau of Mines. The committee in charge of the contest consists of J. H. McCarthy, E. P. Smith, W. E. Greenough, Charles McKinnis, P. J. Gearon, J. L. Boardman, and Stanly A. Easton. It is expected that at least 15 teams will be entered.

Antimony Properties in the Coeur d'Alenes are active. A boiler and hoist have been purchased by the Coeur d'Alene Antimony Co. for unwatering the 170-ft. inclined shaft of the old antimony mine on lower Pine Creek. Ore averaging 40 to 70% antimony has been shipped in past. Brown & Finnel are pushing development work on their antimony prospect, which lies southwest of Sunrise. The crosscut is in 80 ft. and has 50 ft. to go to reach the vein, which shows a foot of high-grade stibnite near the surface. Charles Pederson has a promising antimony prospect in Ross Gulch, on the west fork of Pine Creek; ore of good grade is exposed for 200 ft. at surface and driving is under way to cut the vein at greater depth. Recent test shipment of two tons to Salt Lake gave returns of 60% antimony.

GOLCONDA, NEV.—Sept. 1

In the Divide District there are now 100 or more men. Between Humboldt and Owyhee Rivers, nine miles west of Tuscarora, a discovery of silver ore was made a year ago in prominent croppings that looked so barren no one had before thought to break them. Several groups of lessees are at work, but almost everyone is awaiting the driving of the crosscut tunnel of Storey & Campbell, which is expected to cut the vein at a depth of 100 ft. Strikes have also been made two to three miles farther west, one having been reported as showing more gold and much less silver than in the Divide ores proper. So far the Divide vein has been opened in places to a width of 14 to 15 ft. The miners at Golconda and Midas who have been to the "new strike" talk conservatively about it, but concede that if Storey & Campbell cut the vein and it shows as well as in other places, prospects will be considerably enhanced.

MAGDALENA, N. M.—Sept. 2

Mining is Active in Socorro County. At Magdalena the older mines are running full force, and there is considerable activity among new properties. A test shipment of mine-run ore was recently made to the El Paso Smelting Works by the Hop Cañon Mining & Smelting Co., with smelter returns of 12.9 oz. silver and 7.02% copper. The company is completing a 1,500-ft. tunnel, and expects to make regular shipments soon. The Wheel of Fortune mine, adjoining on the south, has lately developed a 5-ft. vein of high-grade copper ore. The Black Cloud mine, recently purchased by Wolf & Moore, is shipping 120 tons of zinc sulphide weekly; new hoist and other machinery is being installed. The Calumet-New Mexico Mining Co. and others are pushing developments with a view of early shipments of copper-silver ores.

IOLA, KAN.—Aug. 30

The Zinc-Smelting Business in Kansas and Oklahoma is extraordinarily active. A great deal of common spelter is being redistilled, especially at Caney, Kan., and at some of the works in Oklahoma. Other smelters will probably go in for this also. There is much talk about the proposed plant of the U. S. Steel Corporation at Gary, Ind., which is still "in the air," but the belief is that it will be built sooner or later. Manufacturers of smelting machinery are receiving many inquiries for equipment from England. The ore supply of the Kansas and Oklahoma smelters is bountiful, and ore is being offered from Spain, Australia and Alaska. The chances are that the price for natural gas will be raised this winter. However, the smelters who are using fuel oil have long contracts for it at low prices. This fuel does finely for firing roasting furnaces and boilers, but is not so good nor so cheap as gas when all things are taken into consideration. All of the smelters in this region have added to their capacity and building is going on constantly.

HOUGHTON, MICH.—Sept. 4

Actual Tonnages of Refined Copper from the mines of the Lake Superior district have been generally overestimated so far this year. It is extremely doubtful if this copper district will produce 300,000,000 lb. of copper during 1915, although there is no doubt at all that the rock tonnages handled in the mills of this district will be higher than ever before. With the exception of one stamp mill, the Trimountain mill of the Copper Range Consolidated, every other stamp head in the district is operating to capacity, some of them working three shifts a day and some working on Sundays. The estimates of refined copper output have been ranging from 20,000,000 to 26,000,000 lb. each month. The Calumet & Hecla figures, in particular have been generally overestimated. Some estimates for August for instance run over 7,000,000 lb. As a matter of fact the Calumet & Hecla has not as yet produced 6,500,000 lb. of refined copper during any month this year and the average has been nearer to 6,000,000 than 7,000,000. There is but one way to increase greatly the output and that is to increase the rock tonnage from the conglomerate lode which is running about 30 lb. to the ton. From a mining standpoint that is impracticable. So the increase in the Calumet & Hecla rock tonnage has been coming from the amygdaloid mine and that is not averaging much over 15 lb. to the ton. At the present price of the metal this low grade rock can be mined and milled at a handsome profit. It is doubtful if the mines will show great increase in the percentage of copper return from the rock tonnage mined this year. A noted exception to this is the Copper Range Consolidated; at all three of its mines, the Champion in particular, the grade of rock is higher than at any time in their history. The picking system, in vogue at these mines, is working out satisfactorily, as is the sand-filling system. Champion rock frequently goes over 50 lb. to the ton and 30 lb. is not an unfair average for the Baltic and Trimountain mines. Of the two Stanton mines, the Mohawk is breaking its copper-output record and is raising the percentage of copper in the rock. Practically all the other mines of the district are willing to take a lower grade of rock which they formerly discarded and are now sending it to the mill and making a profit on it at present unusual metal prices.

CHISHOLM, MINN.—Sept. 3

Conditions in the Chisholm District—The Glen stockpile, an accumulation of four years' standing, has all been shipped. The Duluth, Missabe & Northern Ry. has completed trackage into the Oliver property now opening in Sec. 27, connecting with the line to the Monroe mine. The Duncan has completed its allotment, and will stockpile for remainder of the season, although underground operations will proceed as heretofore. The Leonard-Burt has been working a double shift on one shovel loading ore, and on one shovel loading rock and lean material, the latter being transported to the Sec. 27 property for a stockpile bottom. No shipments made thus far from the Myers or Clark stockpiles and only a nominal tonnage from the Chisholm stockpile, although all ore hoisted from these properties is being shipped.

BRAINERD, MINN.—Sept. 4

Stripping on the Cuyuna Range, according to mine inspector's figures for the year ended June 30, 1915, was as follows: Thompson, 60,000 cu.yd.; Armour No. 1, 610,960; Rowe, 2,000,000; Pennington, 115,832; Hill Crest, 161,000; Mahnomen, 49,558; total, 2,997,350 cu.yd. The average number of men employed on the range were: Underground, 540; surface, 314; stripping, 287.

TORONTO—Sept. 4

Another Gold Discovery, near Kowkash, has added to the excitement over the rich strike of gold in Munro Township. Kowkash is about 300 miles west of Cochrane on the Transcontinental Railway. A number of rich samples have been brought to Cochrane resulting in an old-time gold rush. A west-bound train on Sept. 2 carried 200 prospectors, and since then a number of miners have left Toronto for the new field. The first find was made Aug. 21 by E. W. Kirk Dodds who staked three claims. The discovery was made close to the Kowawkagashama, or Kowkash, River about 20 miles from Kowkash station. The county rock is diabase with basalt dikes occurring as intrusives and a broad belt of porphyry parallels the vein system the samples from which are wonderfully rich.

The Mining News

ALASKA

GRANITE (Port Wells)—July cleanup at this new quartz mine was $25,000, the largest since starting about a year ago. W. R. Millard is superintendent.

ELLAMAR (Ellamar)—This copper-gold property working full time and shipping on nearly every boat. L. L. Middlecamp is superintendent.

INDEPENDENT (Willow Creek)—Working 20 men. Four stamps and two concentrating tables are running, and the tailings are impounded for cyaniding later. L. S. Robe, manager.

ALASKA GOLD BULLION (Willow Creek)—Manager Donald Harris has 60 men working in the mine and 7-stamp mill and small cyanide plant. Plant will be increased next season.

TAKU-ALASKA GOLD MINING CO. (Juneau)—Charles Goldstein, F. B. Hyder, J. T. Welch and A. D. Nash have formed company to develop the Taku claims. F. B. Hyder is geologist for the Alaska Gold Mines Co.

FUNTER BAY MINE (Juneau)—W. S. Pekovich is working this property, originally opened by William Hunter as the Uncle Sam claims near Icy Straits. Equipment consists of air compressor, drills and 10-stamp mill. Sinking started on new shaft.

ALASKA FREE GOLD (Willow Creek)—At this quartz property, beyond Knik in the Willow Creek district, 60 men are employed at the mine and a cyanide plant is in operation. Will install water-power plant for next year's run. W. H. Martin in charge.

ALASKA GOLD BELT (Juneau)—First unit of mill planned is to handle 8000 tons. First tunnel, 3000 ft. long to cut the upper part of the orebodies, is in about 1000 ft. and a lower tunnel 9000 ft. long at sealevel will be started later. Company expects to install 1400-hp. hydro-electric plant. A. B. Dodd, in charge.

ARIZONA

Mohave County

ORION (Oatman)—The shaft has been unwatered and active operations begun in the mine.

UNION BASIN (Mineral)—This company, owning the Golconda mine, has entered the dividend-paying class.

CROWN CITY (Oatman)—The Tom Reed company recently purchased the controlling interest in this property.

CARTER (Oatman)—On the 150-ft. level a shoot of ore has been opened just east of the shaft. Drifting continues on the 250-ft. level.

JEROME-OATMAN (Oatman)—Company recently installed a hoist, compressor, drill sharpener and other equipment. Shaft sinking in progress.

GOLD REED (Oatman)—On the 350-ft. level 3½ ft. of good ore was recently opened. Drifts are being driven east and west from the 375-ft. level.

UNITED EASTERN (Oatman)—Twenty tons of ore, derived from development on the 460-ft. and 565-ft. levels, are being shipped daily to the Gold Road mill. West drift on the 565-ft. level carries highest-grade ore yet encountered in the mine.

Pima County

LAS GUIGAS (Tucson)—Regular shipments of tungsten ores are being made and a large force is employed at the mine.

GOLD BULLION (Tucson)—A small concentrating plant has been installed to treat the molybdenum ores from the Last Chance shaft.

Pinal County

NEW KEYSTONE—Stockholders at special meeting, by a vote of 277,354 shares out of 358,174 outstanding, voted to decrease capital stock from $3,000,000 to $20,797, new shares to have a par value of $1. Property recently sold to Inspiration Consolidated Copper Co., which gave in exchange therefor 39,797 Inspiration shares. New Keystone shareholders will be offered one share of new stock for every nine shares now held. Suit recently brought by Carl H. Pforzheimer, to prevent the sale of the property, has been withdrawn.

Yavapai County

TREADWELL and BROOKSHIRE (Jerome)—These holdings, comprising 77 claims, may be developed, deeds having been deposited in escrow in Prescott National Bank preparatory to exploratory campaign by a new corporation.

CALIFORNIA

Eldorado County

STILLWAGON (Placerville)—Property, two miles south of Henry siding on Diamond Springs R.R., is to be reopened. Was worked in the early '60s having a production of $250,000. Development to vertical depth of 400 ft. by tunnel 790 ft. long. Equipped with 5-stamp mill driven by water power, concentrator, electric plant, electric power for drills. George Willis is superintendent.

Kern County

ANTIMONY ORE discovered on Indian Creek in Amalie district by Charles Hart, J. W. Wells and H. S. Phillips. Supplies have been taken in and development started.

BLACK HAWK (Randsburg)—Recent cleanup by D. A. Bine of 7½ tons of ore yielded $2274. Property includes both placer and quartz ground in seven claims situated on east side of Stringer district. This extraction occupied time of two men for 7 weeks. Several hundred dollars was recovered by hand mortaring. This sort of activity has been beginning of much development in this region which has resulted in making producing mines.

Lassen County

COPPER CROPPINGS reported upon property owned by H. Day of Susanville. Ledge has been known for several years and assays of ore have shown high-grade copper and some silver and gold. Distance from railroad has probably caused investors to give it but little attention.

Mendocino County

WILD DEVIL (Redwood)—This manganese property owned by J. A. Weidleufel has been leased to E. A. Wiltsee, of San Francisco and Fred Grotefend, of Redding. Development will begin immediately. Reported that lease requires extraction of a minimum of 10,000 tons of ore per annum and that the royalty is $1.50 per ton. Term of lease 15 years.

Nevada County

HAWKE DREDGE (Nevada City)—New dredge recently installed has been put in commission. Capacity estimated at 500 cu.yd. per day.

SIGNAL (Grass Valley)—Shaft has reached 100-ft. point and disclosed 14-ft. lode. Mine is situated on Slate Creek and owned by E. M. Taylor of San Francisco.

YOU BET (Dutch Flat)—Fong Tai, who recently leased this property from owners, is reported to have taken leases on adjoining properties. Indications are that drift mining will be conducted on large scale.

EAGLE BIRD (Washington)—Installing 10-stamp mill under supervision of C. J. Klinker. Additional 10 stamps contemplated. Mine has been unwatered and it is expected to have stamps dropping within 60 days.

NORAMBAGUA (Grass Valley)—Reported that company to be organized in Grass Valley has examined mine with purpose of taking purchase option. Mine is developed by 190-ft. tunnel and 400 ft. of winzes and 200 ft. drift.

Plumas County

DREDGE INSTALLATION is contemplated at English Bar on middle Feather River above Nelson by J. W. Larson. This bar was in early days a good producer of placer gold.

WALKER COPPER CO. (Portola)—Reported that new concentrating plant will be installed with capacity of 100 tons. Flotation process will be used. Thirty men are employed.

Shasta County

BALAKLALA (Coram)—Reported that 10-year contract has been made with Mammoth Copper Mining Co. for shipment of minimum 200 tons of ore per day to smeltery at Kennett.

STOWELL (Kennett)—Fire on morning of Aug. 19 destroyed change house, compressor building with compressor and motor, and blacksmith shop. Origin of fire unknown. Pumps, being operated by air, were stopped by fire, and mine is filling with water; pumps have been pulled.

FRIDAY-LOWDEN (Kennett)—Road to this mine from Mammoth company's head-house is nearing completion. Will be used for transportation of supplies and shipping-grade ore. Property purchased by Mammoth company eight months ago; force of men employed preparing for campaign of extensive development.

Trinity County

VALDOR (Junction City)—Marysville Gold Dredging Co. has two Keystone drills prospecting this property of Valdor Gold Mining Co. on Trinity River. Expected to install a small dredge.

COLORADO

Boulder County

WISCONSIN MINING & LEASING CO. (Sugar Loaf)—Shaft is 246 ft. deep and company contemplates sinking another 100 ft.

PRUSSIAN-SLIDE (Boulder)—H. J. Sisty has secured control of this property and plans to drive the crosscut tunnel several hundred feet to cut the Slide vein. The Prussian mill is to be placed in operating condition and cyanide equipment will be added.

BOULDER TUNGSTEN CO. (Boulder)—Arrangements made for crosscut tunnel for drainage and transportation. Grading now for portal and necessary mine buildings. Tunnel will cut veins at depths ranging from 400 to 700 ft. Power plant and drilling equipment will be installed. Recent exploration in Forest Home property disclosed rich ore.

Clear Creek County

CONCRETE (Idaho Springs)—Lease granted to Denver men. A drift will be driven on the vein west from the Newhouse tunnel. James T. Stewart in charge.

EDGAR (Idaho Springs)—Boston Mine Leasing Co. has been incorporated to operate this old property of the Big Five Mining Co. Following Boston, Mass., men are officers: William F. Brennan, president; Horace H. Bradley, secretary; Leonard Williams, treasurer.

Gilpin County

BATES (Black Hawk)—Leasing company has retimbered main shaft and resumed usual mining operations. A 22-ton lot of screenings assayed 0.85 oz. gold, 6.80 oz. silver. An 18-ton lot ran 1.72 oz. gold, 25 oz. silver and 2.22% copper.

Teller County

PORTLAND (Victor)—Altice lease, 200 level, is shipping 2-oz. gold ore regularly.

CRESSON (Cripple Creek)—Another rich pocket has been opened; this one is on the 1300 level or below that struck last winter; ore is of similar character.

AJAX (Victor)—Mackay lease, 100 level, continues to develop strong shoot of $30 ore and is shipping regularly. Ore is 4 to 7 ft. thick and exposed 700 ft. along drift.

ANNIE D. (Cripple Creek)—This property, which is located near Ella W. on Tenderfoot Hill, where rich ore was recently found near surface, is now controlled by F. S. Cropper and J. A. Smith of Lead, S. D., who will commence active development work in near future.

SPECIMEN (Victor)—Chellon and associates, operating under lease on 200 level of this Bull Hill property, have opened vein of high-grade ore from 2 to 5 ft. wide, assaying several ounces gold a ton. Bateman-Kelly lease is carrying on development on 400 level and opening ore worth $40 a ton.

IDAHO

Elmore County

MONARCH (Atlanta)—Running 5 Huntington mills two shifts on old dumps. Amalgamation followed by concentration, and roasting and cyaniding of concentrates.

BOISE-ROCHESTER MINING CO. (Atlanta)—This new company has acquired old Bagdad-Chase property, including Old Chunk and Webfoot claims and 40-stamp mill. Vein in Old Chunk opened for 400 ft. Operating 15 stamps two shifts until new Bleichert tram, capacity 100 tons in 10 hr., is installed. H. D. Richardson, superintendent.

Shoshone County

GIANT LEDGE (Murray)—This company has let contract for 215-ft. raise from lower to upper workings.

SILVER CABLE (Mullan)—Raise connecting upper and intermediate workings completed and company will commence ore shipments soon.

HERCULES (Wallace)—After a shutdown of several months on account of smelting difficulties, the mine has resumed work with a full crew of about 400 men.

POLARIS (Kellogg)—Company has given W. E. Mann, of Spokane, five-year lease on property for reported consideration of $20,000. Consists of three patented claims adjoining Yankee Boy on Big Creek. Previous development work, consisting of shafts, drifts, and crosscuts, cost about $35,000.

REX CONSOLIDATED (Wallace and 52 Broadway, New York)—This new company has bonded the Rex mine for $200,000 if paid within five years and $150,000 if paid within one year. Fire in August destroyed compressor house. The company lately acquired control of the Black Bear mine, comprising about 70 acres lying between the Frisco and Mace mines of the Federal company. In the lower tunnel, the vein is 5.7 ft. wide averaging 2.2 oz. silver, 7.76% lead and 16.57% zinc.

YANKEE BOY (Kellogg)—Four sets of lessees are working on Yankee Boy. Big Creek Leasing Co. sinking winze to determine course of vein and govern driving of new crosscut to tap vein at depth of 600 ft. Promising strike made in winze is said to show 16 in. of ore from which have been obtained assays of 50% lead and 900 oz. silver. First ore found by lessees in March, 1914, after $80 ft. of work had been accomplished, and shipments during rest of that year totalled 358 tons, valued at $38,000.

MICHIGAN

Copper

COPPER RANGE (Painesdale)—Capital to be increased to $10,000,000, to absorb subsidiaries, thus making savings in federal corporate tax.

CALUMET & HECLA (Calumet)—All regrinders, including those handling sands from lake, again operating, after partial shutdown owing to damage to turbine.

WHITE PINE (Calumet)—This Calumet & Hecla subsidiary has No. 4 shaft down 930 ft. Will pay back to parent company preliminary outlay in product, this year.

Iron

BALKAN (Alpha)—The first shipment of ore consisted of 51 cars. This was taken out of the pit by the drag lines. More ore is to be loaded before navigation closes, while some will be stocked.

IRON MOUNTAIN LAKE (Ishpeming)—Boilers are being prepared and it is believed sinking of shaft will be resumed shortly. It is also quite likely that another shaft will have to be put down. Considerable ore was developed by drills. Work was stopped last fall when shaft filled with water, which pumps could not handle.

NEWPORT (Iron Mountain)—This company has taken options on Secs. 33 and 34 and one-half of Sec. 28 and will start exploring within 30 days. The lands are one mile north of Quinnesec and a short distance east of Iron Mountain. The field is considered promising. This company has no mines on the Menominee range at present. It has several large properties on the Gogebic.

MINNESOTA

Cuyuna Range

CROFT (Crosby)—Steel headframe being erected.

ROWE (Riverton)—Concentrator operating 24 hours daily. Two shovels also at work.

CUYUNA-SULTANA (Ironton)—Mining and stockpiling about two cars daily. Output will be treated in concentrator which will be completed about Sept. 1.

BREITUNG (Negaunee, Mich.)—Option has been secured on two forties on Cuyuna Range near Brainerd. Work has started on exploratory shaft. Captain George Jewell, of Negaunee, is in charge. Ore was found by owners by drills but Breitung interests want further information before taking lease.

Mesabi Range

HOLMAN (Taconite)—One additional shovel started Aug. 20, making three shovels working day and one night.

CALUMET (Calumet)—This Hill Annex property fast being stripped. One shovel uncovered ore a few days ago. However, there is still a lot of overburden to be removed. Stripping contract was largest ever let on the Mesabi.

TROUT LAKE (Taconite)—Washing plant started to work night shifts in two units, Aug. 27; and expects to have five units working in a few days. The D. M. & N. Ry. is now running one ore train each hour from washing plant.

GENOA (Eveleth)—Two gasoline trammers installed here. Standard equipment removed from the pit, which is one of deepest on range. All ore will be mined by hand and trammed to surface for loading on cars. Orders have been received to ship as much ore as possible.

FAYAL (Eveleth)—Stripping operations were begun at south side of mine this week. About 90,000 tons of dirt and rock will have to be moved to get at 500,000 tons of ore lying underneath. One shovel is stripping. Several are loading ore from other end of pit. Fifty more men have been given work. The 1915 production will slightly exceed that of 1914, which was 1,500,000 tons.

MISSOURI-KANSAS-OKLAHOMA

ANCHOR (Miami, Okla.)—New concentrating plant being erected on the Buck land will be ready in about 30 days. Frank Stansbury, superintendent, Joplin, Mo.

W. D. LYERLE (Galena, Kan.)—Sludge mill nearly ready for operation on the Weymann land in the Short Creek bottoms. Will handle the sand from the creek bed. The sand will be brought in by means of a cableway.

BERTHA A. (Webb City, Mo.)—Will install two new sludge tables; have 12 already in operation. Another improvement is the installation of a 2250-cu.ft., direct-driven compressor, operated by a 350-hp. motor. This is the first direct-driven compressor of this size to be used in the district.

MONTANA

Fulton County

NATURAL-GAS FLOW was opened at Baker at a depth of about 1000 ft., Sept. 1. Much excitement prevails.

Jefferson County

COMET MINES CO.—This company has recently been organized, M. K. Rodgers, of Los Angeles, president, to lease the old Comet mine in the Basin district. Old mill has been repaired and tailings are being treated.

Madison County

AMERICAN MINE (Iron Rod District)—Five hundred dollars in gold taken from this mine by two men in six hours' time is record of Charles and Eugene Dahler who have extracted this amount from the American recently. Bar of gold was brought to Twin Bridges and weighed trifle less than 30 oz., or approximately $500. After hauling 18 sacks of ore to mill it took two hours to run it through and an hour more to retort amalgam. Tailings will bring about $100 more.

Missoula County

INTERMOUNTAIN COPPER (Iron Mountain)—Company is at present engaged in work preliminary to developing Amador mine near Iron Mountain, recently taken over from the Amador Gold & Copper Mining Co. Water was turned through new flume Aug. 1, providing electric power for pump which is now at work lowering water in mine. Is now below 400 level and is expected to be all out by Sept. 1. Frame for new concentrator is up and mill machinery is expected on ground within two weeks, 200-ton ore bins are finished and development work will commence within few days on levels, including and above 400. Two-mile flume provides water for mill and power plant. With completion of improvements property will be capable of producing in excess of 100 tons of ore per day.

Silver Bow County

RAINBOW DEVELOPMENT (Butte)—Unwatering of Rainbow shaft which was begun some days ago, proceeding rapidly; water now down to point below 1000 level, where Poser fault crosses shaft. Present depth of shaft is 1300 ft. and as soon as unwatering is finished, work of sinking to 1500 level will begin.

ANACONDA COPPER (Butte)—Mining operations have been resumed at Tropic mine of this company where force of men has been started taking out ore from upper levels. Tropic shaft is down 900 ft. Development work was in progress when war caused curtailment of production by 50% in company's mines as well as stopping development work in many of properties. Company has also resumed work of unwatering Nettie mine in western district of Butte camp, which was discontinued when war started. Large amount of work must be done over on account of water filling up some of the levels and part of shaft since. Pumping is still going on at company's Lexington mine and there are several hundred feet of water in shaft to be removed. Good progress is being made, however; mine will soon be in readiness for operating.

NEVADA

Humboldt County

ROCHESTER MINES (Rochester)—Has purchased Big Pocket claim on Block 1 of Crown Point claim.

Nye County

QUIGLEY REDUCTION CO. (Bonnie Clare)—This recently organized Los Angeles company has taken three-year lease on 20-stamp mill and properties of Bonnie Clare Mining & Milling Co.

LITIGATION HILL PROPERTIES (Manhattan)—Negotiations are under way toward a combination of three properties on Litigation Hill, the Manhattan Amalgamated, Earl and Litigation Hill Merger companies; the new company is also to control the mill of Manhattan Milling & Ore Co.

MANHATTAN DEXTER (Manhattan)—After several months idleness, leasers are now starting operations on both ends of the Union Nine claim. The large gloryhole covering the site of the Briggs-Evans lease shows considerable tonnage of medium-grade ore, and Mushett and Wittenberg have taken a lease on these blocks and are installing machinery to drive in from the south under the gloryhole and extract the ore at a minimum of cost. The 10-stamp mill and cyanide plant of the Manhattan Milling & Ore Co. will handle the ore from this lease.

Storey County

UNION CONSOLIDATED (Virginia City)—Saved 10 cars ore averaging $34.72 per ton. Union in southwest drift on 2500 level from Sierra Nevada incline saved 23 tons averaging $10 per ton.

MEXICAN (Virginia City)—West crosscut on 2700 level and south drift No. 3 on 2500 level in porphyry and quartz of low assay value. Mill crushed 144 tons low-grade ore and shipped three bars of bullion to smeltery.

JACKET-CROWN POINT-BELCHER (Gold Hill)—In old Belcher ground, 99 ft. below 1500 station, water reached and being easily handled. Saved 56 cars mill ore from 1300 Belcher raise and 27 cars from 1300 Crown Point northeast crosscut.

NEW MEXICO

Bernalillo County

GOLD STAR MINING & MILLING CO. (Albuquerque)—Company has filed articles of incorporation. Joe Delfrate, Old Albuquerque, N. M., is agent.

Dona Ana County

TORPEDO (Organ)—Claims and equipment in Organ Mountains has been purchased by J. I. McCullogh, L. M. Stiles and others of El Paso, Tex. Consideration said to be $350,000. Property has been one of camp's best producers but has been in litigation for many years.

UTAH

Beaver County

UTAH LEASING (Newhouse)—This company is building a plant to treat the tailings from the Cactus mill of the South Utah Mines & Smelters. Flotation will be used and the capacity will be 500 tons. Kirk & Leavell have designed the plant and will use the Minerals Separation process. The tailings carry 13.5 to 14 lb. copper to the ton with some gold and silver. The Utah Leasing Co. formerly worked a cyanide plant at the Old Telegraph mine in Bingham. The tailings will be moved by hand at the beginning, and a drag line will probably be used later. A 10-year lease has been obtained and plant should be ready in 60 days.

Juab County

TINTIC SHIPMENTS for the week ended Aug. 27 amounted to 142 cars.

KNIGHT-DERN MILL (Silver City)—About seventy men are employed on the concrete work, etc., now in progress.

CHIEF CONSOLIDATED (Eureka)—A portable compressor has been sent to the Scotia mine in West Tintic, and will be used in developing water near this property.

VICTORIA (Eureka)—Ore is being mined from the 1200 level, by the Eagle & Blue Bell which recently acquired control; four cars were shipped during the last week of August.

YANKEE CONSOLIDATED (Eureka)—Shaft on new strike down 40 ft. in good ore. Raising being done to reach ore bed from a tunnel 200 ft. lower; air line has been put in and drills are being used.

UTAH MINERALS CONCENTRATING (Eureka)—About 1000 tons of ore from the Chief Consolidated have been treated at this company's mill. Concentrates carrying 61% lead and 15 oz. silver were shipped week ended Aug. 27. Isbell vanners are used.

UTAH ORE SAMPLING (Silver City)—It has been necessary to work the mill here overtime, to take care of the increased tonnage from Tintic mines; 400 tons a day are being sampled and 10 to 12 cars of ore a week of Horn Silver ore, from Frisco, consigned to the United States smeltery at Midvale.

VICTOR CONSOLIDATED (Mammoth)—The hoisting plant was destroyed by fire Aug. 26. Fire started on 300 level where lessees are working, and burned shaft timbers, buildings, etc. Lessees escaped to surface through workings of the Carisa. Damage placed at about $15,000. A. W. McCune, of Salt Lake, owns control.

Salt Lake County

ALTA-GLADSTONE (Alta)—Molybdenite and wulfenite are being mined and sorted at this property, under lease to Fred Redmond. Vein is about a foot wide.

NEW UTAH BINGHAM (Bingham)—Company reports following assay for ore recently cut in drift from Giant Chief shaft: Copper 5.63%, lead 1.3, silver 32.4 oz., gold $2.80.

CARDIFF (Salt Lake)—Production has been increased to 125 tons daily. Utah Power and Light Co.'s line has reached the mine. As soon as transformers are installed, electric power will be used.

SECRET MINING (Alta)—Work of driving main tunnel for quartzite limestone contact is in progress. Face is in quartzite and several hundred feet more work necessary. Two shifts being worked. Property adjoins South Hecla and Albion. Wm. H. Minor is president.

EMMA COPPER (Alta)—Stringers and streaks of ore are being followed in two places, and 50 tons have been accumulated for shipment. Chas. S. Herzig, mining engineer, has been elected director of this company, and is directing development work. Ground lies west of old Emma mine.

SOUTH HECLA (Alta)—The Griffith-Field lease on the Quincy tunnel level is opening up well, and will begin shipments at once. A lease has been taken by the Bamberger Exploration Co., on a block of ground west of the Griffith-Field lease. The South Hecla company is shipping 40 tons of ore a day from the 250 level.

Summit County

PARK CITY SHIPMENTS for week ended Aug. 20, amounted to 3,364,140 lb. by 5 shippers; for the week ended Aug. 27, 3,562,320 lb.

SILVER KING COALITION (Park City)—New orebodies have been opened recently on and below the 1300 level, in the southwestern part of the property; also below the Alliance tunnel from the new shaft. In both places the percentage of sulphides are increasing. The machinery is being installed in the flotation section of the mill.

Utah County

BAY STATE (American Fork)—This property has been inspected by J. H. Wooton and Salt Lake mining men. Further development is to be done.

MILLER HILL (American Fork)—Ore showing galena has been opened in the Rock tunnel by the Williams lease.

TEXAN (American Fork)—Arrangements have been made by Charles Tyng, T. W. Boyer and W. H. Child, to work this property which adjoins the old Miller Hill. The tunnel now in 840 ft. is being extended.

PACIFIC (American Fork)—Ore carrying galena has been encountered in the 1000-ft. lower tunnel, which was being driven to cut the vein. The tunnel had passed the point where the vein was expected, and a raise was put up reaching ore a short distance above tunnel. Five feet of milling ore with streaks and branches of galena have been opened. Connections will be made with upper workings for better ventilation. Strike thought to be important in proving ore extends to depth. Additional men will be worked. Ore of a gross value of $25,000 has been shipped during a period of several years.

Washington County

A DAILY STAGE LINE has been started between Modena and Goldstrike. Stage leaves Modena 7:30 a.m., and arrives Goldstrike 4 p.m. Fare is $5 each way.

GOLDSTRIKE BONANZA (Modena)—New directors were elected at special meeting Aug. 24, as follows: G. E. Hale, I. Pett, A. E. Rykert, T. Marioneau and D. B. Shields.

VIRGINIA

Norfolk County

VIRGINIA SMELTING WORKS (West Norfolk)—Is reported to be contemplating construction of plant for manufacture of byproducts from smelting fumes.

WISCONSIN

Zinc-Lead District

THE WISCONSIN ZINC DISTRICT is making the largest output in its history under the stimulus of the very high prices now ruling, yet there is a larger tonnage of ore in the bins than before of medium to low-grade ores, which latter the buyers are not taking at present. This is causing the erection of several new separating plants that will take out the iron and raise a 25 to 45% concentrate up to 58 to 62% zinc.

CANADA

Ontario

GOLD REEF (Porcupine)—Leasers of this property are taking out good ore, which is treated in two-stamp mill realizing about $500 per week.

PIKE LAKE (Porcupine)—Two shafts are being sunk and are down 40 and 25 ft. respectively. A large porphyry dike crossing one of the claims is being stripped.

UNITED STATES (Cobalt)—Property has been taken over on a six year lease by Genessee Mining Co. recently organized by Rochester capitalists. Shaft now about 60 ft. in depth will be put down to contact expected to be reached at depth of 400 ft.

GIOVINAZZO CLAIMS (Boston Creek)—These three claims are under option to Stewart Thorn and associates. Body of quartz 20 ft. wide by 30 ft. long has been stripped. Gives low assays of gold.

MEXICO

Sonora

CANANEA CONSOLIDATED (Cananea)—Copper production slightly exceeds 3,000,000 lb. monthly. Flotation is being introduced at this works.

AUSTRALIA

South Australia

AUSTRALIAN MANGANESE CO. (Broken Hill, N. S. W.)—This company has opened a high-grade manganese deposit at Pernatty Lake, in South Australia, about 74 mi. from Port Augusta. Property is 4½ mi. from the East-West Ry. and shipments have been made to Broken Hill Proprietary Co., Newcastle.

The Market Report

Metal Markets

NEW YORK—Sept. 8

During the last week all of the principal metals were dull and uninteresting, and there was but little change in prices.

Copper, Tin, Lead and Zinc

Copper—Owing to the holiday, which extended practically from Friday to Tuesday, there was relatively little attention paid to the copper market. There was neither any particular demand nor any pressure to sell. Copper for domestic delivery was freely offered at 17⅜@17½c., regular terms, or about 17.20@17.30c., cash, New York, and some small transactions were reported around those figures. All of the principal producers, including those who are standing out for 18c., regular terms, for domestic deliveries, appear to be courting business abroad and quite willing to meet Australian and Japanese competition. Some consderable business was taken at £85@86, several large sales at the latter figure being reported on Sept. 7 and 8. With the existing situation in sterling exchange, of course nobody can tell what these sales are going to net until settlements are finally made.

An improved sentiment among the principal sellers of copper may be discerned. Certain houses that heretofore have been rather bearish appear recently to have changed their opinion.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19@19¼c. per lb. at mill. The chief maker does not quote base price.

Imports of Copper for the week ended Aug. 21 are reported by the Department of Commerce as follows: Metal, 3,559,405 lb.; in ore and matte, 485,880; total, 4,045,285 lb. Exports for the week were 9,566,132 lb., the larger items being 6,770,690 lb. to France and 1,413,524 lb. to England.

Visible Stocks of Copper in Europe on Aug. 31 are reported as follows: Great Britain, 24,389; France, 5,554; afloat from Chile, 2,650; afloat from Australia, 4,000; total, 36,593 long tons, or 81,968,320 lb.; an increase of 2,479 tons over the Aug. 15 report.

Tin—This market was without special feature. A fair business was done from day to day, but the aggregate volume was light.

Visible Stocks of Tin on Aug. 31, including tin afloat: London, 6,404; Holland, 26; United States excluding Pacific ports, 8,697; total, 15,127 long tons, a decrease of 954 tons during August.

Lead—A few good orders were taken at material concessions in price. The price of the A. S. and R. Co. remains 4.90c., New York, but about all of the independent producers have been selling at concessions of $1.50@2 per ton, and lead is freely obtainable from them.

Spelter—The market has been steady, there having been neither any special buying demand nor selling pressure. Spelter for September delivery appears to be in fairly liberal supply, but there are not yet any signs of unsold stocks accumulating. September spelter is easily to be had at 14c., October at 13½c., and November-December at 13c. Sales of brass special were made at 15c.

Zinc Sheets—Business has been on a considerable scale. The base price for carload lots is unchanged at $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

NEW CALEDONIA

Exports from New Caledonia for May and the five months ended May 31 are reported by the "Bulletin du Commerce" of Noumea as follows, in metric tons:

	May	Five Months
Nickel ore	2600	34,228
Chrome ore	....	8,541
Nickel matte	500	609

The matte reported in May was all consigned to New York.

Spanish Metal and Mineral Exports five months ended May 30 are reported as follows, by "Revista Minera" in metric tons:

	Metals		Ores, etc.	
	1914	1915	1914	1915
Iron	6,915	57 514	3,218 872	1,787,947
Copper	8,660	6,072	62 941	21,152
Copper precipitate	4,757	4,355		
Lead	68,406	60,424	1,260	293
Zinc	962	1,450	39 790	9,371
Quicksilver	827	699		
Manganese			6,449	2,327
Pyrites			1,354,582	628,160
Salt			288,955	206,116

Imports of coal for the five months were 594,901 tons, a decrease of 538,220 tons from 1914; imports of coke, 80,573 tons, a decrease of 80,545 tons.

DAILY PRICES OF METALS IN NEW YORK

Sept.	Sterling Exchange	Silver, Cts. per Oz.	Copper		Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.		Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
2	4 5800	47¼	17½ @ 17¾		33¼	4 85 @ 4 90	4 70 @ 4 75	13.50 @14.50
3	4 6500	48⅛	17½ @ 17¾		33¼	4 85 @ 4 90	4 70 @ 4 75	13.25 @14.25
4	4 6700	48½	17½ @ 17¾		33¼	4 85 @ 4 90	4 70 @ 4 75	13.00 @14.00
6								
7	4 6600	48⅝	17½ @ 17¾		33¼	4 80 @ 4 85	4 70 @ 4 75	13.00 @14.00
8	4 6225	48¼	17½ @ 17¾		33¼	4 80 @ 4 85	4 65 @ 4 70	13.00 @14.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0 17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0 20c. on domestic business. The price of electrolytic cathodes is 0 05 to 0 10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6 3c.; St. Louis-Pittsburgh, 13 1c.

LONDON

Sept.	Silver	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic £ per Ton	Copper: Electrolytic Cts. per Lb.	Tin: Spot	Tin: 3 Mos.	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts. per Lb.
2	23 3/16	68½	69½	84½	17.44	153¼	155	22 10/16	4 63	72	15.71
3	23 3/16	67⅞	68⅞	84½	17 44	154¼	155¾	23 1/16	4 78	72	15 94
4	23½	.	.	....							
6	23 13/16	66	67¼	82½	17 03		154	22⅝	4 76	72	16 01
7	23⅝	66¼	67½	82½	17 03	52½	154	22⅝	4 76	72	15 98
8	23⅝	67¼	68⅛	82½	17 03	52½	154	22 10/16	4 75	72	15 85

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver, which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, prices for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4 80: £15 = 3 21c.; £20 = 4 29c.; £30 = 6.13c.; £40 = 8.57c.; B60 = 12 85c. Variations, £1 = 0 213c.

NEW YORK—Sept. 8

Aluminum—Demand continues good. The stocks of foreign metal here have been drawn down pretty low, and prices are advancing. Quotations are 45@50c. per lb. for No. 1 ingots, New York.

Recent London quotations are £180@190 per long ton of No. 1 ingots—equal to 40.2c. per lb.—a price double that of a year ago.

London reports that, by a recent Government order, the exportation of aluminum salts from Norway has been prohibited.

Antimony—The market has been quiet, with only small transactions. Sales of ordinary brands have been made, mostly in small lots, at 28@29c. per lb.; while 44@46c. per lb. is asked for Cookson's.

Nickel—Quotations for ordinary forms are 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

A late London quotation is £225 per ton, equal to 48.8c. per lb., for metal 98% pure.

Quicksilver—The market has been rather quiet. New York quotations are $89 per flask of 75 lb. for large lots and $90 for smaller orders. San Francisco price is telegraphed at $87.50@90, with market quiet. London price is lower at £17 per flask, with the same figure quoted from second hands.

Minor Metals—Current sales of **Bismuth** are at $2.75@3 per lb., New York.—**Cadmium** is quoted at 6s., or $1.44 per lb. in London; $1.25 per lb. New York.—**Tellurium** is quoted at 80s., or $19.20 per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50 @ 5 for retail lots.

Gold, Silver and Platinum

NEW YORK—Sept. 8

Gold and Silver Movement in the United States seven months ended July 31 as reported by the Department of Commerce:

	Gold		Silver	
	1914	1915	1914	1915
Exports....	$117,643,959	$9,774,262	$20,463,126	$28,814,816
Imports....	31,135,137	162,187,374	13,830,568	18,744,541
Excess. .	E $83,508,822	I $152,413,112	E. $15,632,558	E. $10,070,275

Exports of merchandise for the seven months in 1915 are valued at $1,969,787,495; imports, $1,008,909,441; excess of exports, $960,878,054. Adding the gold and silver gives $818,535,217 as the net export balance.

Another large shipment of gold from London was received at New York last week, coming by way of Halifax.

Sales of gold from the New York Assay Office in July were $1,987,000. For the seven months ended July 31 sales were $19,087,928 in 1914, and $16,060,360 in 1915; a decrease of $3,027,568 this year.

Platinum—There has been a sharp advance due to short supplies. Refined platinum, which sold early in the week at $42, is now quoted at $48@50 per oz. The advance is considered temporary, and the arrival of any new supplies would be followed by a fall.

Silver has ruled steady for the past week owing to better demand both in foreign and domestic markets, closing steady at 23⅝d. in London.

A shipment of $400,000 Mexican silver dollars was received in New York, Sept. 7, from Spain. This is an unusual course for such a shipment.

Zinc and Lead Ore Markets

JOPLIN, MO.—Sept. 4

Blende, high price, $89; base per ton, 60% zinc, premium ore, $86; medium, $85@81; lower grades, $80@75; calamine, base per ton, 40% zinc, $78@50; average, all grades of zinc, $81.40 per ton. Lead, high price, $52; base price, $50 per ton of 80% metal content; average, all grades of lead, $49.97 per ton.

SHIPMENTS, WEEK ENDED SEPT. 4

	Blende	Calamine	Lead	Values
Totals this week	10,924,130	$71,230	1,252,060	$511,350
Totals this year	385,716,410	31,092,810	59,468,720	16,888,660

Blende value, the week, $451,360; 36 weeks, $14,629,230.

Calamine value, the week, $28,710; 36 weeks, $689,300.

Lead value, the week, $31,280; 36 weeks, $1,570,130.

A very weak mid-week market closed strong, with buyers in the market for an increased tonnage. Of the week-end purchases but few carloads were shipped. One company picked up from 2,000 to 2,500 tons the last two days, and others had increased purchasing orders. Moyer, of the Western Federation is in the field endeavoring to strengthen the local miners' union and establish an affiliation, promising unlimited support in case of another strike. On the agreement to base the wage scale on average ore prices of preceding month a reduction in the wage scale of 50c. per day was common today. Some fear a strike, and are prepared to meet it as before by making no endeavor to operate.

PLATTEVILLE, WIS.—Sept. 4

The base price paid this week for 60% zinc ore was $85 down to $80 per ton at the week end; medium grades sold from $80 down to $70 base. No sales of lead ore were reported.

SHIPMENTS, WEEK ENDED SEPT. 4

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,027,000	.....	420,900
Year	129,303,440	4,463,160	18,728,710

Shipped during week to separating plants, 4,892,210 lb. zinc ore.

OTHER ORES

Molybdenum—Reports apparently well authenticated say that $1.25 per lb. has been paid in New York for concentrates carrying 80% MoS_2. Heretofore 90% has been the usual standard. Recent London quotations are 117s.@120s. per unit for molybdenite carrying 90% $Mo.S_2$ or over.—**Tungsten** ore has again advanced. Recent London quotations are 55s. per unit for Wolframite, 70% WO_3; the same price for scheelite of the same grade. In New York $28 per unit has been paid for concentrates carrying 55% WO_3, for immediate delivery. It is understood that buyers are no longer insisting on material free from copper. These prices work out nearly on a parity.

Iron Trade Review

NEW YORK—Sept. 8

The iron and steel trades continue extremely active, and demand for various products is on the increase. How much of this is domestic business and how much is war order or munition business for export is rather hard to determine. Concerns receiving foreign orders are rather reticent about them and details are not to be had in most cases.

There is no doubt, however, that domestic buying is improving and that there is more demand on several lines, notably in structural steel, bars and plates.

Pig iron continues to show strength and there is an increasing call for steel making irons, some large contracts having been placed for basic. Foundry demand is also on the increase.

Some of the speculative iron—chiefly Southern—bought at low prices a few months ago is now coming out at the higher levels which have been reached.

Exports from Baltimore for the week included 3,557,400 lb. wire rods and steel billets to Liverpool; 453,600 lb. pig iron to Rotterdam.

FERRO-ALLOYS

Ferrosilicon—London quotations range from £10 10s. up to £14 10s., according to percentage of carbon.—**Ferrotungsten** is quoted at 6s. 6d.@7s. per lb., for alloys 75 to 85% tungsten and not over 1% carbon.—**Ferrochrome** is £25 10s. up to £30 per ton, the high price being for 4-6% carbon.—**Ferromolybdenum** is 18s.—$4.50—per lb for metal 70 to 80% pure.

Pittsburgh quotations for **Ferrosilicon,** 50%, are $73 per ton at furnace.—**Ferrochrome** 4-6% carbon, 20c. per lb.—**Ferrotitanium,** 8@12½c. per lb., according to grade.—**Ferrotungsten,** $3@3.50 per lb. of contained alloy.—**Ferrovanadium,** $2.25@2.30 per lb. of contained alloy.—**Ferromolybdenum,** nominal, none to be had. All prices are for large lots.

PITTSBURGH—Sept. 7

A very interesting news item just being given out is that the Jones & Laughlin Steel Co. is about to build at once a pipe department at its Aliquippa works. This will round out the Aliquippa works as originally projected, the tinplate and wire departments having been in operation for several years. The new department will contain a skelp mill, with two butt-weld and two lap-weld furnaces.

The steel market is firm and active, but has shown no material improvement over conditions existing in August. As that month is usually dull, with September showing an improvement, the general expectaton is for increased activity as September wears along. Steel prices are firm and show an advancing tendency, though there have been no clear-cut advances in the past week. The 1.35c. price is being very firmly maintained on bars, while shapes are firmer at that figure and plates are approaching the level, there being few plate quotations at under 1.30c. Wire products are very strong, with the usual fall demand in the domestic trade coming on top of an already heavy export demand, and a definite shortage in barb wire is expected. Blue annealed sheets are

very firm at 1.50c., showing an advance of $3 a ton within three weeks, black sheets being firm at 1.90c., an advance of $2 a ton in the same time, while openhearth are quoted at 1.95c. Galvanized sheets are stiffer with the recent spelter advance, but demand continues very light.

It is reported that railroads are very seriously considering their steel needs for next year, as with so much export steel already contracted for extended deliveries there are distinct possibilities of a decided shortage in steel. Even rails, which for years have always been obtainable in any tonnage and for any delivery desired, may be scarce on account of so many rail mills being engaged in rolling large rounds for shrapnel and other shells.

The steel trade has not been seriously concerned over the recent sharp declines in sterling exchange. By far the major part of the steel sold for export has been in dollars and not in pounds sterling. Even in sales for London settlement the profits have been such that the fluctuations in exchange do not mean as much as might be supposed. The steel trade regards the steel it has been selling for export as so necessary that it expects exchange matters to be so adjusted that the business can be continued without any interruption whatever.

Pig Iron—The market has been rather quiet the past week. Sellers are rather reserved and there is not much inquiry. Bessemer advanced 25c. on a 3,000-ton sale for export, at $15.75, Valley, while some small lots have gone at $16. Some sellers have advanced their quotation on basic to $15, but there are still sellers at $14.50, and some off basic has been sold at such low prices as to make the $14.50 quotation on standard look otherwise than absolutely secure. Furnaces are quoting foundry iron at $14.50, furnace, for this year and $15 for the first half of next year, but odd lots can sometimes be picked up at slight concessions. W. P. Snyder & Co. announce the average realized prices on bessemer and basic iron in August, in lots of 1,000 tons and over, at $15.064 for bessemer, an increase over the July average of $1.073, and $14.364 for basic, an increase of $1.405. The market is quotable as follows: Bessemer, $15.75@16; basic, malleable and No. 2 foundry, $14.50@15; gray forge, $14.25@14.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The steel trade does not seem to be particularly uneasy about its future ferromanganese supplies, and appears to have fair stocks. It is claimed in some quarters that some material being sent to this country is being sold in prompt lots at ruling prices instead of being applied as deliveries on low-priced contracts. The prompt market is $100@110, fluctuating almost from day to day, while the contract market is nominally $100, Baltimore.

Steel—Still more fancy prices are being paid for openhearth billets, ranging between $25 and $26, Youngstown, equivalent to about $1 more delivered Pittsburgh. There is scarcely any demand for bessemer billets, which are nominally quotable at slightly less than openhearth, while there is no inquiry for sheet bars, which are unquotable, as mills would hardly sell sheet bars at less than billets, while on the other hand sheet and tinplate prices realized are such that mills could not afford to buy sheet bars at anything like the prices being paid for openhearth billets. Rods are scarce and quoted $28@30, Pittsburgh.

SAULT STE. MARIE CANALS

The total tonnage passing through the Sault Ste. Marie canals in July was 9,719,237 short tons. For the season to Aug. 1 the total tonnage was: Eastbound, 20,472,730 tons; westbound, 6,390,641; total, 26,863,371 tons, an increase of 1,182,398 tons over last year. The mineral freights included in the totals were, in short tons except salt, which is in barrels:

	1914	1915	Changes
Anthracite	1,133,532	994,226	D. 139,306
Bituminous coal	5,906,840	4,781,615	D. 1,125,225
Iron ore	14,739,927	18,097,758	I. 3,357,831
Pig and m'f'd iron	142,116	95,595	D. 46,521
Copper	30,087	63,290	I. 33,203
Salt, bbl.	403,331	297,406	D. 105,925

Iron ore this year was 67.4% and coal 21.5% of the totals. The number of vessel passages was 8547, showing an average cargo of 3144 tons.

IRON ORE

It is stated that contracts for Lake Superior ore have been placed with eastern Pennsylvania furnaces to a total of about 500,000 tons. The ores bought were chiefly Mesabi nonbessemers, and the price figures at about 8c. per unit of iron, delivered to furnaces.

Imports at Baltimore for the week included 24,450 tons manganese ore from Brazil.

Exports of manganese ore from India in May were 21,953 tons, against 71,819 tons in May of last year.

Shipments of Lake Superior iron ore in August were 8,081,117 long tons, an increase of 2,211,640 tons over August, 1914. The total shipments to Sept. 1 were 26,806,120 tons, an increase of 5,528,313 tons, or 26%, over last year.

British Imports of Iron Ore, six months ended June 30, were 3,060,639 long tons in 1914, and 3,063,515 tons in 1915; an increase of 2876 tons this year. Imports of manganese ore were 211,465 tons in 1914, and 134,526 in 1915; a decrease of 109,939 tons this year.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 391,310 short tons; shipments, 388,107 tons. The production of the Greensburg and Upper Connellsville districts was 42,905 tons.

The Lackawanna Iron & Steel Co. is installing a plant for the recovery of benzol at its byproduct coke ovens at Lebanon, Penn., with an output of about 1600 gal. a day. The plant will be ready for operation in November.

The coal report of the Geological Survey gives the total production in the United States for two years past as follows, in short tons:

	1913	1914	Changes
Anthracite	91,524,922	90,821,507	D. 703,415
Bituminous	478,435,247	422,703,970	D. 55,731,327
Total	569,960,219	513,525,477	D. 56,434,742

The decrease in the production of bituminous coal was generally distributed over the country, but there were seven states in which the production in 1914 was greater than in 1913—North Dakota, South Dakota, New Mexico, West Virginia, Kentucky, Michigan and Oregon.

Exports and Imports of Fuel in the United States in the fiscal year ended June 30 are reported by the Department of Commerce as below, in long tons:

	Exports		Imports	
	1913–14	1914–15	1913–14	1914–15
Anthracite	3,959,114	3,682,188	8,124	12,358
Bituminous	15,794,966	14,412,995	1,358,002	1,429,608
Coke	7,2,476	602,473	112,541	88,865
Bunker coal	7,851,913	7,062,653	.....	.....
Totals	28,218,469	25,760,309	1,478,667	1,530,771

The bunker coal, or coal furnished to steamships in foreign trade is practically all bituminous. The larger part of the trade, both exports and imports, is with Canada.

Chemicals

NEW YORK—Sept. 8

Conditions in the general market have not changed in any noteworthy degree since last week.

Arsenic—Business is not on a large scale, but the market is inclined to be firm. Prices are about $3.50 per 100 lb. for large lots, up to $4 per 100 lb. for small orders.

Copper Sulphate—On a steady market there has been fair sales. Quotations are $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is inclined to be strong, and no change in prices is reported. September deliveries are quoted at 2.42½c. per lb., while 2.45c. is named for futures.

PETROLEUM

New oil wells completed in August are noted as follows in the monthly statement of the "Oil City Derrick": Pennsylvania grade, 376; Central Ohio, 74; Lima-Indiana, 34; Kentucky, 4; Illinois, 71; Mid-Continent, 363; Texas-Louisiana, 154. In all 1,076 wells were completed in the fields covered by the review. The new production credited to the completions was 97,850. The figures give an increase of 94 in the wells as compared with July, and a decrease of 35,923 in new production. Among the completions were 248 dry holes and 155 gas wells. At the close of August there were 438 rigs up and 1,554 wells drilling.

Recent "Commerce Reports" state that the Standard Oil Co. of New York is about to open up in business on the east coast of Sumatra. Sites for large godowns have been selected at Belawan, Loebong, Pakam, Tebing Tinggi, Perbangan, Bangan Poerba, Sinantar, Tandjong Balei, and even at Langsar and Kota Radja. The construction work will be undertaken by the West Java Engineering Co., and will be completed by the end of 1916. The headquarters of administration in the Dutch East Indies will be at Batavia. The Standard Oil Co. is contemplating developments in Sumatra on a large scale.

Assessments

Company	Delinq	Sale	Amt.
Belmont Shawmut	Aug. 10	Sept. 10	$0 003
Bonanza Con., Utah	Sept. 15	Oct. 6	0 015
Buffalo, Nev	July 22	Sept. 10	0 003
Bullion, Ida	Aug. 30	Sept. 25	0 005
Cash Boy, Nev	Sept. 29	Oct. 30	0 01
Cedar Creek, Ida	Aug. 28	Sept. 29	0 005
Comet, Ida	Aug. 30	Sept. 30	0 0005
Con Virginia, Nev	Sept. 28	Oct. 19	0 025
Copper Chief, Ida	Aug. 30	Sept. 25	0 005
Gethin Le Roy, Utah	Sept. 25	Oct. 13	0 01
Goldstrike M. & L., Utah	Oct. 1	Oct. 20	0 01
Great Bend, Nev.	Sept. 10	Oct. 10	0 01
Hancock Cons, Mich.	Sept. 1		1 00
Hancock Cons., Mich	Jan. 3		1 00
Happy Day, Ida	Aug. 26	Sept. 30	0 0025
Hector, Ida	Sept. 4	Oct. 4	0 005
Hennessy-Burns, Ida	Aug. 20	Sept. 24	0 005
Honolulu, Ida	Aug. 24	Sept. 13	0 0035
Idaho Los Angeles, Ida	Sept. 3	Sept. 25	0 005
Idaho Montana, Ida	Sept. 3	Sept. 25	0 001
Idaho Nevada, Ida	Sept. 7	Oct. 1	0 002
Imperial, Ida	Aug. 31	Oct. 1	0 005
Keweenaw, Mich	Sept. 1		1 00
Laelede, Ida	Sept. 3	Sept. 27	0 003
Lake Superior & West., Ariz.			0 02
LeRoy, Ida	Sept. 25	Oct. 25	0 002
Liquidator, Ida	Aug. 28	Sept. 28	0 003
Lucky-Calumet, Ida	Aug. 27	Sept. 27	0 005
MacNamara, Nev	Aug. 23	Sept. 13	0 02
Nevada-Douglas, Nev	Sept. 27	Oct. 20	0 10
New Arcadian, Mich.	Dec. 1		0 50
New Baltic, Mich	Jan. 15		0 50
New Quincy, Utah	Sept. 2	Sept. 23	0 01
Northern Light, Ida	Nov. 2	Dec. 2	0 004
Old Veteran, Ida	Sept. 2	Sept. 30	0 002
Oom Paul, Ida	Aug. 28	Sept. 28	0 01
Oom Paul Con, Ida	Aug. 30	Oct. 4	0 01
Phedora, Ida	Sept. 21	Oct. 21	0 0005
Phoenix, Mich	Sept. 1		1 00
Phoenix, Mich	Jan. 1		1 00
Revelator, Utah	Oct. 4	Oct. 25	0 004
Royal, Ida	Sept. 1	Oct. 1	0 001
Sandstorm Kendall, Nev	Aug. 23	Sept. 27	0 01
Selma Utah	Sept. 8	Sept. 25	0 005
Snowshoe, Ida	Aug. 26	Sept. 27	0 005
Sunset Dev., Wash	Aug. 25	Sept. 18	0 002
Syndicate, Utah	Sept. 11	Oct. 2	0 001
Tonopah Bonanza, Nev	Sept. 13	Oct. 11	0 01
Tonopah Midway, Nev	Aug. 18	Sept. 18	0 01
Union Cons, Nev	Aug. 24	Sept. 14	0 05
White Caps, Nev	Aug. 14	Sept. 18	0 015

Stock Quotations

There were no sales at auction reported in either New York, Boston or Philadelphia during the week ended Sept. 8.

COLO. SPRINGS Sept. 7		SALT LAKE Sept. 7	
Name of Comp.	Bid.	Name of Comp.	Bid
Acacia	.02½	Beck Tunnel	.06½
Cripple Cr'k Con.	$ .009	Black Jack	.08½
C. K. & N.	.03	Colorado Mining	.09½
Doctor Jack Pot	.09½	Crown Point	.00½
Elkton Con.	.25	Daly-Judge	6 00
El Paso	.76	Gold Chain	.15
Findlay	.02½	Grand Central	.51
Gold Dollar	$ .02	Iron Blossom	.65
Gold Sovereign	.03	Little Bell	$ .10
Golden Cycle	1.76	Lower Mammoth	.02½
Isabella	.17½	Mason Valley	2 00
Jack Pot	.06½	May Day	.17
Jennie Sample	$ .02	Opohongo	$ .00½
Jerry Johnson	.04½	Prince Con	.64
Lexington	.005	Seven Troughs	.01½
Mary McKinney	.35	Silver King Coal'n	3 27½
Pharmacist	.008	Silver King Con.	2 27½
Portland	1 51	Sioux Con.	.01
Raven B. H	.02½	Uncle Sam	.05½
Vindicator	1 60	Yankee	.22

TORONTO Sept. 7			
Bailey	.04	Dome Exten.	.25
Conlagas	1.00	Foley O'Brien	.27
Peterson Lake	.19	Hollinger	24 50
Right of Way	.02	Imperial	.05
Seneca Superior	.78	Jupiter	.13
Silver Queen	.03	McIntyre	.48
T. & Hudson Bay	20.00	Pearl Lake	$ .00½
Timiskaming	.82	Porcu Crown	.70
Wettlaufer-Lor	.05	Preston E. D.	.04½
Dome Mines	21.50	Rea	.09

SAN FRANCISCO Sept. 7			
Comstock Stocks.		Mise. Nev. & Cal.	
Alta	.06	Belmont	$ 3.75
Andes	.09	Jim Butler	.80
Best & Belcher	.06	Lone Star	.04
Caledonia	.60	MacNamara	.01
Challenge Con.	.05	Midway	.10
Chollar	.03	Mont.-Tonopah	.25
Confidence	.15	North Star	.11
Con. Virginia	.15	Rescue Lula	.06
Gould & Curry	.04	West End Con.	.55
Hale & Norcross	.05	Atlanta	.27
Julia	.03	Booth	.42
Mexican	.50	C.O.D. Con	.03
Occidental	.79	Comb. Frac	.08
Ophir	.24	D'field Daisy	.03
Overman	.10	Jumbo Extension	1.40
Potosi	.03	Pitts.-Silver Peak	.06
Savage	.05	Round Mountain	.42
Sierra Nevada	.20	Sandstorm Kendall	.10
Union Con	.46	Silver Pick	.08
Yellow Jacket	.15	Central Eureka	.14

N. Y. EXCH. Sept. 7	
Name of Comp.	Clg.
Am.Sm.&Ref.,com	81½
Am. Sm. & Ref., pf.	106½
Am. Sm. Sec., pf. B.	81
Anaconda	71½
Batopilas Min.	1½
Bethlehem Steel	290
Bethlehem Steel, pf.	140½
Chino	45½
Colo. Fuel & Iron	47
Crucible Steel	84½
Federal M. & S., pf.	45
Great Nor., ore, ctf.	41½
Guggen. Exp.	65½
Homestake	117
Inspiration Con.	35
Mex. Petroleum	82½
Miami Copper	27½
Nat'l Lead, com.	65
National Lead, pf.	112
Nev. Consol.	14½
Ontario Min.	3
Quicksilver	3
Ray Con.	22½
Republic I&S, com.	42½
Republic I&S, pf.	101½
SlossSheff'd, com.	50
Tennessee Copper	55
Utah Copper	67
U. S. Steel, com	74½
U. S. Steel, pf.	112½

N. Y. CURB Sept. 7	
Alaska Juneau	12½
Alta Con	.34
Beaver Con	.27
Big Four	.05
Blue Bell	.02
Braden Copper	7½
Buffalo Mines	2
Can. Cop. Corpn.	15/16
Cashboy	.05
Chambers Ferland	.13
Chile Cop.	18½
Con. Ariz. Sm.	1 1/16
Con. Coppermines	1½
Con. Nev.-Utah	2
Dia. Black B.	.02
Florence	.47
Goldfield Con.	1 5/16
Goldfield Merger	.18
Greene Cananea	39½
International Nickel	190
Kennecott Cop.	54½
Kerr Lake	3½
La Rose	7/8
Magma	15½
McKinley-Dar-Sa	.24
Mines of Am.	12½
Nevada Hills	.19
New Utah Bingham	3½
Nipissing Mines	6
Oro	.06
St. Joseph Lead	12½
South Utah	.15
Stand'd Oil of N.J.	$448
Standard S. L.	1 9/16
Stewart	1½
Success	.95
Tonopah	6
Tonopah Ex.	2 5/16
Tonopah Merger	.35
Tribullion	1/4
Tularosa	1/4
Yukon Gold	2½

LONDON Aug. 26	
Alaska Tre'dwell	£6 17s 6d
Burma Corp.	1 13 9
Cam & Motor	0 12 0
Camp Bird	0 5 0
El Oro	0 7 3
Esperanza	0 7 3
Mexico Mines	3 11 3
Nechi, pfd.	0 12 3
Oroville	0 14 9
Santa Gert'dis	0 7 6
Tomboy	1 0 3
Tough Oakes	0 6 6

BOSTON EXCH Sept. 7	
Name of Comp	Clg.
Adventure	1½
Ahmeek	390
Alaska Gold M	32½
Algomah	2½
Allouez	53½
Am. Zinc	53½
Ariz. Com., ctfs.	8
Bonanza	.35
Butte-Balaklava	3½
Butte & Superior	65½
Calumet & Ariz	62½
Calumet & Hecla	545
Centennial	16½
Cliff	‡ 90
Copper Range	53½
Daly West	2½
East Butte	12
Franklin	8½
Granby	81½
Hancock	16½
Hedley	26
Helvetia	33
Indiana	5
Island Crk, com.	48
Island Crk, pfd.	80
Isle Royale	25½
Keweenaw	2½
Lake	13½
La Salle	5½
Mass	10
Mayflower	3
Michigan	2½
Mohawk	72
New Arcadian	92
North Butte	29½
North Lake	1½
Ojibway	1½
Old Colony	3
Old Dominion	54
Osceola	80
Quincy	82
Santa Fe	2½
Shannon	7½
Shattuck-Ariz.	25
Superior	26
Superior & Bost.	2½
Tamarack	52½
Trinity	3½
Tuolumne	.45
U. S. Smelting	40
U. S. Smelt'g, pf.	46½
Utah Apex	3½
Utah Con	12½
Victoria	2½
Winona	3
Wolverine	63
Wyandot	1½

BOSTON CURB Sept. 7	
Alvarado	$ .50
Bingham Mines	7½
Boston Ely	.20
Butte & Lon'n Dev	.34
Calaveras	11
Calumet-Corbin	.03
Chief Con	.92
Cortez	.45
Crown Reserve	.32
Davis-Daly	1½
Eagle & Blue Bell	1½
First Nat. Cop.	2 9/16
Houghton Copper	2½
Iron Cap Cop., pf.	5
Majestic	45
Mexican Metals	.21
Nevada-Douglas	.56
New Baltic	3
Ohio Copper	.10
Oneco	1
Raven Copper	.12
Rex Cons.	.52
Smuggler Dev.	.15
So. Lake	6½
Tonopah Victor	.25
Trethewey	11
United Verde Ext	5 1/16

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.855	28 983	26 553	22.731
February	61 642	57.506	48.477	28 357	26 573	22.753
March	57 870	58.067	50.241	26 669	26 788	23.708
April	59 499	58 519	50.250	27 416	26.958	23.709
May	60 361	58 175	49.915	27 825	26.704	23.570
June	58 990	56.471	49.034	27 199	25.948	23.267
July	58 721	54 678	47.519	27 074	25 219	22.597
August	59 293	54 344	47.163	27 335	25 979	22 780
September	60 640	53.290		27 986	24 200	
October	60 793	50.654		28 083	23 199	
November	58 995	49.082		27 263	22.703	
December	57 760	49.375		26 720	22 900	
Year	59 791	54 811		27 576	25 314	

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

COPPER

Month	New York Electrolytic		London Standard		London Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14 49	14 394	65.259	63.494	70 188	*
March	14.131	14.787	64.276	66.152	69 170	*
April	14 211	16.811	64.747	75.069	69.313	*
May	13.99	18.506	63.182	77.600	67.786	*
June	13.669	19.477	61.336	82.574	66 274	95.333
July	13.223	18.796	60.540	76.011	64 055	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*		‡		‡	
October	*		‡		‡	
November	14 739		53 227			
December	12 801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48 426	173 619	180.141
April	36.154	47 884	163.963	166.225
May	33 360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37 425	142.517	167.080
August	*	34.389	‡	151.440
September	32.675		‡	
October	30.284		‡	
November	33.304		149.391	
December	33.601		147.102	
Av. year	34.301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4 011	3.548	19.665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3 738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828		3 658		‡	
October	3.528		3 384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21.413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4 967	9.837	21.569	49.888
May	5 074	14.781	4 924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	19.026	4 770	18 856	21.568	97.250
August	5 568	12.781	5.418	12.611	‡	67.786
September	5 380		5.230		‡	
October	4 909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15 06	14.55	14.12	13.45	14 08	13.90
March	15 07	14.55	13 94	13.45	14.10	13.95
April	14.90	14.55	13 90	13.45	14 13	13.95
May	14.90	14.61	13 90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14 90	14.94	13 90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14 08	14.75
September	14 90		13 90		14 03	
October	14.84		13 75		13.97	
November	14.59		13 43		13.83	
December	14.70		13.45		13.81	
Year	$14 88		$13 78		$14.01	

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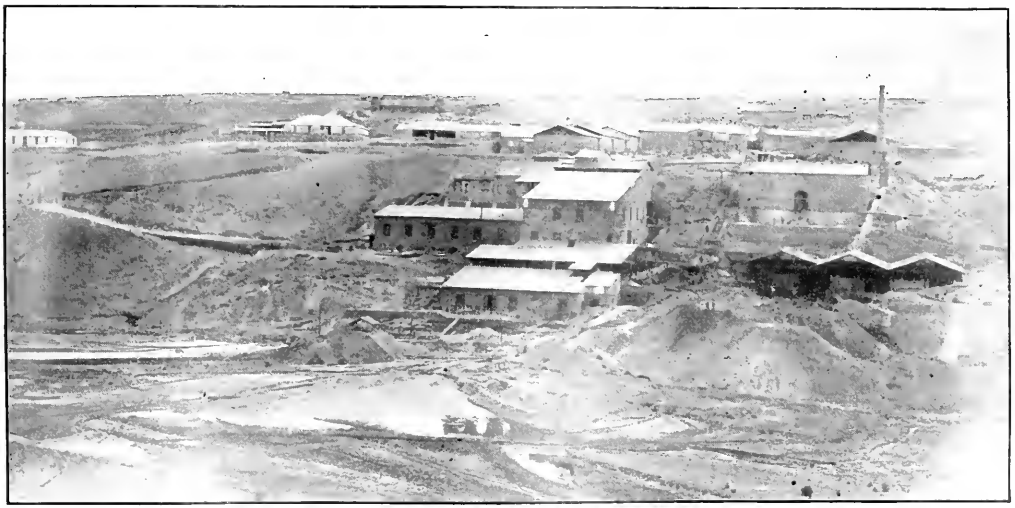
Tin-Ore Dressing at Llallagua, Bolivia—I

By Durward Copeland* and Scovill E. Hollister

SYNOPSIS—Both oxidized and sulphide ores at Llallagua are concentrated on jigs and tables; pyritic middlings are roasted and separated magnetically, the magnetic material being reground and concentrated on tables. The tin occurs as cassiterite in both classes of ores. Operating conditions are expensive on account of high transport charges.

When we were about to leave the United States in 1913 to enter the employ of the Compañia Estañifera de Llallagua, we made some small search of the literature on Bolivia. There were articles on mining and mining equipment, and on milling with pictures of Indians turning a pestle on a stone platform, giving us an illustration of the industry as practiced shortly after the time of Adam.

Having since seen the place from which about one-half of Bolivia's tin comes, we have wondered at the experiences of those whose writings we found. The altitude (about 13,000 ft.) caused us little if any trouble, and among our acquaintances few have been affected. Of course the height above the sea is a convenient and ever-present factor to shoulder the blame for the ill effects of too much food or liquor, two things commonly given every opportunity to do their work by those who come to Bolivia



THE CONCENTRATING PLANT AT LLALLAGUA, BOLIVIA

the subject of Bolivia to find out what conditions—technical, social, climatic and otherwise—we might expect to encounter. Literature we found, and undoubtedly there exists much more than we discovered. There were books on travel, starting at Panama and ending at Patagonia, which told us we might expect to be afflicted with badly bumping hearts when we arrived at the high tableland of from sea-level locations. The climate at Llallagua we have found to be much better than that of either New England or the Middle West. Having had no experience with the climate of California, the writers can make no sweeping statements comparing the part of Bolivia we know with that of the United States as a whole.

The high tableland of Bolivia is within the tropics. At Llallagua from December to May, there are heavy rains, but it does not rain all of the time during these months. During the remainder of the year there is little

*Metallurgist, Cia. Estañifera de Llallagua, and professor of metallurgy, Missouri School of Mines, Rolla, Mo.

†Mill superintendent, Cia. Estañifera de Llallagua, Llallagua, Bolivia.

rain. The season without rains has cold nights, that is, cold enough for ice to form, say—5° C. There are strong winds, particularly during parts of July, August and September. These winds do not blow the whole day but for a few hours only and are, of course, most forcibly felt on the pampas or plains. Through the dry season the days at Llallagua are really delightful—plenty of sun, dry and comfortable. We found that the mines at Llallagua (and at Uncia) possess fairly good equipment, and the mills are not many years behind the times. The Llallagua company has three compressors, about a hundred air drills (half of which are normally in daily use), electric haulage and so on.

Llallagua District Produces One-Half of Bolivia's Tin

It is because we had gained from the available literature an impression so contrary to our experiences that we decided to write this article. We realize that conditions elsewhere in a mountainous country like Bolivia may be quite different from those obtaining at Llallagua, this being particularly true of the climate. Most certainly, also, the tin ores of other parts may be and undoubtedly in some cases are, similar to Llallagua's only in the fact that they contain tin. However, here is produced about one-half of Bolivia's total output of tin, so perhaps the operating conditions are as important as any others when quantity is considered.

The Compañia Estañifera de Llallagua is owned by a group of influential capitalists in Chile. Señor Don Orlando Ghigliotto S. is the general manager, resident in Santiago, Chile, and E. Diaz is resident manager at Llallagua. The property was purchased in 1906 and the present company was capitalized for £125,000, shares having a par value of £1 each. The shares have at times increased greatly in value, being quoted as high as 140 Chilean pesos (about £6). The company has paid in dividends about £600,000, has built from earnings a hydroelectric power plant which will shortly give 800 hp., has installed modern mining and milling equipment, has erected a Deutz motor and Diesel engine plant of 800 hp., and has at present a considerable reserve fund.

The mine of this company and the mines of Simon I. Patiño, at Uncia, are in the same mountain, working the same veins, and are at this writing producing about the same amount of ore. The Llallagua company's production is steadily increasing. In the last few years there has been much litigation between the two companies over disputed territory, but differences have been settled and a definite division line established. The importance of the Llallagua company may be judged from the fact that the yearly production of 8000 tons of *barrilla* (tin concentrates) or 5600 tons of fine tin is about 5% of the world's production, and more than 20% of Bolivia's production. The mines of Señor Patiño, at Uncia, are giving more than 25% of Bolivia's tin. Therefore, from the same mountain and really from veins within an area of a few meters comes about one-half of Bolivia's total output of tin.

Both Oxidized and Sulphide Ores

The ores are, for milling purposes, divided into two classes, the oxidized ores known locally as *pacos* and coming from parts of the mine where surface waters have had good opportunity to flow, and unoxidized ores, *piritas*, which are found in the parts of the mine where surface waters carrying oxygen have had little chance to circulate. The *piritas* material, as the name implies, always contains a great deal of pyrite and other sulphides. It is true, of course, that the *pacos* ores are found usually relatively near the surface while the *piritas* material is obtained from deeper levels, but this is not always the case. The veins or even different parts of the same vein do not offer anything like equal opportunity for waters to circulate without being robbed of their dissolved oxygen. In some of the veins there is at the same level a sharp dividing line between the *piritas* and the *pacos*. In other veins thoroughly oxidized *pacos* are found lower than *piritas* existing in the same vein in unoxidized condition.

The water-concentration section of the mill treats both classes of materials in the same way. The *barrilla* obtained from the *pacos* is called "black tin" and some buyers prefer

CASSITERITE VEIN IN CANCANIRI TUNNEL AT LLALLAGUA, BOLIVIA

it. From the *piritas* ore the *barrilla* obtained is sold under the mark "S.S." to show that it comes from the milling of sulphide ores. It is true that although the *barrilla* obtained from *piritas* is as rich in tin as that from *pacos* ores, still the sulphide *barrilla* contains a little more sulphur and more of metallic impurities than does the *pacos* or black-tin concentrates.

The mineralogical composition of the ores, particularly the *piritas*, is exceedingly complex. The tin always exists as the mineral, cassiterite, no stannite having ever been found at Llallagua. Our cassiterite is black and has a specific gravity of 6.9; the mineralogies give the specific gravity at 6.8 to 7.1. In Llallagua ores, even the

crystallized cassiterite contains small amounts of sulphur and iron, probably pyrite between the planes of the tin crystals. Besides the tin mineral, there occurs in the ore almost everything that one might hope to find. There is always much pyrite; in fact, some of the best ores contain as much as 20% sulphur. Arsenopyrite occurs in large amounts in some veins and is absent in others. Bismuthinite is found in small quantities in nearly all of the pyritic ores. The appearance of the ore when broken, particularly in the case of the very rich material, say, more than 65% tin, would indicate large bismuth percentages, but the assays seldom show any large quantities. This is explained by the fact that the ore seems to break so as to expose to good view the long bismuthinite crystals, and on such ores as those at Llallagua an assay is absolutely necessary in order to form any definite idea of the bismuth content. Such assay is always disappointing. Wolfram, or rather scheelite, is found in all of the veins but not in paying quantities. Native copper occurs in some of the ores, but the occurrence is usually local and the amount of copper in the total is small. Quartz is common and is frequently well crystallized. Then, of course, there are the igneous rock and the slate.

As far as the mill is concerned we are interested in those minerals which are close to cassiterite in gravity. Bismuthinite has a gravity of 6.4, scheelite 6.0 and arsenopyrite 6.0. The bismuth and tungsten minerals occur in such small quantities that they cause us no trouble. Our *barrilla* never contains over 0.5% bismuth. There is not at present enough of the bismuth or tungsten minerals to pay us for their recovery. In the cases where arsenopyrite occurs—and sometimes it comes in large amounts—it is impossible to keep this mineral out of the *barrilla*. However, only small sections of the mine are rich in the arsenical pyrite, or *pirita blanca* as the natives call it, and it is easy to mix the ores so as to keep the percentage of arsenic below 0.5 in the tin concentrates. In case of necessity the ore can be roasted and the arsenic volatilized.

The veins vary greatly in width and in richness. At Llallagua at present there are 15 known veins and more will undoubtedly be found. At times the width of the various veins may be only an inch or two, or in fact may disappear entirely, while again there may be a face of 60% ore more than 1 m. wide and this width and grade may persist for many meters in depth and length. As yet there has been no diminution of tin with depth. A vein, rich near the surface, may grow poor with increase of depth and then rich again at greater distance from the surface. It is not necessary that a vein outcrop. One of the best orebodies in the Llallagua mine at present, a vein nearly 1 m. wide and averaging as mined more than 25% tin, does not so far as we can determine appear at or near the surface. At a depth of 300 m. beneath the surface the ore is as good as or even better than that higher up. Naturally, the tin cannot go down forever, but at 300 m. it still exists undiminished in quantity and quality. In crosscut driving it is not at all uncommon to strike unexpectedly a body of ore of considerable size and richness. The whole mountain seems to be mineralized with veins both in the igneous rock and in the slate. It is true that those bodies of ore existing with igneous material are always more persistent, larger and richer; however, it is a fact that a vein may continue from the igneous into the slate and retain for a few meters its size and richness.

The vein matter and whatever country rock it is necessary to break with it are brought to the surface and then carefully hand-picked by women. Wherever possible the coarsely crystalline cassiterite is cobbed out and sacked ready for the market. This coarsely crystalline material, ready to ship without milling, is locally called *guia* and contains about 65% tin. Some of the veins are for many meters nearly solid *guia* and production in such cases is cheap. The waste rock is rejected and the remaining material containing the relatively finely divided cassiterite is sent 5 km. by aërial tramway to the mill. At Llallagua about 2½ tons of material is mined and brought to the surface for every ton the mill receives. This is in part due to the large amount of preparatory work now being done. Of the present tin production about 5% comes from the *guia* which is hand-picked at the mine.

The mill of the company has at present a single section with a capacity of about 200 tons per 24 hr. When the mill was first built the company was mining *pacos* ores

PRIMITIVE CONCENTRATION AND TRANSPORTATION AT LLALLAGUA

Concentration on the rectangular buddle following hand roasting has been superseded by mechanical devices; jig and table concentration is now followed by roasting in Kauffman furnaces and concentration in Stern magnetic separators. Llama transportation is still used, as Llallagua has no railroad; packages heavier than 100 lb. must be transported over the cart road.

only and the mill was designed to meet the conditions necessary in treating this oxidized, relatively soft, pyrite-free material. At present not more than 15% of the ores which arrive at the mill are of the *pacos* class, the remainder being *pirilas*. For both classes of ores it is necessary to break the material so that all will pass a 10-mm. hole before sufficient of the cassiterite is broken free to make a start in the concentration. The mill is arranged on the graded-crushing, trommel-sizing, Hartz jig plan. Trommels are used to size the ore down to 1.5 mm. when the work is taken up by hydraulic classifiers, followed by settling boxes. Jigs are used to handle all the material above about 0.75 mm. in diameter. The ore finer than 0.75 mm. goes, after classification in Janney classifiers and thickening tanks, to Overstrom tables and Isbell vanners. The middlings and tailings from all jigs treating materials greater than 1.5 mm. in diameter are sent to Huntington and chilean mills. There is being installed at present a 6-ft. Hardinge pebble mill to regrind the coarse middlings and tailings. All jig tailings finer than 1.5 mm. enter the Janney classifiers and are re-treated on the tables. The reason jigs are used to treat material as small as 0.75 mm. is that heretofore there has not been sufficient table and vanner surface. New tables and vanners are now on the ground and in the future the fine material will all go directly to tables with the resultant saving in power, water, and attendance.

Cassiterite the Only Profitable Mineral

The only mineral in the ores that will pay for saving is the cassiterite. With the *pacos* ores there occur no minerals which approach closely in gravity the cassiterite. It is true that the oxidized ores contain much iron oxide, but this oxide is hydrated and porous and therefore relatively light. There is, then, no difficulty with a reasonably good classification in making a clean separation of the cassiterite from the other minerals which accompany it in the *pacos* ores. As in other classes of mills there is, of course, difficulty in saving the fine mineral. The tin ore at Llallagua does not slime badly.

With the pyritic ores the conditions for separation are not so easy. There exists in these unoxidized ores some minerals like arsenopyrite, bismuthinite and scheelite, which are too close to cassiterite in gravity to permit a clean water separation. As before explained the above minerals are not usually present in amounts sufficient to interfere with the grade of the *barrilla*. Pyrite is always present in large amounts. Between the pyrite and the cassiterite there is a gravity difference of two, enough for a clean separation of the two minerals, provided always that classification is good. This is as great a gravity difference as, or even greater than, that between the blende and the dolomitic limestone of the Joplin district of Missouri. So long as the material is relatively coarse there is no difficulty whatever in making a good classification and a *barrilla* free from impurities. "Free from impurities" always means here free from pyrite or, as they say, sulphur. Penalties, and these seem excessive, are imposed (but not always collected) by the European smelters in case the sulphur content of the *barrilla* is high. One form of contract with which the Llallagua company has had experience allows 1% of sulphur without penalty. If over 1% and up to 3%, ½% of tin is deducted for each unit of sulphur, and if over 3% sulphur is present in the *barrilla* the buyer has the privilege of rejecting the lot.

Hand Roasting Too Expensive

As the material grows finer there is difficulty in making at the same time a good tin recovery and a *barrilla* free from pyrite. This is perhaps due to poor classification, but it should be remembered that the amount of sulphur allowable is not large. With the pyrite ores, there was therefore the problem of treating fine-grained pyrite-cassiterite middlings. At first the company installed hand calcining furnaces in which the middlings were dead-roasted as a preliminary to washing on buddles. The only fuel available here for use in roasting is the dung of the llama, this combustible being known as *taquia*. In appearance at least *taquia* is similar to sheep dung. It can be imagined that roasting in hand furnaces with sheep dung costing $10 per ton is a fairly expensive operation. It is not possible to obtain in the firebox of a roasting furnace with this fuel a sufficiently long flame, so the greater part of the fuel is mixed with the ore on the hearth of the furnace. The firebox is used to aid in keeping the mixed ore and fuel up to the ignition temperature. To give air for burning the mixture of dung and pyrite middlings, the working doors of the hearth must be open most of the time. Operating with material all of which will pass 1 mm., a hand furnace 20 ft. long and 10 ft. wide will roast about 4 tons from 30% sulphur to 2% sulphur per 24 hr. The fuel needed (*taquia*) will be about three quintals per ton (1 quintal = 101 lb.). The labor cost is about $1 per ton in addition to the fuel.

The calcined material from the hand furnaces was concentrated in buddles. In these buddles the concentration is primarily a sizing operation. The cassiterite is finer than the pyrite and during the calcination the iron mineral, in changing to oxide, swells. It is true that the particles of iron oxide or gangue will be carried farther down the plane of the buddle than particles of cassiterite of the same diameter. If, however, there exists a great number of small particles of gangue and iron oxide with the cassiterite, concentration in a *tina* or tub is used to keep this material out of the *barrilla*. The ore is fed with an amount of water depending upon its fineness (the finer the less water), and the bed is continually swept to keep an even depositing plane. When the buddle has filled, the bed is marked off by the chief of the section (the *mayordomo*) into concentrates, middlings, and tailings, the concentrates consisting of grains of the finest diameter, the middlings being coarser, and the tailings containing the grains of greatest diameter. Each division is shoveled from the buddle and rewashed until the concentrates are rich enough in tin to be called *barrilla*, and the tailings so poor that they can be sent to the river. The *barrilla* obtained in this manner averages 68% tin and is low in sulphur.

(*To be continued*)

First National Copper

After being shut down for several years on account of complications with the farmers over smeltery fumes, the First National Copper, according to the *Boston News Bureau*, has apparently abandoned the idea of installing devices for the prevention of the emission of these obnoxious fumes. A contract is reported to have been made

with the Mammoth Copper Mining Co., whereby the First National ores will be treated at Kennett, Calif. The Mammoth company will take ore in addition to the 250 tons per day contracted for as fast as the mining company can get its production to a higher basis. This will enable the First National to get in on the present high copper market.

New Almaden Quicksilver Mine

By Richard G. Place*

New Almaden is situated in Santa Clara County, California, about 12 mi. south of the city of San Jose. There is a branch line of the Southern Pacific R.R. running between San Jose and the mines. Instead of rugged mountains that usually surround a mine, the approach is through a beautiful fertile valley of spreading fields and orchards. New Almaden is the largest mercury mine in California and was for a number of years the second largest producer in the world, Almaden of Spain being the premier quicksilver producer.

The main shaft is on the top of a hill, extending down for over 2,000 ft. There is a continuous orebody occurring between layers of serpentine and shale for nearly four-fifths of this distance. Parallel to the orebody is a rhyolite dike. The country rock is sandstone and shattered greenstone.

From the shaft the ore is taken by two cable inclines, that convey it to the retorts at the bottom of the hill. A part of the cinnabar ore is screened, but the majority is fine enough, when it comes from the mine, to be introduced directly into the retorts. Both the retorts and the condensers are of an antiquated type and leak so badly that all the workmen suffer more or less from salivation.

At present considerable profit is being realized by washing the sand and dirt taken from under old parts of the workings that are being remodeled. The washing is done in a rocker such as was used in the early placer mines in this country. The accompanying illustration shows one in operation at New Almaden. So far this year the production has been over 200 flasks per month. The present operators have a lease on the property for 25 years.

*1105 Garfield Ave., Pasadena, Calif.

What Excessive Gold Supply May Do

The National City Bank in its September circular points out in a lucid way what may result from an excessive importation of gold into the United States. In part it says the following:

The Allies still have large holdings of gold. The appeal to the French to exchange their holdings of coin for paper money has brought in over $100,000,000 since May 27, and a similar request lately by the British government has resulted in a noticeable increase in reserve of the Bank of England. Notwithstanding increased liabilities due to the big loan, the reserve now stands at 24%, compared with 16% a month ago. However, these gains are small compared with payments to be made here. Moreover, continued importation of gold is a menace to orderly progress of business in this country. So long as the fabric of credits is not enlarged, additions to gold reserves will do no harm, and serve to broaden the base under the situation; but bank credit is so readily available for a thousand inviting purposes that it is too much to expect of the people that they will abstain from using it for long at a time. They have never persisted in such self-restraint, and bankers have never been proof against their persuasions. There is no money trust strong enough to close the vaults against the public when it is in earnest about wanting accommodations.

There is a normal status, or equilibrium, between countries of the world, in industry, in gold holdings, and in all relations with each other. That status is not fixed, but cannot be changed violently without reaction. It is being changed now, and the prudent man will beware of the reaction. The United States is obtaining more than its share of the world's gold, as gold would be distributed under ordinary conditions, and when the war is over it will not be able to hold the excess. If new supplies have been stored away, unused and unpledged, and can be released without disturbance, well and good; we will have simply lost the interest on their value, and played the part of miser. But if we proceed to build credits on the new store, those credits will have to be liquidated when the base is removed, and liquidation of credits under such conditions is a painful experience. Moreover, the very use of these credits will have effect of expelling the base that supports them, as soon as normal trading conditions are restored. For if under temporary protection and stimulus afforded by the war, our industries are expanded on basis of higher wages and costs, we will be driven out of every foreign market as soon as the war is over, and lose no small share of our home trade also, with the result that the trade balances will turn heavily against us.

It is impossible to use additional credit made available by further increase in gold reserves without raising costs and prices in this country; for it can only be used by extensive borrowing and buying, with inauguration of enterprises which would create a competitive demand for labor at a time when supply of labor is limited; and however desirable it may be to have wages rise by natural progress, nothing will be

Retorting and condensing plant

Washing old mine-filling in a rocker

VIEWS AT THE NEW ALMADEN QUICKSILVER MINE IN SANTA CLARA COUNTY, CALIFORNIA

gained from a spasmodic movement which ends in loss of markets, widespread unemployment and prolonged stagnation. Wages can only be sustained and advanced by a steady demand for products of industries, and this cannot be had if our economic relations with the rest of the world are ignored and heedlessly thrown out of gear. The war is not going to last long enough for us to get far on a career planned only for war conditions.

We should not be alarmed over advent of prosperity because it is likely to end in trouble, but an expansion of indebtedness based on conditions so plainly temporary would be extremely shortsighted. Present bank reserves are more than sufficient to handle any safe degree of expansion and it will be better that the country does not receive additional capital in gold. Whatever is coming to us under these extraordinary trade conditions had better be taken in interest-bearing securities or dividend-paying shares of ownership in going properties, at home or abroad.

Miocene Age of Dodge Gypsum

By Charles R. Keyes*

From a strictly mining angle, it usually matters little what happens to be the geologic age of a mineral deposit. The subject only assumes business interest when the age determination extends the probable volume of available deposits, or points the way to the discovery of new bodies. Just such features are among the important results of recent investigations of the gypsum deposits in Iowa.

The geologic age of the Fort Dodge gypsum beds, which are among the most valuable in the United States, has been long a moot point. Reasoning from lithologic analogy of the Kansas deposits, late deductions have been in favor of a Permian, or Late Carboniferous age. That this inference is incorrect is shown by more recent observations.

The geologic structure of the Iowa gypsum beds, as recently made out, has important economic bearings. In this regard the most remarkable feature is the profound faulting that has taken place in the area. A large block of the gypsum six to eight miles in width has dropped down below the level of the upland plain of the region, and has thus escaped destruction by glacial planation and general stream-corrosion. Since the line of the fault is traceable for a distance of nearly 100 mi. the possible volume of available gypsum is extended far beyond that now opened up.

The determination beyond peradventure of the geologic age of the Iowa gypsum deposits—that the date of its origin is not Carboniferous, Permian, Triassic, nor even Cretaceous, as has been repeatedly urged at different times, but that it is Miocene, or mid-Tertiary—has deep significance. It places the gypsum and associated pink shales among true continental deposits—accumulations on dry land and wholly independent of sea, lake or even running water. It points out the possible occurrence, beneath the deep glacial drift of the state of Iowa, of other incoherent deposits which are not to be classed with the till at all but with the older Tertiary formations.

Since this possibility has been pointed out, evidences of the existence of the pink shales which are inseparably connected with the gypsum have been sought in other parts of the state. As a result these pink shales have been found in a number of places. Whether or not workable beds of gypsum are really associated with them in all cases remains yet to be determined by careful drilling. It seems probable that new fields of gypsum will be discovered.

Inasmuch as the key to the puzzle has at last been found, a large number of deposits that were formerly classed, without much critical scrutiny, with the glacial till have been found to be of earlier formation, and have been determined as Tertiary depositions. It also appears very likely that beneath the great drift-mantle exists an extensive terrane which is altogether Tertiary in age. Hundreds of well records now seem to admit of new interpretations so far as the lower part of the so-called drift section is concerned.

Should gypsum actually be found associated with the various occurrences of Tertiary pink shales which already have been discovered in many widely separated localities in northwestern Iowa, it would perhaps make this region, already very important, worth more than all other known deposits of gypsum combined.

*Consulting engineer, Des Moines, Iowa

Sicilian Sulphur Industry

The production of sulphur in Sicily for 1914 was 334,974 metric tons, a decrease of 11,000 tons from the production of 1913. Exports during 1914 amounted to 338,308 as against 414,716 tons in 1913, according to United States Consul Haven in *Commerce Reports,* Aug. 18, 1915. Production has declined for several years, he reports, owing to lack of capital for financing and to the shutting down of some of the large mines on account of fires.

The production, exports and stocks of sulphur on hand for the last five years are reported in the accompanying table.

SICILIAN SULPHUR STATISTICS

	1910 Metric Tons	1911 Metric Tons	1912 Metric Tons	1913 Metric Tons	1914 Metric Tons
Production	397,808	376,171	357,547	345,974	334,974
Export	393,987	453,826	447,292	414,716	338,308
Stock on hand	640,711	551,422	450,917	376,356	369,001

Owing to the fact that the domestic supply of crude sulphur in the United States meets the demand, none was exported from Sicily to that country. Further, the United States now actively competes with Sicily in the European markets. The decline in Sicilian exports is in part due to this competition, to the increased use of pyrites as a sulphur substitute, and to the paralysis of trade consequent to the war. The exports of sulphur are shown in the accompanying table, giving the countries of destination.

SICILIAN SULPHUR EXPORTS

Destination	1913 Metric Tons	1914 Metric Tons	Destination	1913 Metric Tons	1914 Metric Tons
Sicily	8,504	7,604	Turkey in Europe	1,911	1,177
Italy	72,971	89,611	United States and Canada	1,383	1,919
Austria-Hungary	56,334	25,304			
Belgium	13,321	5,977	Central and South America	7,340	944
Denmark	305	239	Egypt	615	1,260
France	75,186	61,871	Algeria and Tunis	3,242	2,226
Germany	31,968	18,824	Asiatic Turkey	3,596	3,914
Greece	14,615	15,759	British India	5,736	4,316
England and Malta	16,036	12,993	Australia	13,441	1,637
Netherlands	8,975	8,080	South Africa	13,741	2,486
Portugal	14,754	8,427	Other countries	10,362	9,396
Russia	25,892	21,280			
Spain	6,684	9,178			
Sweden and Norway	27,804	23,877	Total	414,716	338,308

The increased cost of the extraction of the ore at the mines induced the producers to petition the government syndicate that controls the sale of the sulphur (Consorzio Obbligatorio per l'Industria Solfifera Siliciana) to advance prices, which request was granted in July, 1914. Prices were increased about 50c. per ton for crude sulphur on board lighters at the port of Girgenti, as follows: Yellow superior, $19.78; yellow inferior, $19.59; brown superior, $19.20; brown inferior, $19.01. (A further advance of 60c. per ton was reported by Consul Samuel H. Shank, of Palermo, early in 1915.)

Crude sulphur in bulk is seldom shipped from Catania. The Consorzio conveys it there for refining and milling purposes and supplies only enough to about fill the demand, and in order to discourage its exports in the natural state from this port the syndicate has established a higher price from Catania than from Girgenti. Refined and milled sulphurs which are chiefly exported from Catania met a fairly active demand during the year. The market prices of refined and milled sulphurs at the end of 1914, per metric ton f.o.b. Catania (in 112-lb. sacks), were as follows: Sublimed flower of sulphur, $34.35; refined sulphur in rolls, $27.98; refined sulphur in lumps, $28.79; and refined ground sulphur, $25.09.

Production of Tungsten and Molybdenum in England

According to the *Times Engineering Supplement,* as quoted by the *Journal of Industrial and Engineering Chemistry,* the outbreak of war found Great Britain deficient in the supplies of many of the rarer metals employed in steel manufacture, and for a time much anxiety was felt respecting the possibilities of manufacturing in England certain of these metals hitherto obtained in large quantities from the Continent. Among these mention may be made of the compounds of chromium, tungsten and molybdenum.

In the case of tungsten, the best wolfram ores are brought from Portugal and India, while the molybdenite used in the preparation of ferromolybdenum comes from Norway, Sweden and Australia. The Australian ores cannot, in the most favorable circumstances, be conveyed from the mines to Britain in less than two months, and as they are extremely costly it would not pay the manufacturer to hold large quantities of ore in reserve.

Process Used at Luton

One factory at Luton, England, has now extended its plant so that it is capable of turning out annually nearly 1000 tons of ferrotungsten and tungsten powder, and it is unlikely that the trade in tungsten powder will ever revert to Germany after the war. The process used at the Luton factory for the production of tungsten powder consists in boiling the finely ground wolfram with a soda solution. The tungstate of soda formed is settled in tanks and dried so as to produce coarse crystals. The compound is then treated with hydrochloric acid in wooden vats, by which means the tungstic acid is liberated as a yellow paste. In order to reduce the acid, it is mixed, after thorough drying, with charcoal in large crucibles and heated for 18 hr. in a reverberatory furnace. The slaglike mass thus prepared is crushed and ground to a fine powder, which is finally passed through 120-mesh wire sieves, and represents tungsten of 98% purity.

In the manufacture of ferrotungsten large 3-ton electric furnaces, each with three suspended electrodes, are used. The feeding of the furnaces takes place by hand in small charges of the mixed ore, with the requisite quantity of carbon, scrap iron and flux. The molten masses of ferrotungsten are drawn off from time to time and after cooling are hand-broken and sorted into various sizes. Owing to the great weight of the material, it is a matter of considerable difficulty to handle it in bulk. It is usually packed in steel casks containing 25 cwt.

The Engineer Function in Modern Warfare

It is being demonstrated that warfare is no longer a display of spectacular heroism, accompanied by a grand fanfare of trumpets, but is largely a question of engineering, one way or another. The use of engineer troops is little understood by the layman, to whom the diversity of engineering features required by an army is astonishing. In the United States Army an engineer company consists of four officers, mounted, and 164 enlisted men, of whom 24 are mounted. Their duties, as outlined in the official bulletin from the office of the Chief of Staff, Washington, D. C., are to apply engineering science to the emergencies of modern warfare in order to protect and assist troops, to ameliorate the conditions under which they are serving and to facilitate locomotion and communication.

Duties of Engineer Companies

In the performance of these duties, engineers are trained and equipped to supplement or amplify, by scientific measures, the efforts of combatant troops in the service of reconnoissance, castrametation, fortification, sieges, demolitions, battlefield illumination, general construction, communication and such other special services of an engineering nature as may arise that are beyond the technical training of combatant troops or such as require the use of engineering implements and material not supplied to combatant troops. The reconnaissance includes both tactical and engineer reconnaissance, surveying, mapping and sketching, photography, drafting and map reproduction. The service of castrametation includes the selection, laying out and preparation of camp and the municipal and sanitary engineering incident thereto, and may include the installation, operation and maintenance of a water-supply system in the case of cantonments.

The service of fortifications pertains both to the attack and the defense and includes the selection of defensive positions when out of the presence of the enemy; rectification of and assistance in the selection of such positions in the presence of the enemy; the location, design and construction of the more important field work; assistance in and supervision of the construction of the hasty defenses wherever possible; the supply of tools and materials; and the reconnoissance, demolitions, water supply and communications incident thereto.

The services of sieges pertains both to the attack and defense, and includes selection and location of defensive line, lines of investment and siege works, the construction of saps, mines, counter-mines and defensive works; the operation of searchlights; preparation for and assistance in attacks, counter-attacks and sorties; organization of captured points; the supply of tools and material; and the reconnoissance, demolition, castrametation, water supply and communications incident thereto. The service of battlefield illumination includes the supply and operation of searchlights, together with any other means to effect the desired end. The service of general construction includes the location, design and construction of wharves, piers, landings, storehouses, hospitals and other such structures of general utility in the theater of operation. The service of communication includes the construction, maintenance and repair of roads, ferries, bridges and industrial structures; the selection and preparation of fords; the construction, maintenance and operation of railways.

To no branch of the engineering profession are these various requirements, either separately or as a whole, more familiar than to the mining engineer. Under average circumstances the conditions under which the military engineer operates are exactly parallel to those under which the mining engineer faces his problems—namely, isolation in the field, lack of tools and equipment, and haste—time being in both instances a most important factor.

With these various engineering problems to be faced it is quickly apparent that a modern army consists of something else besides numbers of men and rifles; and a wonderful field is seen for the mining engineers to render invaluable service, not only in the ultimate issue, but in the present case of improvement and preparation of our national defenses and personnel.

A small number from each engineer company is trained for certain special classes of work, such as sketching, map reproduction, photography, surveying, drafting, demolition, operation of engines, etc.; but practically all of the company are trained for all such kinds of work as roads, fortifications, bridges and mining.

The equipment for each company's use is carried in a combat train, consisting of two wagons containing instruments, tools, tackle, explosives and supplies, for the foot troops; eight mules carrying demolition packs, packs of tools, tackle and supplies, grain, rations and additional tools or explosives, for the mounted detachment of the company. In addition to the equipment carried in the combat trains of the company there is a battalion combat train consisting of one wagon carrying surveying, drafting, photographic and reconnaissance equipment and one wagon containing blacksmith and map reproduction equipment; and also an engineer train of nine wagons with reserve intrenching tools and supplies for infantry, consisting of 234 axes, 63 crowbars, 900 lb. of nails, 1350 mattocks, 4050 sandbags, 117 hand-saws, 117 one- or two-man saws, 2700 shovels, 225 lb. of smooth wire, tool sharpeners, etc.

A battalion, consisting of four companies, of 164 enlisted men each, and the company, battalion and engineer trains, forms a unit of great potentiality in the hands of a competent engineer commander and requires engineering ability of high order to handle, transport and maneuver.

The next Congress will be called upon to make radical changes and additions in our military establishment, and a field is going to be opened for civilian engineers along military or semimilitary lines which will be very attractive, and valuable alike to the country and to the individual engineer.

Miami Copper Co.

The Miami Copper Co. reports that during the first half of 1915 the concentrator treated 589,513 tons of ore, which produced 22,708 tons of concentrate averaging 40.63% Cu. Other data are as follows: Production of merchantable copper, 17,530,865 lb. Average assay of ore, 2.18% Cu. Extraction in milling, 68.16%. Yield of ore per ton, 29.74 lb. of copper.

The finer grinding of the ore, together with improved metallurgical treatment, raised the extraction to 73.98% in June, with only three sections of the mill remodeled. In section 1, remodeled, the extraction was 77.43%.

Extraction of ore from the Captain orebody with the new narrow shrinkage stopes is progressing favorably. The slicing in the main orebody under the large mat of timber has developed in such a successful manner that undoubtedly this method will be continued below the 420-ft. level.

The average cost of copper was 8.6889c. per lb. In June it was only 8.32c. Net income for the half year was $1,296,225, out of which a dividend of $373,556.56 was paid, leaving a surplus of $922,668.69 for the period.

The gross income is apparently figured on an average selling price of about 15.4c. per lb. gross, and the profit amounted to about $1.75 per share. The monthly statistics indicate that this company is working up to a basis of about 50,000,000 lb. per year, which would give it a profit of about $4.75 per share on a 15⅜c. market even if cost of production remained at about 8.7c. per lb.

Mining in China

The Chinese have lately been showing a good deal of interest in the development of their mineral resources. Without any doubt China is going to be a great field for the American mining engineer and the American machinery manufacturer in the not very distant future. According to the New York *Evening Post*, Chou Tzu-Chi, the Chinese Minister of Agriculture, has issued the following order regarding the prospecting of mines in the provinces:

"China is rich in mineral resources, and the reason why mining is not carried on so extensively as it ought to be is that the prospecting work is not done in a thorough manner. When prospecting is poorly done, the minerals are left hidden in the earth. This Ministry has from time to time sent Chinese and foreign engineers to prospect the mines, but on account of the vast area and the unfamiliarity with local conditions, very little progress is made. This Ministry has drawn up regulations governing the prospecting of mines, consisting of seven articles. According to the new arrangement, every magistrate shall make preliminary investigations and submit mineral samples to the Finance Bureau, which shall in its turn send engineers to prospect. Then the Ministry of Agriculture will send engineers to make investigations. The magistrates and the Finance Bureau shall coöperate with and give every facility to the prospecting engineers. The magistrates are required to fill in special forms describing the nature of mines, also of their districts."

The *Chung Hsi Pao* says: "Recently the Wu-fung Mining Co. has located rich deposits of copper in the Choushan Hsien district at places called Dunkaitai and Sikou. A rich capitalist, Mr. Wang, has petitioned the Civil Governor to grant him the right to work the mines at Dunkaitai. As the copper which is used by the Wuchang copper mint in large quantities was imported from Japan, now that local copper mines have been discovered it is necessary to have them developed with the view of supplying the provincial mint. The land partly belongs to the people and partly to the Government, so a boundary line must be marked out in order to prevent future troubles. The Governor has deputed Mr. Yuan to go to the place to verify the report, as well as to mark out the boundary lines."

The Broken Hill Proprietary Co. has closed a contract to furnish the New South Wales Government with 700 tons of rails weekly from its new steel works at Newcastle. The contract is to run for a year, and the price is £7 17s. 6d.—equal to $38.32—per ton at mill.

Valuation of Arizona's Producing Mines

SPECIAL CORRESPONDENCE

The State Tax Commission has announced its valuations on the mines of Arizona. The first Legislature passed an income-tax law providing for a certain proportion of the net, plus a proportion of the gross income, as the valuation for assessment purposes. But this law was operative for only two years, and in spite of considerable urging by the big mines, this last Legislature could not agree on a net-income valuation, which was the demand of the miners. In fact, there was a big fight on over this matter between those representatives favorable to the miners' contention and those headed by the governor who believed that this was not a fair tax valuation. At any rate, the Senate split with the House, and no legislation on the subject was passed, leaving it to the Tax Commission to decide on the valuations. It is believed that in this duty, the commission followed the Michigan plan, as Tax Commissioner Allen of that state was in Phoenix last winter and there outlined their methods and aspirations in full to the public.

The total valuation of mines arrived at by the commission is $121,225,833, an increase of $11,000,000 over last year; but allowing for mines that commenced production during last year, the increase is about 10%, and most of this comes on a few of the larger mines. It will be seen that the old rate of four times the net income, plus one-eighth of the gross income, was a very good guess at a fair valuation if the present figures are anywhere near right. There is a good deal of fault found with this year's results, however, and a number of the mines, notably the Copper Queen, are asking the Tax Commissioner for a rehearing. It must also be noted that these valuations are only for the producing mines, as the nonproducers are not taxed. The final valuations are as follows:

	Mining Property	Improvements
Arizona Commercial Co.	$109,134	$95,787
Arizona Copper Co., Ltd.	6,709,544	6,226,191
Arizona United Mining Co.	28,216	21,570
Bunker Hill Mines Co.	186,750	121,072
Calumet & Arizona Mining Co.	2,054,289	2,895,125
Commercial Mining Co.	37,250	10,300
Commonwealth M. & M. Co.	82,608	290,200
Cons. Arizona Smelting Co.	74,509	364,980
Copper Queen Cons. Mining Co.	29,357,656	5,143,954
Detroit Mining Co.	5,167,981	1,765,085
Duquesne M. & Red. Co.	128,636	75,538
Gold Roads Mining Co.	262,670	166,940
Great Western Copper Co.	41,566	8,778
Thomas Higgins	24,632	
Inspiration Cons. Copper Co.	1,657,817	2,694,346
Iron Cap Copper Co.	119,205	3,250
Leonard Copper Co.	74,378	25,621
Magma Copper Co.	158,118	221,830
Miami Copper Co.	8,739,379	2,746,634
Neales M. & S. Co.	83,960	24,579
Old Dominion C. M. & S. Co.	4,760,488	2,984,911
Ray Cons. Copper Co.	11,904,346	4,709,472
R. R. Richardson	427,362	3,225
Shannon Copper Co.	1,300,192	1,129,980
Shattuck Arizona Copper Co.	4,794,287	89,423
Superior & Boston Copper Co.	55,725	34,785
Superior & Pittsburg Copper Co.	20,551,670	192,010
Tom Reed Gold Mines Co.	3,034,060	175,500
Union Basin Mining Co.	176,677	45,574
United Globe Mines	3,012,767	40,791
United Verde Copper Co.	15,319,160	3,754,480
Vulture Mines Co.	338,490	177,892
Warrior Copper Co.	139,992	8,567
Wolverine & Arizona Mining Co.	143,462	2,200
World's Fair Mine Co., Frank and Josephine Powers, owners	169,093	....
Total for the State	$121,225,833	$35,361,082

These valuations include tracks, etc., heretofore assessed as railroad property, to the amount of $1,455,260.

The Copper Queen continues the heaviest taxpaying company, with a total valuation of $29,357,656, an increase of approximately $3,000,000. The Superior & Pittsburg is next, with $20,000,000, an increase from $16,000,000. This is the greatest individual raise. Inspiration enters the list of producers for the first time, with a valuation of $1,500,000. There are slight increases in Ray, United Verde, Miami and other big companies, while the Arizona Copper Co. drops from $8,000,000 to $6,000,000. Cochise heads the counties in mine valuation with a total of $58,325,468; Gila is next, with $18,538,181; Greenlee has $13,000,000; Pinal, $11,000,000; Yavapai, $15,000,000; Mohave, $3,000,000; Santa Cruz, $725,000, and Maricopa, $338,000.

Progress in the Metallurgy of Zinc in Great Britain

According to the 51st annual report of the British Alkali Inspector, further attention was given during 1914 to the conditions influencing the formation of fume, the means for preventing the escape of fume, and the best methods of dealing with the solid material obtained by such means. Further experiments were made on the fume-arresting efficiency of various types of iron prolong, with special regard to the form favored at each works, and temperature conditions were studied in detail. Owing to the wide difference of practice obtaining at various works, it has been found difficult to state principles capable of general application, but lines for suggested improvement are indicated. The form of prolong favored where oxide or "ashes" are distilled is a cone having a removable cap and divided horizontally into two compartments by a shelf; the gases return over the shelf and are discharged through a wide slotted hole close to the furnace front and well under the ventilation hood. The prolong is constructed to fit the receiver to which it is attached, and its weight is supported by suitable bars hung in front of the furnace. When granular zinc alone is distilled, coke packing is introduced into the upper compartment. The results of the various temperature tests are presented in tables and graphs.

Very similar temperature gradients were observed in works utilizing mainly ore and in those where zinc "ashes" containing volatile chlorides formed the bulk of the charge, although the weights of fume arrested in the two classes of operation were as 2 to 1. The proportion of fume evolved appears to depend on the volume of gas formed, that is, on the proportion of oxide present in the charge, and, for the same class of operation, would seem to be closely related to the heat of the furnace. The greater part of the volatilized chlorine is in the form of zinc chloride, and preliminary experiments showed that on simple treatment with water, the bulk of the chloride could be extracted from the fume and skimmings and recovered, instead of ultimately escaping into the air. The metallic residue could be dried, without risk of firing, before returning to the furnace with a subsequent charge. Hot water should not be used in washing the fume. With a charge of "ashes," the vapors discharged from the receivers during the "steaming stage" were acid to methyl orange and contained free hydrochloric acid, whereas when the charge consisted mainly of ore, the vapors were alkaline, containing free ammonia.

A Byproduct Coke Plant with a capacity of about 2000 tons daily is to be erected in connection with the blast furnaces which are being built by Corrigan, McKinney & Co. at Cleveland, Ohio. The contracts have just been placed.

Mineral-Industry Exhibit at the National Museum

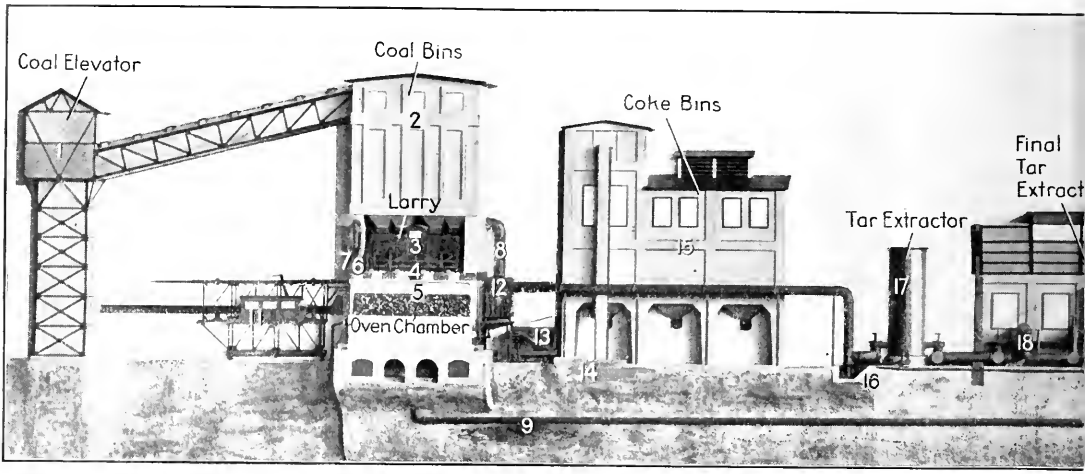
By Chester G. Gilbert*

SYNOPSIS—Model reproductions of each important type of mineral industry, presenting the processes from natural occurrences to finished products, is intended to promote a better appreciation of these industries on the part of the public. The exhibits in the National Museum at Washington are to be supplemented by educational bulletins for popular distribution.

For the purpose of creating a fuller appreciation by the public of its indebtedness to mining and metallurgical enterprises the Smithsonian Institution has arranged for a group of mineral-industry exhibits in the National Museum at Washington. The work is being carried forward in coöperation with important mining and industrial interests, including the Utah Copper Co., National Lead Co., New Jersey Zinc Co., U. S. Steel Corporation, Joseph Dixon Crucible Co., Barber Asphalt Paving Co., Solvay Process Co., American Coal Products Co., Macbeth-Evans Glass Co., etc. With the coöperation of such companies, it is evident that this movement is to be worthy of the interest of all engaged in the mineral industry.

About the middle of 1913, mineral technology was given active recognition in the form of a distinct division in the National Museum. Publicity for this work has been consistently avoided up to the present, but now, at the close of the second year of the new division's active existence, conditions are sufficiently advanced to warrant the statement not only of a definite purpose and of the means to the end in view, but also of assurances derivable from the test of practical application.

From the outset it seemed apparent that technical science and engineering were already adequately provided with media for the intercommunication of ideas, but that the public, whose interest after all is the really vital one, might profit by a more adequate grasp of the mineral technology of the country, and that the opening up of better lines of communication between the producing and consuming extremities might well tend toward a fuller appreciation that would be mutually profitable. In the assumption of such a function, moreover, the Smithsonian Institution would be exercising a peculiar fitness in that such an effort would be projected in its normal direction of a broadening educational influence.



MODEL OF A KOPPERS BYPRODUCT-COKE PLANT AT THE

This wall model is 28 ft. long by 7 ft. high and is constructed accurately to a scale of about $\frac{1}{30}$ actual size. Beginning at the left-hand end of the photograph, the coal hoist is shown conveying coal to the hoppers over the ovens, where chutes feed it into the larry (3), which carries the coal to various ovens and feeds it into the oven chamber (5). No. 11 represents the coke pusher, and Nos. 12, 13 and 14 the coke guide, car and pit respectively. The coke is elevated and delivered into No. 15, which represents the coke-screening station from which the coke is withdrawn into cars and shipped. The gases ascend from the ovens through pipes (6 and 7), and are conveyed by No. 8 to the sump (16), where part of

Mining Not Comprehended by the Public

Viewed in the light of popular comprehension, agriculture and mining—the life and backbone of the country—are in striking contrast. Agriculture is ever present, whereas mining is by nature seclusive, to say the least. With the one, the average mind is thus enabled to project itself, by analogy at least, in a comprehensive motion-picture conception of realities; with the other, the opportunity for the development of any such capacity has commonly been lacking, and the result is at best nothing more than a few scattering snapshots of disjointed facts,

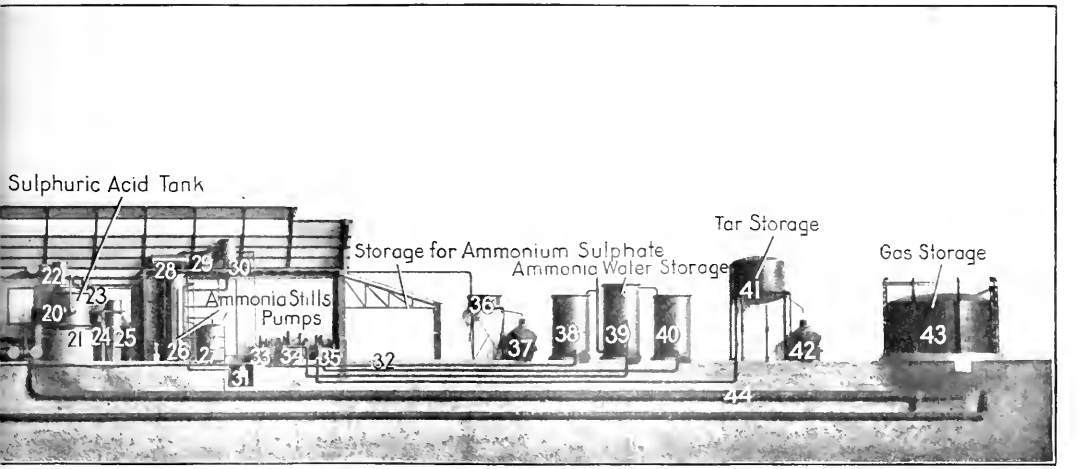
*Curator, Division of Mineral Technology, National Museum, Smithsonian Institution, Washington, D. C.

without the least sequential conception as to the real nature or extent of a given accomplishment. To many people, mining suggests only a twin brother to horse racing, with all the romantic allurements of "inside dope" and "200 to 1 killings." A vision which sees only infesting parasites is the surest evidence of ignorance; and in the case of a commonwealth contemplating its own backbone with such results the ignorance evidenced is calamitous.

Mining and the mineral industries do not represent an errant bit of Utopia uncontaminated, nor are they utterly bad; they are just human, and being human share in the dominant traits of thriving on appreciation as to true worth, and meanwhile measuring up to expectations good or bad. Merited appreciation and unmerited suspicion are just as potent character makers and breakers in industrial life as in that of the individual. To an industry the practical result of indiscriminate suspicion lies in weakened pride and lessened efficiency. To the public the result is felt in a tendency toward the creation of inferior values, coupled with an upward tendency in costs. To the country it means impaired stimulus for achievement.

American genius has also asserted itself over foreign genius backed by a lengthy heritage in skilled artisanship, a new-world standard bearing an American name may be created for an important line of special products and the road opened for the development of important industries. An example of self-sacrificing devotion to industrial effort actuated by patriotism and pride in achievement! There are plenty of others; and such a reflection spread nation-wide would inspire to an infinitely greater national achievement than could ever arise from reflection on the ways of parasites.

It is in the nature of things that the eternal enemies of progress—ignorance and inference—should be especially potent in the general field of mining, for there is no other activity with its significance of demand on attention and at the same time so utterly out of touch with the range of normal human experience. Fake prospectuses and fancy prices do not deserve to characterize mining any more than proprietary fakes and princely fees actually do medicine, but the one group represents about all that effectually reaches the public, while the other is recognized in its true bearing and only serves to reflect the greater credit on what is real in the profession.



UNITED STATES NATIONAL MUSEUM, WASHINGTON, D. C.

the tar is removed. Continuing through tar extractor (17), the gases are forced by the exhauster (18) through the final tar extractor (19) and then to the sulphuric-acid tank, where part of the ammonia is taken out as ammonium sulphate and stored in the storage house (32). From the sulphuric-acid tank the gases continue through pipe (44) to the gas holder (43) at the extreme right of the panel. Nos. 26 and 27 are the free and fixed ammonia stills for obtaining ammonia water, and this solution is pumped by means of pumps (33, 34 and 35) to their respective tanks. The tar coming from sump (16) and the extractors (17 and 19) is pumped through to the storage tank (41), from which it is loaded into cars.

Developing High-Quality Products

There comes to mind a prominent American manufacturer operating in a mineral-industry field where for generations a foreign name has been the unquestionable standard the world over. Now in his fullest maturity this man, leaving the routine of affairs to others, is devoting his undivided attention to perfecting special-quality products to the point where they will surpass those of the foreign standard. His efforts have already met with success in several directions, and in others success is practically assured. As a result, not only are millions of people in this country today profiting by a far better grade of normal product without increased cost, but

Aim of the Mineral-Technology Division

Passing now from analysis of conditions as they have been to the means devised for helping to improve them, "the plans[1] for the development of the Division of Mineral Technology aim toward an embodiment devoted to the interests of the public at large, as opposed to the abstractly scientific or highly technical, and with purposes directed toward the extension of cultural knowledge, together with information concerning current utilitarian facts. In the attainment of these results, it is proposed—to the extent that space is available—to provide model

[1] "Report on the Progress and Condition of the United States National Museum for the Year Ending June 30, 1914"; Richard Rathbun, assistant secretary-in-charge.

reproduction of each important type of mineral industry operating in the field, tracing conditions and processes from natural occurrence to finished products; around that model reproduction as a central theme to assemble in each instance such a systematic exhibit as will best serve to emphasize important features in both manufacturing processes and industrial capabilities; and finally, as each respective series is completed, to make it the basis of an educational bulletin for popular distribution." In other words, the aim is toward enabling the average individual to realize that an ore contains a metal and what the process of reduction implies. It is intended to make the individual familiar in a general way with the life history of the salt he uses and of the plaster on the four walls inclosing him: to familiarize him with the significance of hydrated lime, monel metal, artificial graphite, special-purpose glass and the various other developments, already here and to come, touching on his well-being.

It is possible to misdirect any activity, especially by overdirection. In the present instance overdirection would mean gratuitous advertising, favorable or unfavorable, through the proverbially odious medium of comparison. A presentation of the salient facts involved in a commonsense understanding of conditions, processes and products with their properties, put forth in the manner best suited to catch and hold interest in each separate instance, is the whole end in view. For the museum visitor there will be a minimum of learned effusions in the form of labeling, and a maximum of visualization, so that more or less unaided he may see the ore in its native occurrence, follow through the successive steps and processes, and see exemplifications of products together with their properties when put to practical test. For the public at large illustrations will have to be substituted for realities, but otherwise the same presentation will be available in the form of a bulletin.

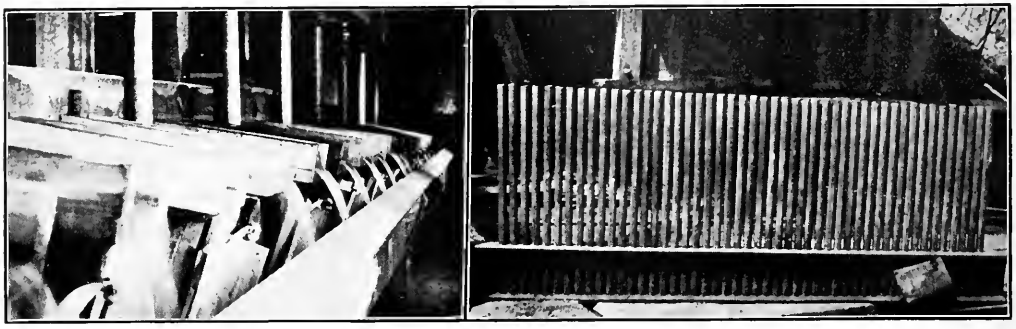
Hearty Coöperation by Producers

Industrial coöperation is essential in this effort, and with but one exception has been given unreservedly from every source thus far approached. The magnitude and diversity of the activities in process of representation at the expiration of the first active year of the movement's existence are suggested by such leaders in the mineral industry as have already been mentioned. Perhaps the most significant feature thus far developed lies in the fact that there has not yet arisen a single instance where industrial coöperation has sought to inject an element of bias or discrimination. The mere fact of readiness to coöperate might simply imply ulterior motives, but the purely impersonal element implies genuine public-spiritedness. In addition to sharing in the general advancement of conditions promoted, the coöperator has his reward in the public recognition of a service; but it is only such recognition as comes to the contributor along conventional lines, and for those who are disposed to ascribe narrow-minded selfishness to industrial interests it is worthy of note that a total of 17 unqualified responses out of 18 solicitations, involving outlays in some instances of several thousands of dollars, will certainly compare favorably with the showing in more conventionally philanthropic circles.

Gold Recovery at Placer Mines

By D. F. Carver*

Discussion of gold-recovery methods in placer mining has shown but few improvements aside from the operation of dredging. That some improvement in a system ought to be forthcoming after its long-continued use seems reasonable, and one case where progress has really been made will be described here.



Launders and classifier pipes Bottom view of spring-steel grizzly

GOLD-SAVING DEVICES AT CAMP CARSON PLACER, UNION COUNTY, OREGON

This system of handling placer material has been in use in California for several years and has recently been installed at the Camp Carson mine in the Blue Mountains, Union County, Oregon. One difficulty in the past has been to handle the material with the primitive sluice-box arrangement. When most of the gold was fine, in the cases of gravels that rapidly filled the riffles, the fine gold passed over the latter into the dump. The tailings in some instances would assay as much as the ground being worked. I shall give here a description of the modified method of operation.

Block Riffles Recover Coarse Gold

The old sluice-boxes with block riffles are used to recover the coarse gold. Experience has shown them to be well-adapted for saving such material. The riffles in the first two boxes are placed in such a manner as to be easily taken up, allowing ready access to the coarse gold that lodges in the first few feet of sluices. At the end of this sluice eight sets of steel grizzlies are placed so

*Camp Carson Mining and Power Co., 1004 American Bank Building, Seattle, Wash.

that the heavy material, over $\frac{1}{4}$ in. in size, is carried into the dump. The finer material is sifted through into an undercurrent flume. The grizzlies do away with all the heavy oversize which has no value and allow the fine material containing the higher value to be handled in a most efficient manner. The flow of water is regulated at this point by a pair of gates designed to balance the water and so permit the oversize to be washed away. The grizzlies are so arranged that the ends of each set project over the next in such a way as to be free of contact. Thus, with one end free, the bars are kept in constant vibration by the heavy boulders passing over them; this prevents the material from clogging the grizzlies and makes the system automatic.

Use of Concentrating Tables

The fine material is carried from this point to a set of nine tables, each 2 ft. 6 in. wide and 8 ft. long, with a drop of 2 in. per ft. On these tables are small steel angle riffles, $\frac{5}{8}$ in. in size, $\frac{3}{4}$ in. apart. They are made in frames which are held in place on the tables by strips of wood and which in turn are secured by wedges. The material coming from the undercurrent flume is distributed evenly over all the tables by gates at the head of each table, opening from a small sluice into which the material runs after leaving the undercurrent flume. The flow of water over these tables is not greater than 1 in. in depth, so that there is no possibility of the fine gold riding past the riffles.

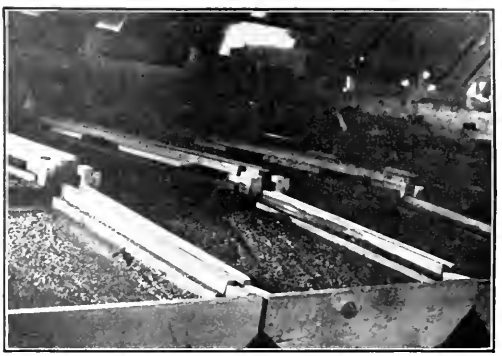
At the entrance to the tables, before the material reaches the small riffles, are 18 trays containing quicksilver—two trays to each table. These trays are similar to those used by the uptodate dredges and are useful in

GRIZZLIES IN PLACE IN THE LAUNDER

catching the fine free gold. The riffles on the tables can be removed if desired, one section at a time, without interfering with the operation of the other tables. It is the work of but 10 min. to remove the riffles of one table, shovel the material into a cleanup box, replace the riffles and remove those of the next table. This permits a cleanup to be made at any time without stopping mining operations in general.

A further separation of material that passes over the small riffles is made by a set of steel screens and hydraulic classifiers. There are nine pairs of the hydraulic classifiers installed below the steel screens. The latter have $\frac{1}{10}$-in. holes, and any material which passes through them is carried into the classifiers, where a separation is made with water under pressure. The light material which contains no gold is taken out of an opening in the upper part of the classifier, while the heavy material drops into the bottom and is taken out through a pipe and then run through a magnetic separator for final cleaning. The classifiers are automatic and, once the flow of water is properly regulated, do not require any attention.

A magnetic separator of large capacity treats the material coming from the lowest opening in the classifiers. This contains principally iron compounds which are picked up by the magnet and carried off on a belt to the



TABLES WITH ⅝-IN. ANGLE-IRON RIFFLES

dump. Gold, being nonmagnetic, drops into the bottom of the separator and is carried into a cleanup box. The belt that carries off the magnetic material covers the surface of the magnet completely, and as the iron sand clings to the surface of the belt and not to the magnet itself, it is automatically cleaned off at each revolution as the belt runs from the magnet.

A large tonnage can be handled at a cost of less than 5c. per cu.yd., and practically all the gold is recovered. Material as low as 8 and 9c. per cu.yd. can be worked at a profit when sufficient tonnage is handled. This recovery system may be used on placer ground that is not suitable for dredging, and can be installed at little cost. At the Camp Carson property all these modifications have been in use a sufficient length of time to remove them from the classification of experiments.

General Petroleum Co.

Editorial Correspondence

The General Petroleum Co.'s balance sheet as of June 30, 1915, and the profit and loss statement for the six months' operation ended June 30 show a decrease in net profit from sales of oil at the wells, due particularly to the decrease in price of light-gravity oil. The profits shown in operation for the six months are materially accounted for by special earnings from a dividend of the Trumble Refining Co., due to the sale of rights of that company. The comparative balance sheet shows assets and liabilities equal to $61,128,450. The capital assets include five items, totaling $57,511,588. The largest item in this group is oil lands and other property amounting to $49,414,962. The next largest item is development and equipment, which amount to $6,212,-

523. The advances to controlled companies, including Federal Oil General Construction, General Water and miscellaneous, totaled $303,585. Capital liabilities amounted to $51,401,700, and the capital surplus, $4,764,607. Deferred payments on lands payable in oil amounted to $25,423, and payable in cash, $35,130. The liabilities to controlled companies totaled $718,495, divided between General Pipe Line and Trumble Refining Co. A suit filed by Mrs. Julia Goldman, a bondholder of General Petroleum, for redemption with interest of ten $1000 bonds is looked upon by some officers of the company as being evidence of opposition to the reorganization plan now being worked out.

New Mill at Elko Prince Mine, Midas, Nevada

SPECIAL CORRESPONDENCE

Construction of the Elko Prince mill on the property of the Elko Prince Mining Co., at Midas, Elko County, Nev., is well under way. Excavation work is completed, the forms are off from most of the concrete foundations and some of the mill framing is now being erected. The mill is being constructed for the Elko Prince Leasing Co. by the Dorr Cyanide Machinery Co., and will cost about $100,000. The daily capacity of the mill will be 50 tons. Ore from the Elko Prince mine and customs ores will be treated. A sampler will be installed in the mill building proper so that custom ores may be used as soon as the mill is ready for operations—probably in December.

The ore will be delivered into bins that will discharge upon a short conveyor feeding into a Telsmith gyratory crusher; the crushed ore will be raised by elevator to the fine-ore bin, whence it will be carried by a special conveyor to a 4-ft. Marcy steel-ball mill, which in turn will discharge into a 5x14-ft. tube mill; thence to a Dorr classifier, the oversize being returned to the tube mill. The Dorr process of counter-current decantation will be used, requiring three agitating vats and two Dorr tray thickeners. The pulp will then pass to an Oliver filter; the gold and silver will be precipitated by zinc dust; a Merrill press will be used. Power will be supplied by a 185-hp. Allis-Chalmers oil engine. Water will be pumped from a gulch at Midas through a 10,000-ft. pipe line to the mill.

Midas is in the Gold Circle mining district, about 50 mi. northeast of Golconda on the Southern Pacific and 35 mi. from Red House on the Western Pacific R.R. An autotruck runs regularly between Midas and Golconda, the roads being in fair shape and on easy grades. The hauling of machinery and supplies is from Red House.

The Gold Circle formation includes chiefly rhyolite, andesite and "bostonite." The mineralization is in vertical fissures in the rhyolite, the hanging wall of the veins in the Elko Prince mine being bostonite. The Elko Prince mine is developed by a crosscut adit about 700 ft. long, from which drifting has been done northward and southward a total distance of from 1,100 to 1,200 ft. on the vein, giving about 350 ft. of backs above this level. Raises and drifts have opened the ground above this level, while winzes and drifts have opened the vein to a depth of 750 ft. and for some distance along the strike.

The vein is a quartz filling carrying gold with silver sulphide. It breaks clean from the bostonite hanging wall but is not so well defined on the rhyolite foot wall, being scattered along numerous planes parallel to the strike with cross-fissures into which the mineralization has penetrated so that the working width will be largely determined by the ability of the miners to carry a narrow stope and by the grade of the rhyolite that will pay to mine. It has been estimated that sufficient ore has been blocked out to net $500,000 over the cost of the mill and operating expenses. The ore averages $40 per ton.

Little mining work is being done at present, but stoping will soon be started. A shrinkage method of stoping will be followed and an effort made to hold the stoping width down to 30 in. Probably sorting in the stopes will be adopted to throw out all coarse foot-wall rock that may be broken. Power drills are used in the mine, the compressor being driven by a Fairbanks-Morse oil engine. An oil engine also drives a dynamo supplying current for a small hoist, and a large compressed-air hoist is installed to raise ore from the levels below the tunnel through the 300-ft. winze which is timbered and equipped with headgear and cage for raising ore cars.

ELLERS LEASE OPENED IMPORTANT VEIN

Paul Ellers, working since January on a lease on the June Belle claim of the Elko Prince property, has opened a new vein paralleling the Elko Prince. It has about the same characteristics as the Elko Prince vein but with indications of proving of greater average width, so there are good grounds for believing that this vein may double the value of the Elko Prince mine. The lessee considers anything from $20 upward as "pay." He is screening the waste, the fines from which are profitable to mill. Custom treatment at the Rex mill costs about $7 per ton and haulage, 50c. Ellers expects to ship steadily to the Rex mill until the Elko Prince mill is completed. The Rex mill has been running under lease from the Battle Mountain owners by Howell & Liddell for about 18 months. It has been reworking old tailings while waiting for Ellers to make steady shipments. The ore developed in the Rex mine is practically worked out, so that the mine will not be able to supply the mill until further progress has been made in opening new orebodies.

Thorianite in Madagascar

The occurrence of thorianite in the Province of Betroka, Southeastern Madagascar, is reported by M. A. Lacroix before the Société de Mines of France. A preliminary analysis gave thoria, 93.02 per cent.; uranium oxide, 4.73; ferric oxide, 0.29; lead oxide, 1.80. The conditions of occurrence remain to be studied. While Mr. Lacroix describes thorianite as a mineral hitherto known only in Ceylon, the *Bulletin* of the Imperial Institute for 1912, page 514, notes the occurrence of thorianite in a gold-placer deposit on the river Boshagoch in the Transbaikal province of Asiatic Russia.

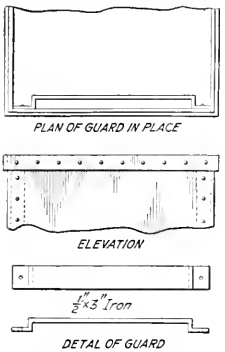
There Were 66,566 Short Tons of Domestic Ocher, umber, sienna, mineral paint, mortar color and ground slate and shale sold in 1914, which was less by 4029 tons than the sales of similar pigments in 1913. Of white pigments—zinc oxide, leaded zinc and the basic sulphate of lead produced by sublimation—there were sold 106,791 tons in 1914. The lead pigments made chemically, including basic-carbonate white lead, litharge red lead, orange mineral and lithopone, showed a decided increase, 245,206 short tons of these pigments having been sold in 1914.

Details of Practical Mining

Finger Guard on Tram Car

By A. E. Hall*

Many minor accidents are caused by chunks of ore crushing the fingers of the trammers against the car rim. In the *Journal* of Mar. 20 a handrail was described which was fastened to the rear of the car and which the trammers grasped instead of the rim of the car body.



FINGER GUARD FOR TRAM CAR

In the accompanying illustration is shown another scheme which is used at Sudbury mines for the same purpose as the outside handrail. Instead of angle iron at the top of the car, there is a strip of ½x3-in. iron running all around. The guard shown was placed on the inside of the car and although it takes up practically no room it accomplishes its purpose very satisfactorily. It is simply a piece of ½x3-in. iron bent as shown and placed inside the car and riveted to the car body. The trammer's fingers go between the guard and the car body.

*

Traction Rope on Aerial Tramways†

The traction or hauling rope for an aërial tramway is invariably a stranded rope with a hemp core, the flexibility depending on the size of the individual wires in the strand and the breaking stress of the material. This rope is endless and in constant motion. In general practice it passes around a driving sheave at one end of the line and around a surging or tension sheave at the other end.

The diameter of the hauling rope depends upon the highest tension occurring in it. To obtain this tension, various formulas are employed, but as it depends upon the weight and friction of the cars and hanling rope, it may be summarized thus:

$$Tension = [initial\ tension + \left(\frac{W}{S} \times H\right) + (w + H)]$$
$$+ [(W + \mu_1 \times N) + (L \times \mu_2 \times w) + (R \times 2)]$$

Where

W = weight of full carrier;
S = spacing of carriers in feet;
H = difference in level between stations in feet;
w = weight per foot of traction rope;
μ_1 = coëfficient of friction of cars;
μ_2 = coëfficient of friction of traction rope;
L = length of line in feet;
N = number of carriers on one side of line;
R = number of supporting rollers on one side of line.

This gives the tension in the rope in pounds, which if multiplied by the factor of safety 6 to 8, and divided by the breaking stress, gives the area of the rope necessary. This is for the general case with the drive at the upper terminal and the load ascending. When the loads are descending the plus sign in the center of the formula becomes minus. To obtain the tension when the ropeway is just put into work, the second half of the formula should be doubled.

*

Normal Underground Temperatures

Men cannot work with full efficiency in high temperature; consequently for both economic and hygienic reasons high temperatures in working places ought to be prevented. This subject has been studied extensively by a Royal Commission on Mining Industry at Broken Hill, New South Wales, from which report, 1914, there appears to be a wide difference of opinion as to what should be the standard of normal working temperatures. In Western Australia the standard is 87° F. dry and 80° F. wet bulb; in Victoria 83° F. wet bulb; in New Zealand 80° F. wet bulb; in Queensland a reasonable degree of humidity must be maintained; that is, at 85° F. dry the wet bulb must not exceed 80° F. If the dry bulb exceeds 85° F., the wet bulb must be at least 7° less.

Quoting from the Royal Commission on Coal Mines, 1909, in Great Britain, the report says: "The existing evidence indicates that in still and saturated air, continuous hard work is practically impossible at temperatures exceeding 80° F., even when men are stripped to the waist; and that, when the air temperature is higher than this, the result is the same if the wet-bulb temperature rises above 80° F. A temperature of 100° F. or 110° F. with the air so dry that the wet-bulb temperature is only 80° F. is thus no worse than air completely saturated with moisture at 80° F. In other words, it is the wet-bulb temperature, and not the actual temperature of the air, that matters when the air temperature is high. In moving air, however, a somewhat higher wet-bulb temperature can be borne than in still air. At wet-bulb temperatures exceeding 80° F., the amount of continuous work which a man is capable of doing without serious rise of bodily temperature rapidly falls off and becomes practically nothing at 90° F. wet bulb. Inasmuch as it seems clear that, for the economical working of a mine, the wet-bulb temperature should not in general be allowed to rise above 81° F., unless there is a good air current, great importance attaches to studying the causes of excessive heat and moisture in mines, and so arranging the ventilation as to

*Creighton Mine, Ont.

†Abstract from article in the "Engineer," London, July 23, 1915.

keep the wet-bulb thermomoter within reasonable limits and insure a good air current throughout the working places of the mines.

The Life of Wood Pipe

The results of an investigation of the lasting qualities of wood pipe carrying water, made under instructions from the director and chief engineer of the Reclamation Service, are given at great length by D. C. Henny, consulting engineer, for the service at Portland, Ore., in *Engineering News*, Aug. 26.

This inquiry on the life of wood pipe covered three general types—continuous wood-stave, section wood-stave and sectional bored.

Reviewing the information, it may be estimated that under conditions of continuous water pressure the life of various kinds of pipe may be as follows:

Wood	Condition	Years
Fir	Uncoated, buried in tight soil	20
Fir	Uncoated, buried in loose soil	4–7
Fir	Uncoated, in air	12–20
Redwood	Uncoated, buried in tight soil, loam or sand, and gravel	Over 25
Fir	Well coated, buried in tight soil	25
Fir	Well coated, buried in loose soil	15–20

Under conditions interfering with complete saturation of the wood, the life is cut down materially. These conditions are in the case of uncoated pipe brought about by open soil and low water pressure. The effect of coating appears to be equivalent to tight soil cover, with possibly the additional advantage of tar in the coating acting as a di-infectant. The effect of unfavorable conditions as to lack of complete saturation is serious in redwood, resulting in a life which may be shorter than 15 years.

On the whole the following conclusions seem justified as regards the relative life of fir and redwood in pipe:

(a) Under favorable conditions of complete saturation fir well coated may have the same life as redwood uncoated.

(b) Either kind of pipe will have a longer life if well buried in tight soil than if exposed to the atmosphere. Such life may be very long, 30 years and over, if a high, steady pressure is maintained.

(c) Either kind of pipe will have a longer life if exposed to the atmosphere than if buried in open soil, such as sand and gravel and volcanic ash, provided in hot and dry climate it be shaded from the sun.

(d) Under questionable conditions, such as light pressure or partially filled pipe, fir, even if well coated, may have only from one-third to one-half the life of redwood.

(e) Under light pressure the use of bastard-sawn staves in fir pipe should be avoided.

(f) The use of wooden sleeves in connection with wire-wound pipe is objectionable and has caused endless trouble and expense. It is possible that the objection may be partially overcome by dipping ends of sleeves in creosote and by applying a heavy coating of tar to the ends of the sleeves. Saturation of sleeve wood will never be as perfect, however, as of the straight pipe, and full creosote treatment of the wood or else some form of metal sleeve, either riveted iron or steel heavily coated, or cast iron will probably be well worth the extra cost.

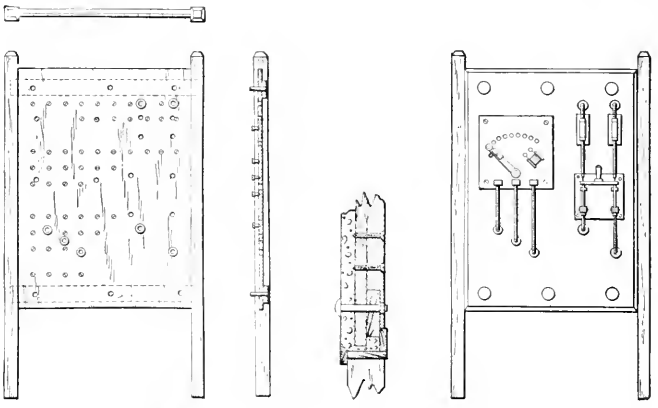
(g) If wooden sleeves are employed, they should be provided for sizes at least from 10 in. up with individual bands to permit taking up leaks.

Wood pipe is not suitable in cases where it cannot be kept full and under pressure during periods of use. Coating cannot under such conditions be expected to afford protection against decay. Coating should be continuous and heavy, not less than one-sixteenth inch to be fully effective, and should preferably consist of more than one individual coat of a mixture of asphaltum and tar, or of an application of gas tar followed by one or more applications of refined coal tar. Little experience, however, can be quoted in support of all-tar coating.

Concrete Switchboard

In a mill where I was employed there is a 500-volt, direct-current motor driving the machine shop, says J. R. Chapman, in *Power*. The switch, fuse blocks and rheostat were fastened to the wall of the building with sheet asbestos for protection.

One day the insurance inspector came in and insisted that a change be made to comply with the underwriters' rules. I suggested getting a slate board, but it was finally decided that a home-made board would do. Accordingly, I took two pieces of 3x3-in. hard wood, 7 ft. long and mortised in two cross-pieces, making a frame 4 ft. wide, as shown above. This was covered with dry pine boards between the uprights, making a tight back for the form. I next placed the fuse blocks, switch and rheostat on the board and marked where the bolt holes came and where the wires would pass. Through the cross-pieces I bored $\frac{5}{8}$-in. holes and drove in wooden pins, leaving them 2 or 3 in. long.



FORM FOR SWITCHBOARD AND END SECTION

For the wires I bored holes to fit porcelain insulation tubes 3 in. long and drove them in as far as necessary. The face of the board was set with $1\frac{1}{2}$-in. screws projecting about 1 in. and spaced 4 in. each. One-inch boards beveled on one edge to about 40 deg. were mitered even with the inside edge of the form to give a beveled edge to the face of the work when done, as shown in the accompanying illustration.

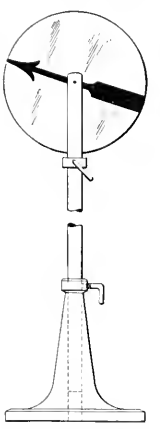
Next, I took a straight-edge and laid it across the front of the form and drove the insulating tubes even with the edge and cut the pins the same length. After the wood-work was done I laid the board on two timbers, face side up, and leveled it by a straight-edge laid across the sides of the form.

A concrete mixture of one part portland cement to three of fine sand, mixed thin enough to run freely, was poured in the form and allowed to set for a week or more. When it was thoroughly dry and hard, the form was removed and the wooden pins driven out through the cross-pieces. The concrete was bolted to the board with ⅝-in. bolts.

The fuse blocks, main switch and rheostat were then fastened in place with ¼-in. bolts through the holes left by driving out the wooden pins. The wiring was mostly at the back of the board, the porcelain tubes serving as passages for making the necessary connections to the apparatus on the front. The back of the board was covered with sheet asbestos for safety and the wires were supported on porcelain cleats. All the conductors were thoroughly insulated from the wood and concrete parts, so that the work passed the underwriters' rules. Finally, the board was painted with a mixture of lamp-black and linseed oil, which gave it the appearance of slate. The whole has a good appearance, as shown in the illustration and satisfies all concerned.

A Holder for Danger Signs

It is conceded by safety experts that the different-colored disk-shaped danger signs now used by many industrial concerns fill an important place as a means of preventing accidents, says J. E. Cooley in *American Machinist* of Sept. 2, 1915. One drawback found in using these is, there is not always a suitable place (or means) to hang or tack them up where a danger exists, and workmen are therefore exposed to hazards because no place is convenient to put up a sign, or it is too much trouble to provide means for this purpose.



A HOLDER FOR DANGER SIGNS

The illustration shows a danger-sign holder that can be moved about for temporary use or fastened to the floor and used in a permanent position. It is made so that it can be used anywhere and so constructed that the sign can be set to a point directly at the danger to be avoided.

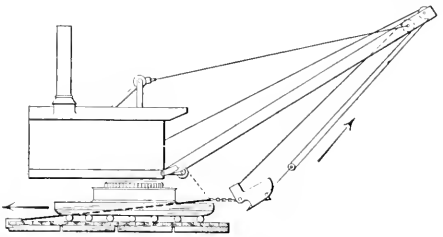
It consists of a cast-iron base, having an adjustable rod about ½ in. diameter, held in place with a binding-screw in the base. At the top of the rod an opening is sawed down a short distance through the center, in which to place the sign, which turns on a small pin, as shown. The binding-collar and screw near the top secures the sign in place, after the arrow-head is set to point at the danger to be avoided.

The use of these holders will prevent many accidents that would otherwise happen. Several of them should be made up and placed where they will be accessible at all times.

Moving a Dragline Excavator Over Soft Ground

An ingenious method is employed by the Winnipeg Aqueduct Construction Co., says the *Excavating Engineer*, for moving its dragline excavators over the soft material in which they are digging. The material is called muskeg, which is nothing but decayed moss and vegetable matter, so soft that it is impossible to get a firm hold with the bucket without digging from 4 to 6 ft. until clay is encountered. This operation naturally caused considerable delay. The following effective method was evolved to overcome this trouble.

The draglines operate on four platforms. When a machine is ready to move and the platform in the rear of the machine is swung and dropped in place in front



TACKLE FOR MOVING DRAGLINE EXCAVATOR

of the machine in the direction in which it is desired to move, the dragline is swung facing the rear. A 20-ft. chain, or better yet, a cable, is hooked by means of a clamp onto the platform which has just been dropped in front of the machine. This cable is run under the base of the machine and the other end is hooked through the bucket chain. When the bucket is hoisted, the machine moves ahead easily in the direction desired. With this method, the machine is ready to dig in five minutes.

Bonus-System Mucking

An instance of the effect of the bonus system on the industry of the men is given by S. P. Brown, chief engineer of the Canadian Northern-Montreal Tunnel and Terminal Construction. Seven muckers were employed in the heading under normal conditions, three in advance throwing the muck back from under the bar and the four other men loading on the cars direct. Mr. Brown says that normally a mucker thinks he is doing a good day's work when he shovels 7 cu.yd. of loose muck into a car, and that really this is all that can be expected of him.

During the record month at the Mount Royal tunnel, however, the four muckers who were loading on the cars handled up to 15 cu.yd. per man per shift, and averaged over 12 cu.yd. In order to appreciate that this is probably a mucking record, it must be remembered that nearly two hours were lost out of the eight in blasting, as two shots were fired regularly every shift. On this work a foreman never had to hire or discharge men during periods of rapid progress. If a man failed to do his share of the work, his comrades ran him out of the tunnel and brought in a better man to take his place.—*Engineering News.*

Details of Milling and Smelting

Corrosion of Iron Pans in Zinc Melting

In hot galvanizing the zinc is generally fused in iron pans, and the iron pans are attacked by the fused zinc, says *Engineering*, Aug. 20, 1915. If that were not so, mechanical galvanizing would hardly be efficient; for the zinc is to adhere to the iron, and it does adhere because it alloys to a certain extent with the iron. The iron pans in which the zinc is fused hence suffer, and the practice considers certain kinds of iron especially suitable for making iron pans. Two years ago the well-known establishment of Julius Pintsch, of Fürstenwalde, observed to its surprise that an iron pan, supplied by an English firm of repute, which had always given satisfaction, was more quickly corroded by the zinc than lower-grade iron pans. The fact was ascribed to a certain peculiarity in the iron, but a more thorough investigation of the problem was deferred.

The results of the subsequent investigation were published last May in the *Zeitschrift des Vereines Deutscher Ingenieure*. Sheets of 10 different kinds of iron were supplied by Krupp in Essen. After having been analyzed and examined metallographically, they were cut up into plates, and pairs of these plates were suspended for 8 hr. in molten zinc at different temperatures. All the plates lost in weight by being kept in contact with the molten zinc, the loss amounting to about 20 grams of iron per hour per square meter of iron surface in a well-heated bath; and as long as the temperature was not raised materially, the composition of the iron did not appear to make much difference.

An increase in the carbon percentage did not favor the corrosion, nor did a change in the manganese proportion. A rise in the phosphorus percentage from 0.025 to 0.090 did not affect the corrodibility either, though the introduction of phosphorus into the zinc bath is of course undesirable. An increase in the silicon percentage did increase the solubility of the iron noticeably, and want of homogeneity in the structure of the iron had the same effect. But these influences were not important, and the temperature of the bath proved of much greater consequence. Zinc melts at 419.4° C. As the temperature of the bath was slowly raised from about 437° C., at which the first observations were taken, the loss of iron increased slowly at first, but much more rapidly afterward, when the temperature exceeded 500° C. In one case the losses of weight were: 20 grams at 437°; 23 grams at 467°, 28 grams a 486°, 41 grams at 495°, 68 grams at 500°, and 288 grams at 532°, the loss being understood as before, per hour per square meter of iron surface. This was not the worst case. One iron lost over 500 grams, another 800 grams in the eighth hour. At higher temperatures, moreover, the differences between the different sorts of iron became much more pronounced.

The chief thing to guard against, then, is an unduly high temperature of the zinc bath. It was further observed that it is advisable to keep the pan, so far as possible, at fairly even temperatures, and to avoid repeated complete cooling and reheating, lest crusts of hard zinc should peel off and impair the iron locally.

*

Theory of the Bucket Elevator

By L. Kresser*

The discharge conditions of a belt elevator can be determined theoretically and in advance of construction. In Fig. 1 the circle C represents the head pulley or the circle described by the backs of the buckets of an elevator. Assume the diameter of this circle to be $2r$ and the circumferential speed v_0, then the centrifugal acceleration is $\frac{v_0^2}{r}$.

In a position of the bucket in which its back is inclined at angle α, as is indicated by line AB, a piece of material at A is subject to the action of gravity and of the centrifugal force $\frac{v_0^2}{r}$. The tangential component of the gravity is $g \times \sin \alpha$ ($g = 32.19$ ft. per sec.^{2}), which is the driving force for the discharge of the material. The frictional resistance is $\left(g \times \cos \alpha - \frac{v_0^2}{r}\right)\mu$, wherein $\mu = tg\,\varphi$ is the coefficient of friction between the material

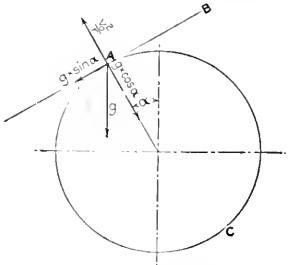


FIG. 1. PARALLELOGRAM OF FORCES, BUCKET ELEVATOR

and the bucket. Ejection of the material will take place as soon as $\alpha = \alpha_0$, α_0 to be determined from:

$$g \times \sin \alpha_0 - \left(g \times \cos \alpha_0 - \frac{v_0^2}{r}\right)\mu = 0$$

The acceleration for the motion of discharge of the material $p_t = g \times \sin \alpha - \left(g \times \cos \alpha - \frac{v_0^2}{r}\right) \times \mu$.

The velocity is:

$$v_t = \int p_t dt; \; put \; \alpha = K \times t \text{ where } K = \frac{v_0}{r}$$

*Mechanical engineer, Passaic, N. J.

$$v_t = \frac{1}{K} \times \left[g \times \cos \alpha_0 + \mu \times g \times \sin \alpha_0 - \mu \frac{{v_0}^2}{r} \alpha_0 - \left(g \times \cos \alpha + \mu \times g \times \sin \alpha - \frac{{v_0}^2}{\mu r} \alpha \right) \right]$$

For an angle of $\alpha = \alpha'$ this velocity is: v_t'.

wherein α' is determined by: $g \times \cos \alpha' = \frac{{v_0}^2}{r}$

For an angle $\alpha > \alpha'$ the acceleration is $p_t = g \times \sin \alpha$ and the velocity $v_t = \frac{1}{K} \times \left[g \times (\cos \alpha' - \cos \alpha) \right] + v_t'$

However, more important than the velocity is the discharge of the material which is: $s_t = \int v_t \times dt$.

$$s_t = \frac{1}{K^2} \times \left[\left(g \times \cos \alpha_0 + \mu \times g \times \sin \alpha_0 - \mu \times \frac{{v_0}^2}{r} - \alpha_0 \right) (\alpha - \alpha_0) + g \times (\sin \alpha_0 + \mu \times \cos \alpha) - g \times (\mu \times \cos \alpha_0 + (\sin \alpha + \frac{\mu}{2} \times \frac{{v_0}^2}{r} \times (\alpha^2 - {\alpha_0}^2) \right] \quad For\ \alpha \leq \alpha'$$

For angle $\alpha = \alpha'$ is the displacement s_t' and for angles $\alpha > \alpha'$ $s_t = s_t' + \frac{1}{K^2} \times \left[g \times (\alpha - \alpha') \times \cos \alpha' - g \times (\sin \alpha - \sin \alpha') + v_t' K \times (\alpha - \alpha') \right]$

The result of this complicated formula has been plotted in the charts of Figs. 2, 3, 4 and 5, which are figured for a value of $k = 1$, and any displacement taken from it is to be divided by the square of the angular velocity. The four charts are figured for coefficients of friction $\mu = 0.2$, 0.4, 0.6 and 0.7. Each curve is drawn for a certain value of the centrifugal acceleration as a fraction of the acceleration of gravity. Values of $\frac{{v_0}^2}{r} = 0.1 \times g$ up to $\frac{{v_0}^2}{r} = 1.0 \times g$ include all slow- and fast-running elevators. By means of the chart it is possible to determine the angle at which a complete discharge of the material from the bucket has taken place.

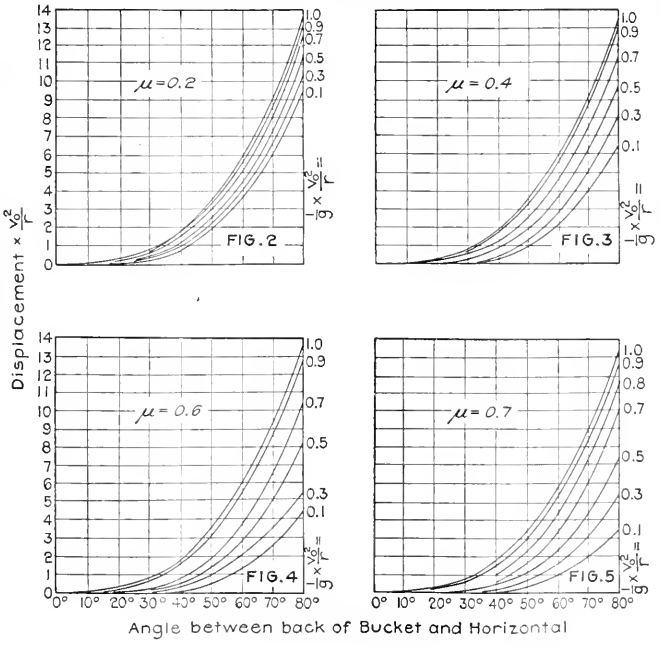
Example: Material: Hard coal $\mu = 0.6$. Size of bucket, 12x6x6. Speed of elevator, 360 ft. per min., or 6 ft. per sec. Diameter of head pulley, 40 in., or $r = 1.66$ ft.

$$\frac{{v_0}^2}{r} = \frac{36}{1.66} = 21.7 \text{ and } \frac{{v_0}^2}{r} \times \frac{1}{g} = 0.674;$$

$$\frac{v_0}{r} = K = 3.61; \left(\frac{v_0}{r} \right)^2 = 13.03$$

For a displacement of 6 in. the chart value is $13.03 \times 0.5 = 6.5$ ft.

We find in the chart for $\mu = 0.6$ a curve somewhat below $\frac{{v_0}^2}{r} = 0.7 \times g$ and reach a displacement of 6.5 ft. at about 70°. If we should prefer an earlier discharge at the same speed we have to use a larger head pulley, for instance, of 52 in. diameter, and the discharge will be complete at an angle of 64°. If we run this elevator with a 40-in. pulley at a speed of 180 ft. per min., or 3 ft. per sec., the discharge will be complete at an angle of 52°.



FIGS. 2 TO 5. CRITICAL SPEEDS OF THE BUCKET ELEVATORS

Hall Sulphur Reduction Applied to Blast Furnaces

The Hall process for the recovery of elemental sulphur has been applied to blast-furnace smelting (U. S. pat. 1,134,846). A reducing flame is introduced at about the normal level of the top of the charge, while the charge is put in through openings which are normally sealed, just as in iron smelting. The reducing flame decomposes the SO_2, while the shutting out of the oxygen ordinarily admitted through the charge doors gives the sulphur no chance to reoxidize. Therefore it passes out of the furnace as sublimed sulphur and is recovered in a gas washer.

Colley Briquetting Process

An ingenious method for rendering ores suitable for blast-furnace treatment is the one patented by Bernard T. Colley, of Rancagua, Chile (U. S. pat. 1,098,883). His process consists in taking the sulphur dioxide from the roasters for the manufacture of sulphuric acid (20% or stronger). This acid is then thoroughly mixed with crushed limestone and agitated, producing calcium sulphate. This calcium sulphate to the extent of 5% is then mixed with the roasted ore, where it exercises the same briquetting power that plaster of paris would.

The Cost of Doing Things

Cost of Mining in Alaska

The figures herewith give details of mining costs at the Alaska Treadwell Gold Mining Co., the Alaska United Gold Mining Co. and the Alaska Mexican Gold Mining Co., Douglas Island, Alaska, for 1914, as shown by their annual reports.

A summary of the table for the Alaska Treadwell shows that the total cost of producing 910,285 tons of ore, 608,794 tons of which were drawn from the broken-ore reserve, was 68.9c. per ton for mining. This cost is made up of 5934 ft. of development at $17.753 per ft.;

DEVELOPMENT COSTS PER FOOT

	Alaska Treadwell	Alaska United Ready Bul.	Alaska United 700-Ft. Claim	Alaska Mexican
Machine drillers	$5.749	$0.638	$1.959	$1.183
Hand miners	....	....	.175	.007
Laborers	2.370	.244	1.063	.560
Powdermen	.063	....	.008	....
Foremen, shift bosses	.418	.353	.213	.536
Machinists, pipemen	.125	....	....	.001
Carpenters, timbermen	.579	....	.228	.183
Contractors	1.304	5.676	2.607	.337
Engineers, oilers and skip-men	.052	....	....	....
Cagemen	.016	....	....	....
Trainmen and trammen	.034	....	....	....
Track and stablemen	.080	....	....	.003
Timekeeper	.174	....	....	....
Total direct labor	$10.964	$6.911	$6.253	$2.810
Powder	$1.817	$1.829	$1.173	$0.598
Primers	.393	.297	.181	.098
Candles	.007	....	....	....
Machine drill supplies	.574	.390	.003	.009
Drill steel	.524	.184	.009	.025
Lumber and timber	.496	.287	.109	.147
Lubricants	.014	.017	....	....
Carbide	.024	....	.007	.002
Miscellaneous	.421	.337	.093	.118
Total direct supplies	$4.270	$3.341	$1.575	$0.997
Electrical repairs	$0.031	$0.025	....	....
Mechanical repairs	.224	.034	$0.007	$0.014
Power	.008	.001	....	....
Train service	.098	.054	.013	.053
Assaying	.016	.040	.014	.002
Surveying	.056	.111	.060	.040
General expense	1.551	.500	.566	1.068
Steam heat	.053	....	....	....
Compressed air	1.219	.932	.647	.372
Blacksmith shop	.773	.676	.606	.354
Diamond drilling	1.244	1.154	.352	.079
Central development	5.575	....	1.089	2.990
By Treadwell Co.	....	....	3.611	6.529
By United Co.	....	....	....	.388
Total mixed labor and supplies	$10.848	$3.533	$6.965	$11.889
Grand total	$26.082	$13.785	$14.793	$15.696
Credits	8.329	....	.134	....
Net total cost	$17.753	$13.785	$14.659	$15.696
Feet of development	5,934	3,569	8,528	2,952

sloping 301,491 tons at $1.050 per ton, tramming 910,285 tons at 11.6c. per ton, hoisting 910,285 tons at 9.4c.; and pumping at 1.6c. per ton. These costs consist of 33.8c. for labor, 19.6c. for supplies, and 21.2c. for subsidiary accounts; less 5.7c. per ton for credits. No depreciation is charged in these figures.

The cost of mining on the Ready Bullion claim of the Alaska United was $1.055 per ton for 233,100 tons exclusive of depreciation. Included in this cost is 3569 ft. of development at $13.785 per ft., sloping 249,545 tons at 51.3c. per ton, tramming 233,100 tons, 12.2c.; hoisting 233,100 tons, 13.9c.; and pumping, 3.4c. per ton. These costs consist of 59.8c. for labor, 23.2c. for supplies and 22.5c. for subsidiary accounts. Costs at the 700-Ft. claim amounted to $1.23 for 225,214 tons, of which 106,002 tons were stoped and the remainder was drawn from broken-ore reserves. The cost was made up of 8528 ft.

STOPING COST PER TON OF ORE STOPED

	Alaska Treadwell	Alaska United Ready Bul.	Alaska United 700-Ft. Claim	Alaska Mexican
Machine drillers	$0.172	$0.098	$0.138	$0.124
Hand miners	.032	.018	.034	.037
Laborers	.219	.136	.238	.241
Powdermen	.029	.008	.029	.020
Trainmen, trammen	....	....	....	.004
Trackmen, stablemen	.001	....	....	.001
Pumpmen	....	....	....	.002
Foremen, shift bosses	.021	.026	.037	.021
Machinists, pipemen	.002	.005	.002	.004
Carpenters, timbermen	.002	.010	.005	.018
Timekeeper	.003	....	....	....
Chutemen	....	....	....	.006
Total direct labor	$0.481	$0.301	$0.483	$0.478
Powder	$0.317	$0.077	$0.169	$0.114
Primers	.087	.026	.052	.034
Candles	.005	.002	.003	.002
Machine drill supplies	.020	.014	.020	.015
Lumber and timber	.004	.003	.007	.005
Lubricants	.001	.001	.002	.001
Carbide	.002	.002	.002	.002
Miscellaneous	.009	.006	.011	.005
Drill steel	....	.007	.016	.010
Total direct supplies	$0.447	$0.138	$0.282	$0.188
Electrical repairs	$0.002	....	....	$0.002
Mechanical repairs	.001	....	....	.001
Train service	.001	$0.001	$0.001	.001
Assaying	.003	.002	.004	.003
Surveying	.001	.001	.001	.001
General expense	.069	.022	.034	.064
Steam heat	.003	.002	.004	.003
Compressed air	.024	.027	.037	.034
Blacksmith shop	.018	.019	.036	.034
Total mixed labor and supplies	$0.122	$0.074	$0.117	$0.143
Total cost stoping	$1.050	$0.513	$0.882	$0.809
Tons stoped	301,491	249,545	106,002	167,274

TRAMMING COST PER TON OF ORE TRAMMED

	Alaska Treadwell	Alaska United Ready Bul.	Alaska United 700-Ft. Claim	Alaska Mexican
Laborers	$0.042	$0.055	$0.046	$0.035
Engineers, oilers, skipmen	.001	....	.008	.006
Chutemen	.017	.014	.017	.021
Trainmen, trammen	.013	.014	.013	.017
Trackmen, stablemen	.003	.005	.005	.007
Foremen, shift bosses	.003	.005	.005	.006
Carpenters, timbermen	.002	....	....	....
Machine drillers	....	.001	....	....
Powdermen	....	....	.001	....
Machinists, pipemen	....	....	.002	.001
Total direct labor	$0.081	$0.094	$0.097	$0.093
Steel rope	$0.001	....	....	....
Lumber and timber	.001	....	....	....
Electric motor	.004	....	....	....
Stable	.001	$0.003	$0.003	$0.003
Miscellaneous	.003	.012	.005	.002
Lubricants	....	....	.001	.001
Total supplies direct	$0.010	$0.015	$0.009	$0.006
Electrical repairs	$0.006	$0.001	$0.001	$0.002
Mechanical repairs	.003	....	.006	.003
General expense	.012	.007	.007	.012
Compressed air	.002	....	.003	.002
Electric lights	.001	.001	.001	.002
Blacksmith shop	.002	.004	.004	.003
Central tramming	.001	....	.001	.001
Train service	....	....	....	.001
By Treadwell Co.	....	....	....	.002
Total mixed labor and supplies	$0.027	$0.013	$0.023	$0.028
Credits	.002	....	....	....
Total cost tramming	$0.116	$0.122	$0.129	$0.127
Tons trammed	910,285	233,100	225,214	233,457

of development at $14.659 per ft., stoping 106,002 tons at 88.2c. per ton, tramming 225,214 tons at 12.9c., hoisting 225,214 tons at 11.9c. and pumping, 1.2c. per ton.

These costs consisted of 59.5c. for labor, 40.4c. for supplies and 43.1c. for subsidiary accounts.

Mining costs at the Alaska Mexican amounted to $1.019 per ton for 233,457 tons, exclusive of depreciation. Of this tonnage 167,274 tons were stoped and the remainder was drawn from broken-ore reserves. This cost was made

COST OF HOISTING PER TON HOISTED

	Alaska Treadwell	Alaska United 700-Ft. Ready Bnl.	Alaska United 700-Ft. Claim	Alaska Mexican
Engineers, oilers, skipmen	$0.017	$0.048	$0.021	$0.027
Cagemen	.003	....	.007	.009
Carpenters, timbermen	.001	.006	....	....
Laborers	....	.001	....	....
Trackmen, stablemen	....	.005	....	....
Total direct labor	$0.021	$0.060	$0.028	$0.036
Steel rope	$0.001	$0.005	....	....
Lumber and timber	.001	.001	....	....
Miscellaneous	.002	.006	.003	....
Lubricants	....	.002	....	$0.001
Total direct supplies	$0.004	$0.014	$0.003	$0.001
Electrical repairs	$0.002	$0.001	....	....
Mechanical repairs	.004	.005	$0.004	$0.004
Power	.030	.048	.024	.043
General expense	.002	.004	.003	.005
Steam heat	.001	.004	....	....
Blacksmith shop	.001	.002	.002	.001
Central hoisting	.030	....	.038	.019
Building repairs	....	.001	.002	.002
Rental of equipment	....	....	.015	....
By Treadwell Co.	....	....	....	.001
Total mixed labor and supplies	$0.070	$0.065	$0.088	$0.075
Credit	.001	....	....	.016
Total hoisting cost	$0.094	$0.139	$0.119	$0.096

up of 2952 ft. of development at $15.696 per ft.: stoping 167,274 tons at 80.9c. per ton; tramming 233,457 tons at 12.7c.; hoisting 233,457 tons at 9.6c. and pumping 1.7c. per ton. The charge for labor included in these costs was 51.3c. per ton; supplies, 15.4c.; subsidiary accounts, 35.2c. per ton.

Dredging and Hydraulicking Operations in the Yukon

The following data were taken from the report of the Yukon Gold Co. for 1914. At Dawson the dredges began operations on May 12 and ran until Oct. 23. The average length of the dredge season was 164 days, during which the dredges operated 87.2% of the possible time. The thawing cost was reduced 1.39c. per cu.yd. and was lower than for any previous season. A total of 421,835 sq.yd., or 68.6% of the ground handled, was frozen and had to be thawed by steam. The dredges handled 4,800,181 cu.yd. of material, which produced $2,602,685, or 54.21c per cu.yd., at a working cost of 27.62c. per cu.yd.

The Iditarod dredge operated from May 4 to Nov. 11 and handled 668,737 cu.yd. of material, producing $739,631, or $1.10 per cu.yd. The operating cost, including $50,000 depreciation, was 50.2c. per cu.yd., with the dredge operating 91.91% of the possible time. The maximum grade of the creek did not exceed 5% and few boulders were encountered, but large quantities of granitic sand were handled. A total of 67,260 sq.yd. of ground, or 14% of the total area, was thawed by steam.

The three California dredges operated by the Pacific Co. handled 3,198,192 cu.yd. of gravel and produced $322,571. The average cost of the three dredges was 4.27c. per cu.yd., including depreciation.

The hydraulic operations at Dawson handled 3,241,641 cu.yd. of material at a working cost of 7.6c. per cu.yd., exclusive of depreciation of the main ditch. The total amount of water used amounted to 519,834 miner's inches, equal to a duty of 6.02 cu.yd. per miner's inch.

Cost of the Belmont Mill*

The Belmont mill at Tonopah, Nev., was designed and constructed by the Belmont staff. Ground was broken in August, 1911, and milling operation started July 25, 1912. The metallurgical flow-sheet and the machinery adapted to carrying out operations in accordance with this plan were decided upon from experience gained in the treatment of Belmont mine ores at the old Belmont mill at Millers, Nev.

Detail drawings were made by the engineering staff of the Tonopah-Belmont Development Co. under the supervision of Otto Wartenweiler, who also had direct charge of the construction, consulting with the general superintendent of the company, Frederick Bradshaw, and A. H. Jones, superintendent of milling.

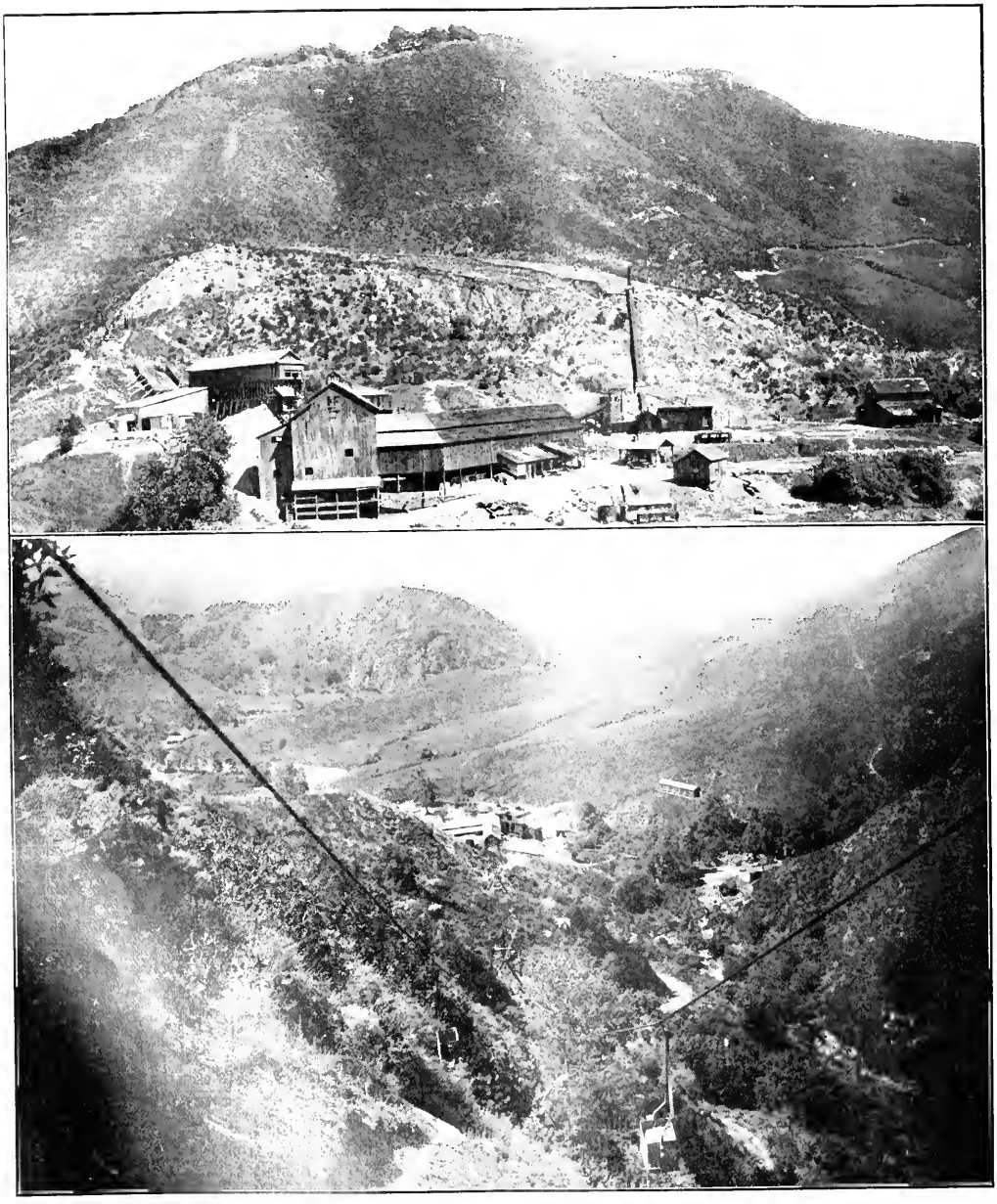
The total cost of the plant, designed to handle 500 tons per day, was $465,189.07. The savings in operating costs and increased extraction, as compared with the best results from the old mill at Millers, were such as to return the entire cost of the new plant from the treatment of 269,000 tons of ore, or approximately 18 months' operation. The accompanying table shows the costs of construction.

CONSTRUCTION COSTS, BELMONT MILL

	Excavation, Concrete Walls and Foundations	Floors and Machinery Foundations	Buildings: Frames	Buildings: Covering	Machinery, Including Erection, Piping, Belting, Etc.	Totals
Crusher plant	$5,760.72	$2,527.58	$2,230.72	$1,476.69	$21,174.96	$33,170.67
Inclined conveyor	166.41	238.02	1,771.75	585.19	3,620.79	6,382.16
Battery bins	399.00	489.70		2,067.69	3,475.14	6,431.53
Stamps	.....	8,797.82			36,873.06	45,670.88
Tube mills and classifiers	.....	3,180.95			40,127.89	43,308.84
Callow cones	.....	26.02			856.63	882.65
Concentrating plant	.....	1,663.23			11,356.35	13,019.58
Concentrate house	76.80	449.69	354.80	623.27	602.10	2,106.66
Dorr thickeners	..	11,297.98			15,034.53	26,332.51
Circulating system	...	147.81			6,846.05	6,993.86
Air agitation	261.71	3,987.80			25,257.89	29,507.40
Clarifying	...	1,829.63			8,573.87	10,403.50
Precipitation system	395.00	44.05			29,581.02	30,020.07
Briquetting plant	...	...			1,589.49	1,589.49
Air compressor	.....	1,084.39			7,094.52	8,178.91
Filter plant	.....	4,456.68			30,104.50	34,561.18
Refinery	2,473.84	1,552.23	2,200.17	2,292.80	7,548.79	16,067.83
Boiler plant and fuel-oil system	571.56	90.97	401.25	531.11	7,606.28	9,201.17
Tank-heating system	.....	9.56			3,362.39	3,371.95
Transformer house	91.83	101.05	428.69	213.07	4,804.89	5,639.53
Lime house	11.00	.....		753.30	305.85	1,070.15
Machine shop	1,297.66	843.01	1,138.73	1,191.93	339.36	4,810.69
Storeroom	511.55	1,509.60	1,305.84	1,315.78	152.04	4,794.81
Inclined railway	133.25	.....	432.70	203.41	379.51	1,148.87
Mill building	39,645.45	6,757.60	45,493.48	19,607.14	9,020.51	120,524.18
Total	$51,795.78	$51,085.37	$55,758.13	$30,861.38	$275,688.41	$465,189.07

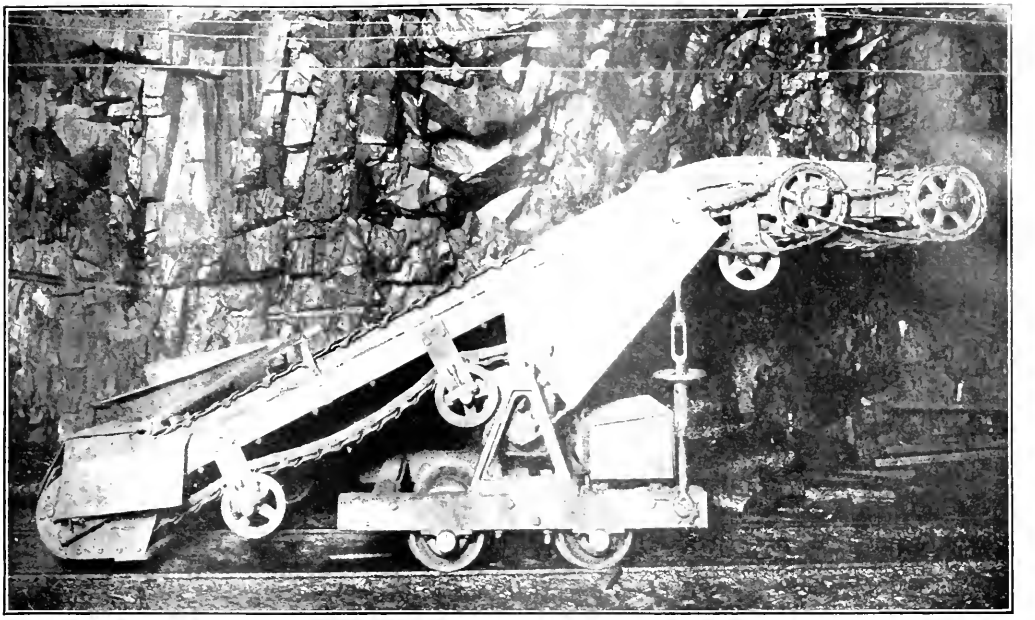
*From an article by A. H. Jones in "Bulletin" A. I. M. E., August, 1915.

Photographs from the Field



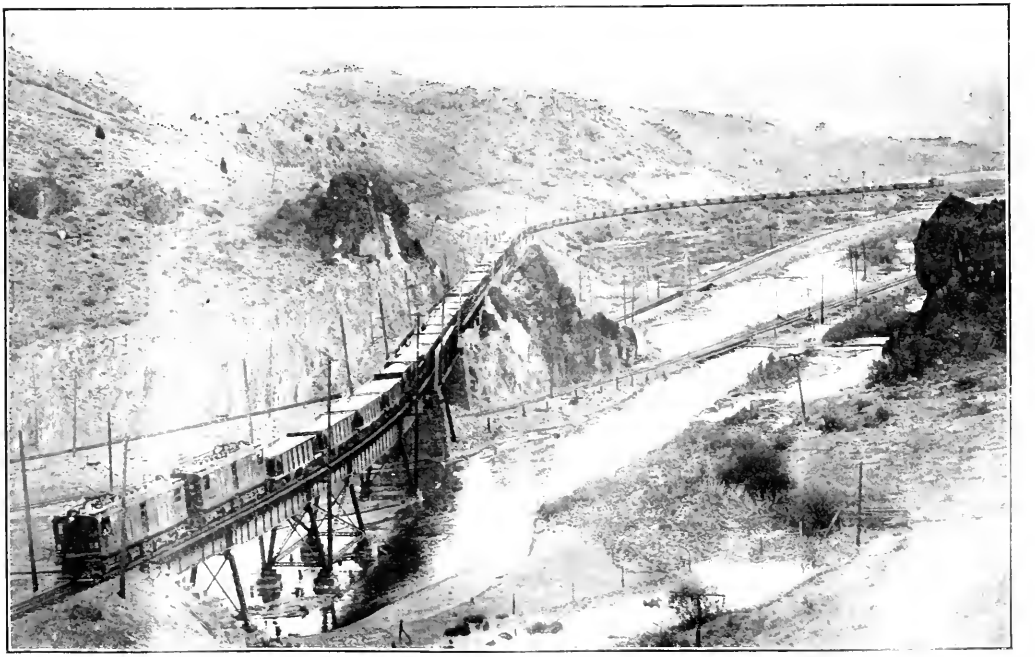
OCEANIC QUICKSILVER MINE, NEAR CAMBRIA, CALIF.

Upper view shows the mine. Lower view shows the aërial tramway used to convey ore from the mine to the furnace plant



PORTABLE LOADING MACHINE AT THE MORRIS-LLOYD MINE OF THE CLEVELAND-CLIFFS IRON CO.

The muckers shovel into the lower end of the machine, rock being then elevated on a steel-apron conveyor belt and dumped into 8-ton saddle-back cars. A 30% increase of efficiency over simple shoveling was gained.



LONG ORE TRAIN, CONTAINING 75 CARS, ON THE BUTTE, ANACONDA & PACIFIC RY. IN SILVER B[OW], MONT.

At this place the Anaconda railway crosses two transcontinental lines—the Northern Pacific and the [Chicago, Milwaukee & St. Paul—both of which are shown in the picture.

Correspondence and Discussion

Securities of the American Smelting and Refining Co.

The able review of the securities of the American Smelting and Refining Co. and its subsidiary, the American Smelters Securities Co., in the editorial columns of the *Journal* of Aug. 28 has been read by me with much interest.

The answer to the inquiry as to "why one of the premier securities of so solid a company should be available at so low a price" is that in this case the American investor is profiting temporarily by the necessities of his unfortunate European brother. A large part of this issue was originally sold abroad, and the enormous financial requirements of the European War have compelled investors in the belligerent countries to dispose of some of their holdings of sound American investment securities at prices materially below their intrinsic worth; in this respect the market quotations for American Smelters Securities preferred shares, series A, have been particularly affected.

In connection with the table showing the comparative yields of the securities of the American Smelting and Refining Co. and its subsidiary, the inclosed comparison between American Smelting and Refining preferred and American Smelters Securities preferred, series A, will no doubt be of some interest.

STATISTICS OF AMERICAN SMELTERS SECURITIES PREFERRED STOCK A

	American Smelting and Refining Co. Preferred Stock, 7% Cumulative	American Smelters Securities Co. Preferred Stock, Series A, 6% Cumulative
Price	106	85
Yield	6½%	7.06%
Number of times preferred dividend was earned—		
Calendar year 1914	1 9	3 8
Calendar year 1913	2 1	4 4
Average from May, 1905, to Dec. 31, 1914	2 35	3 7

American Smelters Securities preferred stock, series A, has the provision for the retirement of the stock at 100 by lot under the operation of the cumulative annual sinking fund, by which the entire issue should be retired by 1947. The holder of the stock purchased at present prices should therefore receive a profit of $15 per share on his investment, and the profits derived from such redemption will form a considerable addition to the dividend yield.

A comparison of the earnings of the two companies over a series of years shows that the dividend requirements of the latter stock are protected by a materially larger margin of earning power than those of the former; the position of Smelters A is therefore better from an investment standpoint.

The opportunity for material profit through the retirement of the shares at par under the operation of the sinking fund is a feature not possessed by any of the other securities of the American Smelting and Refining Co. or its subsidiary. While the present value of this profit through retirement to any individual investor depends upon the date on which the shares are drawn, the provision is a valuable one and should entitle these shares to a market valuation materially above others equally well secured but lacking this feature.

I am pleased to note a review of securities of this class in the editorial columns of the *Journal*, because it is in the interest of sound mining finance, upon which sound mining operations are necessarily dependent.

EUGENE MEYER, JR.

New York, Aug. 28, 1915.

[The fact remains that in any inter-company dealings to the advantage of the A. S. & R. Co. as against the A. S. S. Co., the latter's preferred A stock is the only one of its issues that could be hurt, barring the common, and that is all owned by the American Smelting and Refining Co.—Editor.]

Holmes Professorship, Colorado School of Mines

On Aug. 12 the Board of Trustees of the Colorado School of Mines created the Joseph A. Holmes Professorship of Safety and Efficieney Engineering, in honor of the late Doctor Holmes, Director of the United States Bureau of Mines.

I was authorized by the board to nominate persons suitable for this position, and we are enabled to offer a salary that would induce a first-class man, trained in such work, to come here. I would therefore be greatly obliged for suggestions as to filling this position.

The specific object of this professorship is to train our students in the use of all life-saving apparatus and in all matters that would be embraced under the general term of safety and efficiency engineering, in so far of course as they may be separated from other work of a similar character.

I believe that this is the first and only professorship of the sort in the United States, and naturally we have to feel our way along a bit. We would like to have the man chosen for the position devote himself, for the next few months, to becoming acquainted with conditions here if he does not already know them, so that he may himself be able to outline the proper course of instruction.

We have felt that there could be no more fitting memorial to Doctor Holmes than the establishment and maintenance of this professorship to bear his name, and surely we must see to it that it is conducted in a manner that he would approve of. One cannot, of course, say offhand just how many and what subjects should be embraced under the general term "safety and efficiency engineering"; but we are resolved to work this problem out according to our best lights and to do this we must have a first-class man in charge of the chair. A modern equipment will be provided and kept uptodate, and we hope to have this chair stand for all that is best in safety engineering.

WILLIAM B. PHILLIPS,
President, Colorado School of Mines.

Golden, Colo., Aug. 28, 1915.

NEW PUBLICATIONS

COAL FIELDS OF BRITISH COLUMBIA. Compiled by D. B. Dowling. Pp. 350, illus. Memoir 69, Canadian Department of Mines, Geological Survey Branch, Ottawa.

A LIST OF CANADIAN MINERAL OCCURRENCES. By Robt. A. A. Johnston. Pp. 275. Memoir 74, Canadian Department of Mines, Geological Survey Branch, Ottawa.

THE FAUNA OF THE BATESVILLE SANDSTONE OF NORTHERN ARKANSAS. By George H. Girty. Pp. 170, illus. Bull. 593, U. S. Geological Survey, Washington.

RECONNAISSANCE OF THE GEOLOGY AND OIL PROSPECTS OF NORTHWESTERN OREGON. Chester W. Washburne. Pp. 111, illus. Bull. 590, U. S. Geological Survey, Washington.

PETROLEUM AND NATURAL GAS RESOURCES OF CANADA. In two volumes; Vol. 1. By Frederick G. Clapp and Others. Pp. 378, illus. Canadian Department of Mines, Ottawa.

THE MINERAL RESOURCES OF TEXAS. By William B. Phillips, Director, Bureau of Economic Geology and Technology. Pp. 362, illus. Bull. 365, University of Texas, Austin, Tex.

WESTERN AUSTRALIA—ANNUAL PROGRESS REPORT OF THE GEOLOGICAL SURVEY FOR THE YEAR 1914. With an Index Map. Pp. 41, illus. Western Australia Geological Survey, Perth.

ANTICLINAL STRUCTURE IN PARTS OF COTTON AND JEFFERSON COUNTIES, OKLAHOMA. By Carroll H. Wegemann. Pp. 168, illus. Bull. 602, U. S. Geological Survey, Washington.

GEOLOGY AND MINERAL RESOURCES OF KENAI PENINSULA, ALASKA. By G. C. Martin, B. L. Johnson and U. S. Grant. Pp. 243, illus. Bull. 587, U. S. Geological Survey, Washington.

REPORT ON THE NON-METALLIC MINERALS USED IN THE CANADIAN MANUFACTURING INDUSTRIES. By Howells Frechette. Pp. 221. Canadian Department of Mines, Ottawa, Canada.

CANADA—SUMMARY REPORT OF THE GEOLOGICAL SURVEY DEPARTMENT OF MINES FOR THE YEAR 1914. Pp. 201, illus. Canadian Department of Mines, Geological Survey Branch, Ottawa.

AN INVESTIGATION OF IOWA FIRE CLAYS. By Milton F. Beecher. Pp. 117, illus. Bull. 40, Engineering Experiment Station. Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa.

REPORT ON MINING OPERATIONS IN THE PROVINCE OF QUEBEC DURING 1914. Theo C. Denis, Supt. of Mines. Pp. 151, illus. Department of Colonization, Mines and Fisheries, Quebec, Canada.

RESULTS OF THE INVESTIGATION OF SIX LIGNITE SAMPLES OBTAINED FROM THE PROVINCE OF ALBERTA. By B. F. Haanel and John Blizard. Pp. 110, illus. Canadian Department of Mines, Mines Branch, Ottawa.

RAPPORT SUR LES OPERATIONS MINIERES DANS LA PROVINCE DE QUEBEC DURANT L'ANNEE 1914. Pp. 150, illus. Division des Mines, Ministere de la Colonisation, des Mines et des Pecheries, Quebec, Canada.

ANALYSES OF ROCKS AND MINERALS FROM THE LABORATORY OF THE UNITED STATES GEOLOGICAL SURVEY, 1880 TO 1914. Tabulated by F. W. Clarke. Pp. 376. Bull. 591, U. S. Geological Survey, Washington.

GUIDEBOOK OF THE WESTERN UNITED STATES. Part A. The Northern Pacific Route with a Side Trip to Yellowstone Park. By Marius R. Campbell and Others. Pp. 212, illus.; $1. Bull. 611, U. S. Geological Survey, Washington.

EXTRACTS FROM REPORTS ON THE DISTRICT OF UNGAVA RECENTLY ADDED TO THE PROVINCE OF QUEBEC UNDER THE NAME OF THE TERRITORY OF NEW QUEBEC. Pp. 208, illus. Department of Colonization, Mines and Fisheries, Mines Branch, Quebec.

A STUDY OF METHODS OF MINE VALUATION AND ASSESSMENT, WITH SPECIAL REFERENCE TO THE ZINC MINES OF SOUTHWESTERN WISCONSIN. By W. L. Uglow. 6¼x9½, pp. 73, illus. Wisconsin Geological and Natural History Survey, Madison, Wis.

ANNUAL REPORT OF THE BRITISH COLUMBIA MINISTER OF MINES FOR THE YEAR ENDING December 31, 1914. Being an Account of Mining Operations for Gold, Coal, Etc., in the Province of British Columbia. 6½x10½, pp. 544, illus. Richard McBride, Minister of Mines, Victoria, B. C.

QUEENSLAND—ANNUAL REPORT OF THE ACTING UNDER SECRETARY FOR MINES. Including the Reports of the Wardens, Inspectors of Mines, Government Geologists and Other Officers, for the Year 1914. Pp. 227, illus. Anthony James Cumming, Government Printer, Brisbane.

CHEMICAL GERMAN. An Introduction to the Study of German Chemical Literature. By Francis C. Phillips. Second edition, 5½x8¾, pp. 252, illus.; $2. Chemical Publishing Co., Easton, Penn.

A new edition, enlarged by 12 pages, of a well-known book.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF METALS, Vol VIII. Edited by Charles Vickers. 5¾x8¾, pp. 394, illus. American Institute of Metals, Buffalo, N. Y.

Contains the proceedings of the meeting of September, 1914, the papers read thereat, and the reports of the officers and committees.

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS. By Frank F. Fowle. 4x6½, pp. 1984, illus., leather, $5. McGraw-Hill Book Co., New York.

This has been so greatly amplified as to be almost a new publication. It is an indispensable guide to the practising engineer and a valuable supplement to the standard text books. The various sections of the book are prepared by specialists in the fields treated, and the whole then edited by Mr. Fowle.

FINANCING AN ENTERPRISE. A Manual of Information and Suggestion for Promoters, Investors and Business Men Generally. By Francis Cooper. Fourth Edition. $3 postpaid. 5¼x8, pp. 524. The Ronald Press Co., New York.

The usual impression is that any meritorious enterprise can readily find the money for financing it. This book is intended to correct the ordinary idea and to show how to present any proposition in such a way as to obtain it a favorable hearing, and how to choose among the various ways that are open when financial support has been promised. A good book for the investor, promoter and examining engineer.

REPORT OF THE ROYAL COMMISSION ON MINING INDUSTRY AT BROKEN HILL IN THE STATE OF NEW SOUTH WALES. 11¼x13, pp. 862; board covers, 20s. William Applegate Gullick, Government Printer. Sydney.

Report by the commission appointed by the Governor to make inquiry into the advisability of providing, in connection with the various mines in the Broken Hill district of New South Wales, for the abolition of piece work, with a view to making mining work healthier and safer; the reduction of the temperature in the mine workings to 75° F., and if this be impracticable, a reduction in the hours of work in proportion to the increased temperature of the mine concerned; the compensation of employees by mining companies in all cases of industrial sickness or accidents, and the compensation of the relatives or dependents of employees who have lost their lives through sickness or accident; the improved ventilation of said mines; the authorizing of officials of industrial unions to visit any of the said mines or any working places in connection therewith, and to examine the pence-cards with a view to preventing the employment of non-unionists; and the prevention of the wholesale influx into Australia of foreigners unable to speak the English language; as to the best means of insuring a diminution in the number of accidents generally in the said mines; and concerning the provisions of means of exit from the mines in the case of fire, and generally as to the safe working of the mine.

The commission included a member of the Amalgamated Miners' Association, who, in various instances, made minority reports of the various findings.

CATALOG OF TECHNICAL PERIODICALS OF THE LIBRARIES IN THE CITY OF NEW YORK AND VICINITY. Compiled and Edited by Alice Jane Gates, Assistant Librarian of the Engineering Societies, with the coöperation of a committee of the New York Library Club. 8x10, pp. 110; $3. Library Board of the United Engineering Societies, New York, N. Y.

This volume, number one of the bibliographical contributions of the Library of the Engineering Societies is a worthy beginning of a promising series. It is a valuable catalog, or rather a directory, of the technical periodicals and engineering society transactions in or near New York City. It is as valuable to an individual as it is to libraries, in that an engineer, by referring to it, may readily locate a periodical reference in his research notes. The seven large and representative libraries contained in the catalog are: Columbia University Library, Chemists' Club Library, Library of the American Society of Civil Engineers, Library of the Engineering Societies, New York Public Library, Plainfield Public Library, and Library of Stevens Institute of Technology.

The catalog is a great step in a country-wide plan to record effectively the periodicals throughout the various cities, and is the outgrowth of a suggestion made by the late Dr. John Shaw Billings to W. P. Cutter, the librarian. The attempt was made to have a complete record of foreign and domestic periodicals, i.e., to include all changes of title, consolidations, record of indexes published, and suspension or cessation of publication. In short, it aims to be a concise history of every important technical periodical. The entries in the pages are compiled in an original and pleasing manner. The names of the periodicals, arranged alphabetically, are followed by a complete statement of the numbers published. Below this are given the numbers of the periodical to be found in one or more of the libraries represented. The size of the page is 8x10 in., and the printing is set up in two columns making it easy to follow. There are, in all, over 2600 main entries and cross-references with a list of indexes consulted, a list of the libraries and information regarding them, and a brief statement of the system followed. Above all, it is printed on heavy glare-proof paper, is strongly bound, and will prove a valuable addition to any engineer's library.

Naval Advisory Board

The Naval Advisory Board will consist of the following members, each of the 11 societies mentioned nominating two:

Thomas A. Edison, chairman.

W. R. Whitney and L. H. Backeland, of the American Chemical Society.

Frank Julian Sprague and Benjamin G. Lamme, of the American Institute of Electrical Engineers.

Robert S. Woodward and Arthur G. Webster, of the American Mathematical Society.

Andrew M. Hunt and Alfred Craven, of the American Society of Civil Engineers.

Matthew B. Sellers and Hudson Maxim, of the American Aëronautical Society.

Peter Cooper Hewitt and Thomas Robins, of the Inventors' Guild.

Howard E. Coffin and Andrew L. Riker, of the American Society of Automobile Engineers.

William L. Saunders and Benjamin B. Thayer, of the American Institute of Mining Engineers.

Joseph W. Richards and Lawrence Addicks, of the American Electro-Chemical Society.

William Leroy Emmet and Spencer Miller, of the American Society of Mechanical Engineers.

Henry A. W. Wood and Elmer A. Sperry, of the American Society of Aëronautical Engineers.

Secretary Daniels announced, Sept. 12, the names of these 22 scientists and inventors who, with Thomas A. Edison as chairman, will assist the United States navy in its technical development.

The members of the board were chosen by 11 scientific societies of the United States, each of which nominated two men. Mr. Edison was chosen by Secretary Daniels for the chairmanship, the plan resulting in the creation of the board having been taken up first with Mr. Edison as the foremost inventor of this country.

Mr. Daniels announced that he has arranged for the first meeting of the advisory board to take place in his office at 11 a.m. on Wednesday, Oct. 6. At this meeting it is expected that organization will be effected and plans for the conduct of work discussed.

Zinc Production in China

According to an American consular report a Hongkong firm recently placed an order in the United States for a considerable quantity of zinc. Large quantities are used in Hongkong and in the trade field tributary to Hongkong. Heretofore these supplies have been secured almost entirely from Germany and Belgium, though at times some of the metal has been obtained in China. Zinc is produced in Kweichow and Hunan provinces in considerable amounts, and is exported in ordinary years to the extent of about a thousand tons of spelter and ten thousand tons of ore, mostly to Germany and Belgium.

[The production of spelter in China is statistically an unknown quantity. It is produced by a crude method of distillation in minute retorts and the output of any one smelter may be only a few tons per annum, but there may be a good many of them.—Editor.]

Asbestos Deposits Have Been Found Near Pachow in Chungking Province, China, according to a report from United States Consul E. C. Baker. As the asbestos appears to be of good quality and the price is low, the possibilities of direct exportation to the United States may be of interest to certain American dealers at this time. The mining expenses and cost of carriage to Chungking amount to about 75c. United States currency per 100 lb. The production and exportation of this article is a part of the industrial work for boys carried on under the direction of Rev. W. B. Williston, of the China Inland Mission at Pachow, Szechwan Province.

NEW PATENTS

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

AGGLOMERATION—Improvements Relating to the Agglomeration of Ores and Metallurgical Products. W. Buddeus, Charlottenberg, Germany. (Brit. No. 29,033 of 1913.)

ALLOYS or Compounds for Improving Copper and Its Alloys. Charles Vickers, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,151,744; Aug. 31, 1915.)

BLAST FURNACES—Method of Heating the Checker-Brick Heaters of Blast Furnaces. A. Pfoser, Baden, Germany. (Brit. No. 18,912 of 1913.)

BRIQUETTING—Mechanism for Preparing Pulverulent Materials for Molding or Briquetting. Ellsworth B. A. Zwoyer and Rolland A. Zwoyer, Perth Amboy, N. J., assignors to Zwoyer Fuel Co. (U. S. No. 1,152,469; Sept. 7, 1915.)

CHEMICALLY PURE METALS—Process for Producing Chemically Pure Metals. O. Voigtlander and H. Lohmann, Essen-Ruhr, Germany. (Brit. No. 27,369 of 1913.)

COPPER—Process for Separating Iron and Nickel from Copper in Certain Ores and Masses. Wilhelm Borchers and Eduard Thilges, Aachen, Germany. (U. S. No. 1,152,699); Sept. 7, 1915.)

CYANIDING—Apparatus for Treating Solid-Bearing Solutions. Lamartine C. Trent, Los Angeles, Calif. (U. S. No. 1,152,769; Sept. 7, 1915.)

DRILL HOLES—Device for Ascertaining the Vertical Angle and Direction of Diamond-Drill Holes. Helge A. Borresen, Marquette, Mich. (U. S. No. 1,152,701; Sept. 7, 1915.)

DRILLS—Chuck for Drills. Willis Coulson, Mace, Idaho. (U. S. No. 1,153,033; Sept. 7, 1915.)

DRILLS—Device for Rotating Pneumatic Drills. Henry J. Cook, Los Angeles, Calif., and Herbert E. Marsden, Ottumwa, Iowa. (U. S. No. 1,152,882; Sept. 7, 1915.)

DRILLS—Improvements to Rock Drills and the Like Cutting Machines. A. Berner, Nuremberg, Germany. (Brit. No. 35 of 1914.)

ELECTRIC FURNACE. Parvin Wright, Seattle, Wash. (U. S. No. 1,152,586; Sept. 7, 1915.)

ELECTRICAL FURNACE. William H. Hampton, New York, N. Y., assignor to Conley Electric Furnace Co., Inc., Wilmington, Del. (U. S. No. 1,152,505; Sept. 7, 1915.)

FLOTATION—Improvements in or Relating to the Concentration of Ores. Minerals Separation, Ltd., London, E. C., England. (Brit. No. 17,327 of 1914.)

HOISTING-ENGINE CONTROL. William J. Lilly, Butte, Mont. (U. S. No. 1,153,124; Sept. 7, 1915.)

LEACHING—Metallurgy of Copper. Raymond F. Bacon, Pittsburgh, Penn., assignor to Metals Research Co., New York, N. Y. (U. S. No. 1,151,236; Aug. 24, 1915.)

ORE REDUCTION—Improvements in or Relating to Ore-Reducing Furnaces. New Metals Process Co., Chicago, Ill. (Brit. Nos. 17,322 and 17,323 of 1914.)

PULSATOR for Pulsatory Tools. Arthur Henry Gibson, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,151,936; Aug. 31, 1915.)

RADIO-ACTIVE MINERALS—Improved Process for Treating Ores of Radium, Mesothorium, Thorium and Other Radio-Active Substances. E. Ebler, Heidelberg University, Germany. (Brit. No. 28,445 of 1913.)

RECOVERY—Improved Process for the Recovering of Metal from Ore and Apparatus Therefor. New Metals Process Co., Chicago, Ill. (Brit. No. 17,325 of 1914.)

REVERBERATORY FURNACES—Improvements Relating to Reverberatory Furnaces. Manchester Furnaces, Ltd., and W. A. R. A. J. Lord Globe Works, Manchester, England. (Brit. No. 6,050 of 1915.)

SEPARATING—Ore-Separating Process. Arthur J. Moxham, Wilmington, Del. (U. S. No. 1,151,117; Aug. 24, 1915.)

SEPARATOR—Apparatus for Separating Coal, Ore, Etc. Frank Pardee, Hazleton, Penn. (U. S. No. 1,149,463; Aug. 10, 1915.)

SMELTING FURNACES—Improvements in or Relating to Smelting Furnaces. Anna Nieweth, Berlin, Germany. (Brit. No. 21,738 of 1913.)

STEEL—Process of Treating Steel. Charles Henry Augustus Frederick Lockhart Ross, Balmagown Castle, County of Ross, Scotland. (U. S. No. 1,151,049; Aug. 24, 1915.)

SULPHUR BURNER. Albert Gustav Hinzke, Rothschild, Wis., assignor to Valley Iron Works Co., Appleton, Wis. (U. S. No. 1,149,765; Aug. 10, 1915.)

SULPHURIC ACID—Method and Apparatus for Producing Sulphuric Acid. Georg Schliebs, Cologne, Germany. (U. S. No. 1,151,294; Aug. 24, 1915.)

SULPHURIC ACID—Process of Making Sulphuric Acid. Henry Howard, Brookline, Mass. (U. S. No. 1,151,103; Aug. 24, 1915.)

TUNGSTEN—Treatment of Refractory Metals. Gottlieb Gmür-Zehnder, Aarau, Switzerland. (U. S. No. 1,150,670; Aug. 17, 1915.)

ZINC—Electric Reduction of Zinc Ores. Woolsey McA. Johnson, Hartford, Conn., assignor to Continuous Zinc Furnace Co., Hartford, Conn. (U. S. No. 1,150,271; Aug. 17, 1915.)

ZINC—Method of Smelting Sulphide Ores. Henry L. Doherty, New York, N. Y. (U. S. No. 1,150,841; Aug. 17, 1915.)

ZINC—Process of Treating Zinc Tailings. Arthur C. Spencer, Washington, D. C. (U. S. No. 1,150,897; Aug. 24, 1915.)

Editorials

The Prospects for Copper

Up to about a fortnight ago there were two views respecting copper among producing and selling interests—one bullish, the other bearish. It is unnecessary now to discuss the reasons for the bullish view. The bearish was based chiefly upon the enormously increased production, the weight of which was considered bound to tell. Consumers also held this view and deferred further purchases, even requesting producers to anticipate contractural deliveries, with the expectation that later they would be able to buy copper much cheaper.

Recently there was a change of opinion among those selling interests that previously had been bearish. The reasons for this were two—a growing belief that the military use of copper is much greater than any previous estimate, no matter how large; and the perception that regardless of the increase in production, refining capacity imposes a limit that cannot be overstepped. It is significant that there is but little additional refining capacity in preparation, the only important construction of this kind being at Tacoma and Great Falls.

Confirmation of this theory is to be found in several important things that have recently transpired. Thus it is well known that recent refining contracts have been made at $20 per ton, whereas $15 was formerly regarded as a fine price. Moreover, although the British embargo on crude copper was lifted under certain conditions, the unusual disparity between the prices for electrolytic and standard has continued, showing that refiners are not in a position to buy standard freely. Finally, it is a matter of more or less common knowledge that several copper-producing companies are having to pile up blister copper in consequence of inability to have it refined.

At the beginning of 1915 the electrolytic-refining capacity of the United States was about 148 million pounds per month. At the middle of 1915 it was about 152 million pounds. The new construction that is now going on will raise it to 164 million pounds, but this will not be attained until the end of the year, and it may be that the new plant at Great Falls will not be ready until 1916. Included in the foregoing figures is the small capacity—about five million pounds per month—for electrolytic Lake copper.

The Donora Zinc Works

The Donora zinc smeltery of the United States Steel Corporation is going to be unique in zinc-smelting construction by reason of the extensive use of reinforced concrete in its several parts. There is to be approximately 50,000 cu.yd. of concrete, of which about 30,000 cu.yd. will be reinforced concrete. The plant is also remarkable for the speed with which it is being built. About 1,000 cu.yd. of concrete is being placed per day. This is being done by the Dravo Construction Co., of Pittsburgh. The American Bridge Co. is naturally doing the structural-steel work for the plant. The brickwork is being done by the Steel Corporation's own force of bricklayers, which is recruited from the several plants of the corporation, precedence over everything else being given to the Donora construction.

Contrary to previous reports, the Donora plant is the only one now being built by the Steel Corporation. After the first announcement it was intimated that it had been decided to divide the retorts between Donora and Gary, and the idea obtained credence in well-informed quarters that construction had actually been begun at Gary. This was erroneous, although it is not unlikely that a smeltery will be built at Gary, or in the Illinois coal field, later, which would be a natural development. The Donora plant will have about 10,000 retorts, which will give capacity for smelting about 100,000 tons of ore per annum and making about 40,000 tons of spelter, which will make it the largest zinc-smelting unit in the world.

Things in Technical Literature That Are Not So

In the great flood of literature that is flowing through the pages of the engineering and technical press there are bound to be blunders, the expression of erroneous opinions, the misstatement of what pass for facts. No editor is infallible either in his own writings or in the endorsement that he gives to contributors by printing their articles. However, the contributors are the main offenders, for the simple reason that there are more of them.

Now, there is no great harm in the expression of an unsound opinion. Everybody knows that it is merely an opinion that may be right, may be wrong. Each expression will be weighed by itself. The reprehensible thing is for some one to represent as a fact what is not a fact. That this may happen out of carelessness—intentional deception is probably rare—is no palliative of the harm that is done. The following excerpts from a communication of a correspondent in South America is illustrative of what we mean:

> It has been a pleasure to me to supply the inclosed information, the more because in the course of years American technical papers have been publishing a lot of nonsense about this country. There is a certain Mr. —— who wrote in the "Journal" and also in the —— about Bolivia, and from his writings I conclude that he was in Bolivia about 10 years ago, and then only for a couple of days. His articles are simply redundant; everyone who knows anything about Bolivia is aware of the fact that the mining laws, and especially their execution, are so bad as to prevent any foreign capital from coming in, and that the Bolivians are the worst people on earth from whom to buy mines. There were also some small errors in the editorial in the "Journal" of Oct. 10. The Cia. Minera de Oruro uses the Ingersoll stoper BC-21 in addition to jackhamers for mining. Further, there are no steam pumps; the water is so acid that lead-lined pipe would be required, so the mines are kept dry by bailing with automatic tanks. The San José mine, which lies between two mines of the Cia. Minera de Oruro and works the same veins, bails with buckets made of rawhide. No steam is used at present in either San José or the Oruro mines; the first company has a 200-hp. Diesel engine, and the Cia. Minera de Oruro uses a power plant of 300-hp. Diesel engines and a 120-hp. suction gas motor, which generate a 1000-volt three-phase current.

This power is only used for the mines, the mill at Machacamarca having its own gas-producer power plant.

The —— published some time ago the cost of getting one ton of concentrate from Bolivia to the European smelters, but this account was silly and confusing. It is remarkable that the information published about Bolivian conditions should be on the whole so unreliable. It seems to me that most of the articles are written by people who visit the country for a few days, absorbing during their short stay all the talk that Bolivians will let them have, thinking that they would publish that afterward as true, first-hand information, and that there were no men in the country who did not know better. For instance, I remember some time ago a certain Mr. —— wrote in the —— that the mines of Oruro did not produce any tin, but principally copper, whereas they were shipping tin concentrate at that time at the rate of over 200 tons per month, against two tons of copper precipitate of about 25% Cu. I have often thought to call those scribes to account, but after all did not think it worth while.

We hold that it was not only worth while but that it ought to have been done. The printing of erroneous statements in a technical magazine is apt to be perpetuated by the professors in their textbooks and treatises. Thus there creeps into permanent literature the recording of many things that are not so.

The correspondent whom we have quoted puts his finger upon the explanation of much of this. The editor accepts a contribution from a person whom he knows and believes to be reliable. It may turn out, however, that the contributor was deceived. There does not appear to be any effective way of preventing this. The only thing that can be done in most cases is to print a correction, and in the interest of everybody the readers of a paper ought to draw attention to misstatements that they observe in its pages.

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Zinc Refining by Redistillation

The extraordinary premiums that have been paid for high-grade and superior intermediate spelter led naturally to the production of such spelter by refining by redistillation, and a large tonnage of refined spelter is now being produced in that way. As has been previously pointed out in the *Journal*, there is no novelty in this, a good deal of refined spelter having been so produced during many years by dross and junk smelters in this country and Great Britain, and also in Sweden and Norway, and perhaps elsewhere. The dross and junk smelters in this country commonly perform the redistillation in large retorts. The smelters in the Scandinavian countries do it in electric furnaces. The practice recently developed in the United States is novel in that the ordinary ore furnace is used for the purpose. Yet even that is novel only in the making of a regular practice of it.

The same thing was tried about 17 years ago in one of the works of the old Cherokee-Lanyon Spelter Co., then managed by A. B. Cockerill. Mr. Cockerill, who was something of an experimenter, thought then to improve his metal product by redistillation. He found that he could make a refined spelter assaying approximately 99.9% Zn, but he found also that he lost about 10% of his zinc in doing it (by absorption in retorts, breakage of retorts, failure to condense, etc.), and the premium realized for high-grade spelter at that time was not enough to pay for making it in this way. When, however, the premium rose to 10@15c. per lb., as it did recently, the aspect of things was changed radically.

Nevertheless there is some doubt as to just how much profit there is in refining spelter by this method under existing conditions, exceptional as they are. The slabs of common spelter are broken up or are recast in little bars, and are piled up in the ordinary retorts, which are heated in the ordinary way. The direct cost of redistillation is variously estimated at 0.5 to 1c. per lb., probably being nearer the lower figure than the higher. Then comes the cost of the zinc that is lost. This is variously stated at 10 to 12%—a confirmation of Mr. Cockerill's experience. If the common spelter that is being redistilled costs 10c. per lb., the loss is 1c. per lb. If it costs 20c. per lb., it is twice as much. The third element of cost is the use of smelting capacity. In normal times, when there is a surplus, this might reasonably be reckoned as nil, but certainly not so at present when smelting capacity is so urgently needed. An Iola furnace of 600 retorts is figured as taking about 30 tons of spelter per day for redistillation, or 60,000 lb. Such a furnace takes normally about 12½ tons of calamine or roasted blende. If the latter, say about 15 tons of raw blende. Now if the smelter can make a profit of $40 per ton in smelting ore (he talks about such figures), he does not make it if he uses his furnace for refining spelter, and such use may therefore be reckoned temporarily as costing him $600 per furnace per day, or 1c. per lb. The total cost of refining is therefore from 3 to 4c. per lb., which is not bad if a premium of 10c. be realized. We understand, however, that there has been some difficulty in bringing all of the product up to the highest grade.

There would probably be a better way of refining crude spelter by redisillation than by using the ordinary ore furnace for this purpose. A specially adapted, fire-heated retort, or an electric furnace after the fashion of Trollhättan, would probably be superior. However, our metallurgists were confronted by an emergency and had no time for either experimentation or new construction.

The craze for high-grade spelter on the part of the Allies prompts the inquiry, What have the Germans been doing for it? In the first place they had a large accumulation of New Jersey willemite which they had been importing and storing during many years. Secondly, they also have been refining crude spelter by redistillation. Having a surplus of smelting capacity and an ample supply of spelter this is for them a relatively inexpensive process.

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New Projects at Joplin

Two interesting schemes are being promoted in the Joplin district. One of these is for the erection of warehouses, into which ore may be put for storage when the market is unsatisfactory. The other is the erection of a zinc-smelting works to be owned and operated by local persons. Both of these ideas are excellent, and it is to be hoped that they will be carried out. The Joplin district has always been prosperous, and lately the increase of its wealth has been phenomenal, wherefore there ought to be no difficulty in obtaining the necessary money right at home. The advice may be offered, however, that care be taken not to let the promotion and organization expenses run too high, and also that good engineering advice be secured for determining the location and making the plans for the smelting works. Some persons experience a conniption fit when they are told that engineering expense may come to 10% of the total cost of construction, but it is better to pay the engineers $50,000 out of a total of $500,000 than to pay them only $5,000 out of a total of $600,000 and get a poor plant at that.

BY THE WAY

The plan of reincorporation of the du Pont Powder Co. with $120,000,000 capital has been noted in the *Journal,* but on Sept. 1 application was filed for a charter for E. I. du Pont de Nemours & Co. with a capital of $240,000,000, of which $150,000,000 is to be nonvoting preferred, $10,000,000 voting debenture shares, and $80,000,000 common.

Men who are engaged in large affairs often have hard work to determine where good things ought to be placed among their many personal and corporate interests. Too many of our big companies have managements that look upon their companies as customers for their indifferent or doubtful ventures, while the good ones are their own. The attitude is similar to that which is ascribed to Chinese government officials, who are said to look out carefully for the interests of their government when they do not conflict with their own.

The main business street of Kusa, Okla., will be paved with material which contains both gold and silver. It is the residuum or "sludge" from a zinc smelter there, according to the New York *Tribune.* An official of the townsite company has completed arrangements with the smelters to save the waste material. The paving will be done in 60 days. Much of the ore, 100 tons of which will be smelted daily, carries considerable gold and silver. When the gold value is sufficiently great to defray the cost of shipment it is sold to smelters. If found to be insufficient it will be used on Kusa streets.

The term "sappers and miners" is often used for one reason or another, but beyond knowing that it is a military term, seldom with any comprehension of the meaning of or the distinction between the two. The mines and countermines which are used against the enemy are prepared by the miners, while the open trenches, of which so much is heard in the war news of today, are prepared by the "sappers." In military parlance a sap is a narrow trench in the direction of the enemy, generally at an angle to the line of advance to protect against enfilade fire, to give protection of approach or to afford an opportunity for mining the enemy's position.

According to word received in Ottawa, Kan., from Dr. J. Scott Walker, of Chetopa, Western points have no more reason to become excited about gold than has Chetopa. A Denver commission man came all the way to Chetopa to investigate, say press dispatches. For three years past the Chetopa poultry dealer has been shipping large consignments of ducks to the Denver man, who regularly found a quantity of gold in the gizzards of the birds. Particles the size of a pinhead were found and the total amount usually netted a tidy sum for the commission merchant, in addition to his profits for handling the ducks. He went out to the district whence the ducks came and looked around, after which he slipped quietly back to Denver. But the price of land near Chetopa increased materially as a result of his visit when the news leaked out.

A recent number of the "Safety Bulletin" of the Illinois Steel Co. gives the following directions on how to make money at home: Start a saloon in your own house. Be the only customer (you'll have no license to pay). Go to your wife and give her $2 to buy a gallon of whiskey, and remember there are 69 drinks in a gallon. Buy your drinks from no one but your wife, and by the time the first gallon is gone she will have $8 to put into the bank and $2 to start business again. Should you live 10 years and continue to buy booze from her, and then die with snakes in your boots, she will have enough money to bury you decently, educate your children, buy a house and lot, marry a decent man, and quit thinking about you entirely.

Practical experience tells just as surely in war as in peace, says the London *Financial Times.* Mining men are chuckling over how one of their number recently caught out some Royal Engineers who were engaged in warlike mining operations. While in the saps the latter found their light compasses played them some queer tricks, and accordingly they indented, ingenuously enough, for good solid ones of 12 lb. weight. Along came a mining man to the excavations a day or two later and, the vagaries of the original compasses being demonstrated to him, he drily remarked: "What about those picks and shovels in the corner there?" Naturally, as soon as the iron was removed the compasses became normal again, and the "twelve-pounders," which duly arrived later on, were not even unpacked. By the way, while compasses are, of course, very handy and at the same time sufficiently accurate for temporary operations such as mentioned, they are becoming almost obsolete in mining proper.

Virginia City was always speculatively inclined, says Charles E. Van Loan in the *Saturday Evening Post,* but the high tide struck the Comstock in the '70s. Men went money mad, and women, too. In 1870 stock in the Belcher mine went begging at $1 a share; in 1872 it was worth $1525. During the same period Crown Point advanced from $2 to $1825. Those were the days when stock quotations were posted every hour. When the miners came up out of the shafts they rushed to the bulletin boards to see how much money they had made while underground. Rich and poor, high and low, white, black and yellow, everybody gambled. The financial giants of San Francisco were juggling Virginia stocks, and nobody had to wait long for action. Fortunes were made and lost every day. A chambermaid in Virginia City "fooled with stocks a little," and in 1875 she retired with a bank balance of two hundred thousand dollars. A man in Gold Hill lost the best cook he ever had just because she got rich when Consolidated Virginia went up. A $25 investment in Consolidated Virginia would have paid $109,980, if—and this is a big if—bought at the bottom and sold at the top. The same investment in Belcher would have paid $38,125 and in Crown Point, $22,800. At one time or another fortune's wing grazed every man on the Comstock; the grizzled veterans of the bonanza period are able to point out the exact spot where they missed their big chance. "You see," says the Oldest Inhabitant, "there was the stock you knew you ought to buy, but didn't. There was the stock you bought and sold too soon. And then there was the stock you didn't sell soon enough."

Lake Superior Mining Institute

The Sept. 11 issue of the *Journal* contained the telegraphic account of the twentieth annual meeting of the Lake Superior Mining Institute, which opened at Ironwood, Mich., on Sept. 6. Some features of this year's meeting deserve further mention.

Unknown First-Aid Problems

The first-aid contest, held on the morning of the first day, was particularly interesting because the problems used were unknown to the contestants until read to them on the field. Heretofore the problems have been of a more technical nature, permitting previous training with a certain degree of accuracy. Following are the four problems given at Ironwood:

One-Man Event (Time: 15 Min.)—Miner found a distance of 50 ft. in, in closely caved workings, with palm of right hand lacerated and bleeding profusely; in shock. Treat and transport 20 ft. to more open workings, then carry 20 ft. by shoulder lift.

Three-Man Event (Time: 15 Min.)—Miner found in caved drift (2½ to 3 ft. high) in bad air after explosion of powder, unconscious from gases, burns of face and hands. Transport for 20 ft. and administer artificial respiration by Schaefer method for one minute. Treat burns. During transportation one of the rescuers is overcome, becoming unconscious; rescue and administer proper treatment.

Team Event (Time: 20 Min.)—Miner caught by fall of rock; left ear torn off, left shoulder dislocated, left thigh broken in upper third of leg (compound fracture), with profuse bleeding; in shock. Treat and transport 30 ft. on improvised stretcher.

Team Event (Time: 20 Min.)—Miner walks into blast; face badly lacerated over left cheek bone with profuse bleeding; severe laceration of upper part of abdomen; back of right hand lacerated, blood oozing; fracture of right kneecap; unconscious from powder gases; treat on spot (gas has cleared away) and transport 40 ft.

Teams in Good Condition

As pointed out by Dr. A. F. Knoefel, in charge of the judging, and president of the American Mine Safety Association, the slight range of points scored by the winning teams indicated the excellent condition of all teams. He stated that the latter are as good as or better than those he has encountered anywhere else. Each team was told why it was penalized and every member of every team after the contest received a copy of the tally sheet.

Mining Practice on Gogebic Range

In the paper on "Mining Methods on the Gogebic Range," presented at the Monday evening session, O. E. Olsen pointed out some interesting innovations. It has been found desirable to use automatic gongs on the underground locomotives, as well as red lights on the tail of the trains. The gongs are connected with the driving mechanism, and start ringing when the motor starts and vice versa; they can be heard for about 250 ft. The paper on the "Opening of the Wakefield Mine," by W. C. Hart, superintendent of the Wakefield Mine, aroused probably the greatest interest. Doubtless this was because of the fact that Mesabi stripping methods are seldom used on the Michigan ranges. Also the pit had been visited in the afternoon and many had questions to ask.

The depth to which it is profitable to strip came in for its share of discussion.

Cuyuna Range Visited

It is safe to say that the Cuyuna Range never before received so much concentrated attention from mining men as it did on the following day, Tuesday, Sept. 7. George H. Crosby, a pioneer on the Cuyuna since its earliest days, was on hand to see that no point of interest was overlooked—and none was. Carl Zappfe, geologist of Brainerd, Minn., who for years has made a particular study of the formations on the Cuyuna, was able and willing to give the visitors a good understanding of the peculiarities of the range, difficulties of exploration and mining and future possibilities. This was welcomed and appreciated, and there is no question that operators present from the other Lake Superior ranges now have a better knowledge and probably a more favorable impression of the Cuyuna Range.

Standing Committees Appointed

The final business session was held at Crosby, Minn., where the following officers were elected: President, C. E. Lawrence, Palatka, Mich.; vice-presidents, George L. Woodworth, Frank E. Keese, Frank S. Barber; managers, Frank Armstrong, William Wearne; treasurer, E. W. Hopkins; secretary, A. J. Yungbluth.

Standing committees for the year 1916 were also appointed: Prevention of Accidents, W. H. Jobe, Palatka, Mich., chairman; William Connibear, Ishpeming, Mich.; E. W. Walker, Mass, Mich.; W. H. Harvey, Virginia, Minn.; P. S. Williams, Ramsay, Mich. Care and Handling of Hoisting Ropes: W. J. Richards, Painesdale, Mich., chairman; C. E. Holley, Ishpeming, Mich.; C. W. Murphy, Crystal Falls, Mich.; F. H. Armstrong, Ironwood, Mich.; A. Tancig, Hibbing, Minn. Papers and Publications: William Kelly, Vulcan, Mich., chairman; A. W. Gow, Duluth, Minn.; F. W. McNair, Houghton, Mich.; J. E. Jopling, Ishpeming, Mich.; Frank Blackwell, Ironwood, Mich. Bureau of Mines: M. M. Duncan, Ishpeming, Mich., chairman; F. W. Denton, Painesdale, Mich.; A. J. Yungbluth, Ishpeming, Mich., secretary. Biography: J. H. Hearding, Duluth, Minn., chairman; R. A. Douglas, Ironwood, Mich.; M. B. McGee, Crystal Falls, Mich.; W. H. Newett, Ishpeming, Mich.; James Fisher, Houghton, Mich.

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The Redjang Lebong in Sumatra, the best-known gold mine in the Dutch East Indies, had an unsatisfactory year in 1914, owing to the drought, which extended from May until the middle of November. As the mine depends on water for power purposes, a gradual stoppage of operations was necessitated. Milling was practically suspended for three months, and in October it was feared that the lower levels would be flooded out, as the pumps could only be kept going to a modified extent. As a result the ore crushed showed a heavy decline, amounting only to 62,037 tons, which yielded 28,047 oz. gold and 154,870 oz. silver—an average of 0.452 oz. gold and 2.496 oz. of silver per ton. In 1910, the most prosperous year, there were 103,715 tons of ore crushed, with a return of 85,250 oz. gold and 441,914 oz. silver, an average of 0.778 oz. gold and 4.035 oz. silver per ton. The ore reserves at the end of the year are estimated at 211,000 tons, averaging 0.44 oz. gold and 2.65 oz. silver.

PERSONALS

Arthur W. Burgren is now with the Cinco Minas Co. at Magdalena, Jalisco, Mexico.

D. C. Jackling recently visited the Ray mines and concentrating plant at Hayden, Arizona.

George Long has returned to the United Eastern mine at Oatman, Ariz., after a vacation on the Coast.

C. W. Wright is returning to Sardinia, Italy, having sailed from New York, Sept. 11, on the "Dante Alighieri."

E. A. Cappelen Smith, having put the Chuquicamata plant into successful operation, has returned to New York.

J. B. Armitage of Duluth, Minn., is making examination of a gold-mining property in Rio Grande County, Colorado.

J. R. Finlay has gone to Butte, Mont., where he expects to be occupied with professional work for about two months.

Carl M. Bernegau, vice-president and treasurer of the Keuffel & Esser Co., New York, has been traveling in the West.

H. A. Wagner of the Gray Eagle Reduction Works at Mayer, Ariz., will attend the International Engineering Congress.

A. L. Flagg, superintendent of the Kelvin Sultana mine, is attending the International Engineering Congress in San Francisco.

J. V. N. Dorr, of the Dorr Cyanide Machinery Co., has arrived at New York from San Francisco. He will remain about two weeks.

Alden D. Perley has been appointed superintendent of Hall Furnace of the Republic Iron & Steel Co., Sharon, Penn., which has just gone into blast.

George H. Garrey, who has been on work in the West for the past two months, spent a couple of days in New York last week, but has again left for California.

Frank Jewett, vice-president of the San Francisco Stock Exchange and A. S. Wollberg, member of the governing board, recently visited the Oatman-Gold Road mining districts in Arizona.

W. de L. Benedict left New York last week on his way to California by way of Denver, on professional business. Incidentally he expects to attend the engineering congresses at San Francisco.

James Myers, of Golden, Colo., has again assumed the superintendency of the old Brown Mountain smeltery at Ouray, Colo. It has been operated by the Wanakah Mining Co. for the past two years.

E. L. Rodgers and party of New York have been traveling by automobile in Montana and Washington, and recently left Spokane for Hedley, B. C. Mr. Rodgers is interested in mines in the Basin District in Montana.

F. C. Newton has resigned as superintendent of the Perth Amboy plant of the American Smelting & Refining Co., to become vice-president and general manager of the Newton Manufacturing Co., of Lowell, Massachusetts.

William J. Chamberlain of Denver, well-known mining man and president of the long-established sampling works company bearing his name, was married in Denver, Sept. 3, to Miss Eugenia A. Brueck of Kansas City.

H. W. McCaskey of the United States Geological Survey is in Salt Lake City on a trip of inspection of the Western offices. Mr. McCaskey expects to visit the Alta-Cottonwood district, and the new camp of Goldstrike in Washington County.

George B. Drummond, of Eau Claire, Wis., left on Sept. 7 for the interior of Honduras, Central America, having accepted the position of cashier of the Ulcawas Gold Mining Co. His duties will include the purchase of supplies and machinery.

F. C. French, who has been with the Butte & Superior Copper Co. and other copper properties in the Butte District for the last three years, has returned to Salt Lake City, where he will soon reopen offices for the practice of civil and mining engineering.

G. C. Riddell, superintendent of the East Helena smelting plant, has been a recent visitor in New York and St. Louis. He is on a general tour of zinc- and lead-smelting plants in the East and South, while returning from a vacation on the Atlantic Coast.

W. L. Honnold, who has recently retired from the chairmanship of the Brakpan Mines, the Spring Mines, and the Transvaal Coal Trust, has taken up his residence at the Hyde Park Hotel, London. Mr. Honnold will join H. C. Hoover in the Belgian relief work, and will go to Belgium in October.

Dr. T. O. Bosworth, petroleum expert, who has been making extensive explorations in Northern Alberta, is now pursuing his investigations in the Peace River country. He will lecture in London, England, before the Institute of Petroleum Technologists and hopes to interest British capitalists in the resources of the Canadian West.

It is stated in "Nature" that the sum of £140 has been given to the Royal Society of Arts by R. Le Neve Foster for the purpose of founding a prize in commemoration of his father, Peter Le Neve Foster, who was secretary of the society from 1853 to 1879. The council has decided to offer the prize (consisting of £10 and the society's silver medal) for a paper on "Zinc: Its Production and Industrial Applications."

Vice-President C. F. Kelley of the Anaconda Copper Mining Co. will transfer his residence from Butte to New York on Oct. 1, in order to be more intimately related, in an official way, to the affairs of the Anaconda company, under conditions that result from its recent reorganization. As a result of the acquisition of the International Smelting Co., the Raritan Copper Works and the United Metals Selling Co., the company's business has greatly enlarged, and it has been deemed necessary to increase the executive organization of the company in New York. Mr. Kelley will continue to have direct connection with all operations of the company in Butte and Montana.

OBITUARY

Alexander Tropenas died at Lyons, France, July 14, aged 55 years. He was widely known as a metallurgist and as the inventor of the Tropenas converter.

Charles M. Cabot, who as a stockholder of the Steel Corporation, gained some prominence several years ago by attacking labor conditions in the iron and steel industry, died at his home at Beverly Farms, Mass., Sept. 5. He was 49 years of age. Mr. Cabot served as a member of a committee of stockholders which investigated the general conditions among employees of the Steel Corporation and made certain recommendations subsequently put into effect. In business life he was engaged as a broker. Mr. Cabot was called a crank when he first brought up the subject at the Steel Corporation meetings, but his activity and persistence had much to do with the later action for safety of employees and improvement of working conditions.

SOCIETIES

American Institute of Mining Engineers—In order to make the meetings of the Southern California Section more interesting and fruitful, the executive committee has formed a subcommittee on programs for section meetings, which announces for the coming autumn and winter season, four dinner meetings, at intervals of two months, in which the cooperation of all section members is urgently requested. The subjects chosen for discussion at these meetings, with the proposed dates, are as follows: Sept. 28, "Mining Geology of Mojave County, Arizona"; Dec. 14, "General Geology and Mining Conditions in Southern California"; Feb. 1, 1916, "Petroleum, Its Geology and Technology"; Apr. 4, "General Mining Conditions in South America." Notice of the hour and place of each meeting will be issued later.

University of Arizona—The number of inquiries that have been received relative to the short course for miners to be given by the College of Mines and Engineering of the University of Arizona has proved that there is a great demand for such work. The particular value of the short course as it is to be given by the university lies in the method by which it is to be conducted, which is the intensive study of one subject for two weeks. Inasmuch as the short courses that are of particular interest to the prospectors start early in October, it is desired that those interested make their plans early for attendance. Students may take two, four, six or any number of weeks, the whole year making an admirable trade course in mining. The first course starts Oct. 4, being elementary mineralogy and blow-pipe analysis. Besides this course those of interest to prospectors which immediately follow are courses in elementary mineralogy and petrology, principles of surveying, field geology and prospecting, and assaying. These courses together last 10 weeks, and will be an excellent foundation for more scientific and successful prospecting.

Editorial Correspondence

SAN FRANCISCO—Sept. 8

Gold Was Produced in 30 Counties in California in 1914. Seven of these counties, according to Charles G. Yale, of the U. S. Geological Survey, yielded over $1,000,000 each: Nevada, $3,301,948; Amador, $3,082,002; Yuba, $2,800,713; Sacramento, $2,164,491; Butte, $1,697,120; Calaveras, $1,336,875; Shasta, $1,101,202. This includes both lode and placer production. The leading hydraulic county was Trinity. Placer was the leading drift-mining county and Yuba the leading dredging county. Of the deep-mine producers Nevada County was in the lead, and this county also made a larger increase in gold production in 1914 as compared to 1913, the amount being $383,215. The total ore milled in the state from deep mines in 1914 was 1,993,821 tons. Of this amount 62% or 1,243,529 tons came from the five counties of Amador, Calaveras, Eldorado, Mariposa and Tuolumne. The average yield of ore in Mariposa County was $9.19 per ton; Eldorado, $4.95; Amador, $4.89; Tuolumne, $4.24; Calaveras, $2.32. The two largest lode-mining camps are Grass Valley-Nevada City and Jackson-Sutter Creek. In the Jackson-Sutter Creek district 387,602 tons of ore were treated yielding in gold and silver an average of $5.48 per ton. In the Grass Valley-Nevada City district 267,618 tons yielded in gold and silver an average of $11.38. Kennett, Shasta County, was the most productive metal camp in the state in 1914, producing 243,138 tons yielding $376,846 in gold, $299,110 in silver, $2,411,323 in copper; a total of $3,087,279 or an average of $12.70 per ton. The report shows that silver was produced in all the gold-producing counties; but the leading gold producers were by no means the leading silver producers. The nine counties producing as much as 10,000 oz. were: Shasta, 626,954 oz.; Inyo, 466,575; Calaveras, 109,299; San Bernadino, 67,737; Nevada, 48,487; Amador, 30,800; Tuolumne, 21,731; Mono, 16,436; Kern, 14,470 oz. The total amount produced in 30 counties in 1914 was 1,471,859 oz., being an increase of 92,960 oz. over 1913.

Hookworm Disease Endemic in California Mines in certain mining districts is the finding of Herbert Gunn, M. D., of San Francisco. He further finds that from 50 to 80% of the men working in the mines inspected are infected with the disease; and that the infection is undoubtedly present in practically all of the gold mines in California and just over the border in Nevada. A number of men were examined in Amador and Eldorado Counties and whether the disease is of foreign origin or endemic in the mines, the fact remains that hookworm disease actually exists according to Doctor Gunn's report and the reports of Dr. F. F. Sprague and Dr. E. E. Endicott. The earlier cases reported were Italians, Austrians or Cornishmen, many of whom are known to be infected with hookworm before coming to this country. Of six cases referred to by Doctor Gunn two were American, native of California and never out of the state, two were native of England, one native of Italy and one whose nativity is unknown but who had not been out of California in 48 years. Doctor Gunn states that there is no question that the general efficiency is noticeably impaired and that many of them have to take time off now and again to recuperate. The greatest loss to the mine operators he states is occasioned by the large number of men moderately affected. The danger of the disease being spread is commented upon especially as the sanitary arrangements for the disposal of sewage in the town of Jackson are poor and many of the infected miners too ill to work in the mines live on the nearby farms until recuperated. In connection with Doctor Gunn's report which is made to the California State Board of Health it is stated that the Industrial Accident Commission will take up the matter under recent amendments to the Workman's Compensation law, which make occupational diseases subject to compensation from employers. It is suggested that it will be a part of the duty of employers to endeavor to prevent the disease from spreading. In most cases it is quite likely that the municipalities in which the miners live are more amenable to law than the mine operators, but this particular law applies only to employers. But Jackson is not the only mining town in California that is in need of sanitary regulation; and it is quite likely that wherever hookworm disease is found there will also be found unsanitary living quarters either in the town or at the mine. The prevention of the disease cannot be accomplished except by control of the municipalities in which the infected men reside.

DENVER—Sept. 9

Official Measurement of Drainage Water issuing from the Roosevelt tunnel in the Cripple Creek district was made Sept. 1 by Engineer T. R. Countryman. Drainage amounts to 11,200 gal. per min. The breast was advanced 230 ft. during the first month after resumption of operations and is within 1,400 ft. of the Elkton mine. Three shifts are employed and Supt. Charles Fuller expects to reach the Elkton shaft about Jan. 1.

Boulder County Metal-Mining Association has published, for free distribution, a neat 52-page pamphlet descriptive of the history of mining for precious, semiprecious and rare metals, coal, oil and gas, and nonmetallic minerals in this pioneer county of Colorado. Each of the eight metal-mining districts in the county is described geologically and mineralogically, while one chapter is devoted to the tungsten industry. The pamphlet will be welcomed by persons who appreciate straightforward descriptions of the mining country without exaggerations. It may be had upon application to the secretary of the association, Boulder, Colo.

A Tonnage Record for the Cripple Creek District was established in August when 84,800 tons of ore were shipped to mills and smelteries. This does not mean a maximum valuation for a single month's output, the August production being valued at $1,242,264, or approximately $14.65 per ton. The Pueblo and Globe plants of the American Smelting & Refining Co. handled about 4,000 tons having an average value of $55 per ton; the Golden Cycle cyanide plant at Colorado City treated 38,000 tons of an average value of $19; the Colorado Springs mill of the Portland company handled 10,500 tons worth about $21 per ton; the Portland company's two mills in the district treated 30,600 tons of dump and low-grade material worth $2.59 per ton.

The Federal Industrial Relations Commission Report is so flagrantly unfair to the mining operators of Colorado that Governor Carlson has issued a statement specifically challenging the charge made in the Walsh report that an instructor in the state-university college of law had been dropped through corporation influence because he had appeared as counsel for the United Mine Workers during the strike turmoil a year ago. Explaining that this James Brewster was appointed only to fill a vacancy caused by the drowning of Professor Pease, the appointment being for the remainder of the college year only, Governor Carlson goes on to say: "Walsh and his puppets have not spared from calumny and false imputation the good name of our university. His insatiable gluttony for cheap publicity has caused him to utter a baseless and wicked charge. Had he made an honest investigation he would have found that the charge had foundation only in the mind of a disgruntled professor. . . . Walsh's statement may be given temporary credence in other states but not in Colorado."

The Florence & Cripple Creek R.R. Co. has Passed. It built the first rail line—a narrow gage—into the district, in 1894, and for a few years did a capacity business at high rates. The Midland Terminal Ry. soon followed, with a branch from the main line at Divide, a station on Ute Pass. Some years later, the Colorado Springs & Cripple Creek District R.R. built into the district, circling Pike's Peak on the east and south. The Florence road paid for itself within three years. Competition and numerous serious washouts of track then decreased this road's profits until it finally consolidated with the other roads all of which it then operated with financial success for years. The company also purchased the Golden Circle R.R., a 5.72-mi. electric line that traverses the high, central part of the mining district and reaches numerous large mines not served by the steam roads. The original outside terminal of the pioneer road was Florence but it was shifted to the neighboring town of Cañon City. The recent decision of the directors to abandon the old line follows acts of the residents of the latter town who insist that the company rebuild practically 10% of its roadbed destroyed by floods. This the company did not feel justified in doing since the cessation of cyanidation and chlorination activities in the several custom-treatment plants that formerly existed at Florence. The company has reorganized as the Colorado Springs & Cripple Creek R.R. Co. and will operate all lines except the old narrow-gage. It has started

suits against the treasurer and board of commissioners of Teller County, seeking to prevent the sale of the roads for delinquent taxes and to have tax assessments reduced. The assessed valuation of the Terminal at $25,686 per mile and that of the Golden Circle at $21,872 per mile are claimed, by the company, to be grossly excessive, and payment has been offered the treasurer of the county on what are claimed reasonable figures.

BUTTE, MONT.—Sept. 9

Anaconda Zinc Experiments have been so successful that it is said a plant capable of producing 10 tons per day is now going to be installed. The Anaconda management is active in keeping its engineers in the field, looking for new gold, copper and zinc mines. The recently acquired mines in Chile are reported to be developing favorably.

In the First-Aid Contest Between Butte Teams at the Labor Day celebration at Columbia Gardens, Butte, the team of the Original mine won the honor of going to the national meet at Panama Exposition the latter part of September and will represent the State of Montana in that event. The Original team consists of the following: Elmer Kelly, captain; David Snell, Joseph Beadle, John Campbell, John Butler and Thomas McKeown.

Reduced Wage Scale for Butte Miners—Miners' wage scale for August in Butte district will be at the rate of $3.75 per day instead of $4 per day, as paid in July. Official price of copper, as announced in the "Engineering and Mining Journal," was 16.9c. per lb. for August, or a tenth of a cent below the required 17c. to make the scale $4 per day. Payrolls of all Butte companies, including zinc producers, are based on the copper scale and all companies are making out their rolls on basis of 16.9c. per lb. Opinion prevails that September scale will be back at the $4 rate.

No Miners Marched in the Labor Day parade at Butte. The celebration of Labor Day was the biggest event of the kind ever seen in Butte. All but about half a dozen unions in Butte participated in a parade and the day's celebration. The parade was several miles long, requiring 1 hr. and 35 min. in passing, but not one miner was in the line of march. The large turnout of other union laborers was due to extra efforts that were made by the officers to get the men out in order to make an impressive showing, and heavy fines were provided for failures to march. There is no miners' union in Butte that is strong enough to enforce any such orders on the miners, although there are now three organizations calling themselves miners' unions.

The Butte-Duluth Bankruptcy Proceedings have finally been heard in the Federal Court at Butte and Judge Bourquin has under consideration the petition to declare the company a bankrupt. The petitioners, a number of unpaid miners, based their contention of insolvency on the admissions made in behalf of the company when the latter was thrown into the hands of a receiver upon suit brought by an Eastern creditor. The officers now claim, and did so in the bankruptcy proceeding, that the company is not insolvent, and that it was beginning to make money under the management of Receiver Everett when operations were stopped by the bankruptcy action. Some interesting testimony was given by officers of the company. Superintendent Sherwood stated that the mill was running on ore averaging 1.52% Cu during the last four months of operations, and drill cores to a depth of 202 ft. from the bottom of a 23-ft. pit ran from 0.98 to 2.70% copper. He said that the leaching plant of the Butte-Duluth was the first of its kind ever installed, but since it has been perfected three other similar plants have been installed in other places and are operating successfully on sulphide ores. At the time of the shut-down the Butte-Duluth had just reached a stage where it could operate its mine at a profit. A saving of 50% is now possible in buying acid for the plant, as it used to cost $25 per ton to bring it from Denver, and now it may be secured from the Anaconda company at $12.50 per ton. This effected a saving of 38c. per ton of ore treated. Receiver Everett estimated the value of the company's property at $741,368, against an indebtedness, bonded and otherwise, of $241,368. The total of claims filed is $190,833, of which $42,368 is represented by due bills to miners.

Anaconda Has About Reached Normal Capacity of its mines and it is not expected that the monthly figures will hereafter show any remarkable gains until after the first of the year when the Great Fall smelting works will be in full commission again. The August production, 22,800,000 lb., was the largest of any month this year. The figures for the eight months of 1915 follow: January, 13,700,000 lb.; February, 15,100,000; March, 19,000,000; April, 21,800,000; May, 20,500,000; June, 22,100,000; July, 22,100,000; August, 22,800,000; total, 157,100,000; the figures include the output of the Anaconda company and also the copper from ores received from the North Butte and other smaller producing concerns. The Anaconda company is pushing development work at various properties—copper, silver and zinc properties—but it will be a long time before these mines will be producing. While the pumps are running night and day in the Nettie mine, the silver property on the west side of the Butte district, it is expected that the mine will not be completely unwatered for four or five months. The Nettie seems to drain the entire western section of the district, and before the shut down and curtailment last fall the pumps had been running for eight months, and still all the water was not out of the mine. The Nettie vein is a large one and was a good producer of silver many years ago. With depth the Nettie may develop large deposits of copper and zinc. There is a large area of zinc deposits extending for several miles from the Emma mine in Butte westward beyond the old Blue Bird properties. In the western section several copper properties have also been opened, but none were ever developed to an important producing stage. It is expected that the western section will be pretty thoroughly explored and demonstrated through the work to be done in the Nettie by the Anaconda company, and the owners of other properties there are awaiting results with interest.

SALT LAKE CITY—Sept. 9

Dissolution of the Tintic Smelting Co. was begun on Aug. 31, in a petition filed with Judge A. B. Morgan of Provo. The petition was signed by Jesse Knight, J. William Knight, C. W. Nibley, W. Lester Mangum and R. E. Allen, who represented 4844 shares of stock out of a capitalization of 5000 shares. The petition states there is no opposition to the dissolution. The company was organized in 1906 and built a smeltery at Silver City to treat ore of the Knight mines and other properties in the Tintic district. The plant operated for a short time, several years ago, but on account of not having common-point freight rates, and other matters, did not earn a profit. Since that time the smeltery has been dismantled and a part of the machinery sold. The Tintic Milling Co. controlled by the Knight-Dern interests, is building its new mill at the former smeltery site.

Utah Copper Co. Produced in July 14,641,009 lb. copper, and the August production is estimated to be of about the same amount. Production for the four months just ended will exceed that for any similar period since the beginning of operations; with the July output as given above, the August output estimated at the same rate, the May output amounting to 14,053,705 lb., and that for June to 14,730,912 the total is between 57,000,000 and 58,000,000 lb., making a yearly rate of 171,000,000 lb. Additional dumping ground for tailings has recently been acquired by the company near the Arthur and Magna mills, the purchase price having amounted to about $50,000. There are buildings on a part of the ground, which may be used for dwellings for employees. On the south side of Carr Fork the company is constructing five 6-room houses for the use of the assistant superintendent of the mine, the assistant mining engineer, and others. These houses will be made accessible to the Bingham & Garfield depot by a new road from the south side of the cañon.

SEATTLE—Sept. 8

British Columbia Zinc Properties are entering the most important period of their development. After being considered a misfortune to be avoided and penalized, zinc promises to become a basic source of British Columbia mining wealth and scores of properties that have been idle for years, because of their large zinc showings, are entering the active list. These facts are indicated by developments reported from various points in British Columbia. A feature of the general revival of zinc was the recent bonding of the Big Ledge property at Halcyon, B. C., by English interests from L. L. Tower, of Northport, and associates. The Consolidated Mining & Smelting Co. has begun the erection of the zinc-reduction plant and it is announced that the entire output of the new works at Trail will be taken by the Dominion government until the end of the war.

Yukon Gold Production will reach $5,000,000 this year according to the latest estimates. Last year's production is now definitely established at $4,750,000, which shows that the 1915 production is little more, principally for the reason that the largest dredge in the district—Canadian-Klondyke No. 2, which overturned last October—has not been in operation on account of undergoing repairs. Another dredge, which worked most of last year on Bonanza, is idle this year. Notwithstanding the idleness of these two dredges, the other boats are making a good showing. The Yukon Gold Co. fleet has been doing exceptionally well and two Canadian-Klondyke's three dredges have been in some of the richest ground this year that they have ever worked. The gold produced in the Klondike camp now by dredges comes chiefly

from the Klondike River between Bear and Bonanza Creeks, and from Bonanza, Eldorado, Hunker and Gold Run Creeks. The largest hydraulic operations are along Bonanza benches and Eldorado benches.

KELLOGG, IDAHO—Sept. 8

Cœur d'Alene Mines Employ About 5,000 Men at present, the largest number in the history of the camp. Nearly 4,000 of these are with the larger companies, and it is estimated that there are another thousand scattered over the district on smaller properties. The larger mines, tributary to Wardner and Kellogg, employ 1,450 men distributed as follows: Bunker Hill & Sullivan, 650; Ontario, 150; Caledonia, 50; Last Chance, 300; Stewart, 300. The mines tributary to Mullan employ 665 men as follows: Morning, 450; Hunter, 150; National, 50; Reindeer-Queen, 15. The mines tributary to Wallace employ 1,850 men, distributed as follows: Hercules (Cañon Creek), 450; Hecla (Cañon Creek), 175; Marsh, (Cañon Creek), 100; Green Hill-Cleveland (Cañon Creek), 325; Frisco (Cañon Creek), 100; Tamarack-Custer (Cañon Creek), 225; Success (Ninemile), 125; Interstate (Ninemile), 350.

Rex Consolidated is assuming importance as a new Cœur d'Alene mining company. Charles Sweeny, formerly of the Federal Mining & Smelting Co. has joined the board of directors and will be a member of the executive committee of the new company, with his son, Robert Sweeny, and W. J. Hall, a former director of the Federal company. The other directors of the Rex company are M. J. Sweeny, a brother of Charles Sweeny, and Peter Bernier, president of the Black Bear Consolidated, which recently passed to the control of the Rex company. It is reported that the board is to be joined soon by a New York capitalist, and that it is the intention to make of the Rex another organization like the Federal company. With this object in view the directors are said to be negotiating for two more Cœur d'Alene properties in addition to the Rex and Black Bear.

The Consolidated Interstate-Callahan property, the youngest and richest of the Cœur d'Alene mines, may be placed in the hands of a receiver as an outgrowth of the fight for control at the last annual meeting, held in Duluth on Aug. 16. The Callahan-Boutin faction were unable to vote 170,000 shares held by the Callahan Mining Co., which would have given the insurgents control, and as a result two sets of directors were elected. The Robbers-Percival-Sussman faction, identified with the American Metal Co., is in physical control of the property, and a plea for a receiver was filed in the district court at Wallace on July 27 by the opposition. The complaint alleges that the Callahan company and Frank Boutin "believe that the officers of the American Metal Co. will control the Consolidated Interstate-Callahan Co. and its property for its own benefit and to the loss and injury of the Consolidated Interstate-Callahan Co. and its directors." It is further alleged that the American Metal Co. obtained an unfair contract for a period of 10 years for practically all the output of the Interstate-Callahan, whereby the latter company is receiving and will receive much less than its ores would bring from other smelters. The contract is said to call for a flat rate of $38 a ton for all concentrates. Judge Woods has appointed as receiver Eugene R. Day, of the Hercules. Meanwhile, attorneys for the present management have raised the point that, since the Interstate-Callahan is not an Idaho corporation, the state courts have no jurisdiction and that the case must therefore go before the Federal courts. Pending action on the motion in the Federal court, the receiver is not now in possession, and will not take charge of the property unless the motion is decided in favor of Boutin and associates. Indications are that the contest will be long drawn out and bitter, and the prediction is made that the issues involved will go to the U. S Supreme Court for final settlement.

DULUTH, MINN.—Sept. 11

The Oliver Iron Mining Co. on Aug. 30 requested and received permission to contribute $70 monthly to the state school at Owatonna, Minn., for the care and maintenance of several children of Paul Paulson, deceased. The man was killed while in the employ of the company, and the latter voluntarily paid the widow $5,000, being the legal limit. Desirous of doing more than the legal requirements the company is now assisting in the education of the children.

Leased State Iron Mines will ship 2,000,000 tons, this season, according to the estimates of State Auditor J. A. O. Preus. The record season was 1913, when 2,875,982 tons went forward. According to the records there is an estimated tonnage of 144,000,000 still remaining. Deposits making up this tonnage are contained in the area covered by 47 leases, which have an average of 34 years still to run, thus making the average output required to exhaust these mines about 4,250,000 tons. State leases carry a royalty of 25c. per ton, so there is a total royalty of $36,000,000 in sight for the state, which goes to the state's permanent school, university and swamp-land funds

Iron-Ore Cargoes were leaving the Duluth-Superior harbor at rate of one every hour during the first week in September. At the Ashland, Wis., docks, where much Michigan iron ore is loaded, both the C. & N. W. and the Soo docks are handling exceedingly heavy tonnage. The August shipments down the lakes totaled 8,681,117 tons, being the second largest tonnage of ore delivered in a single month on the Great Lakes. From now on, weather conditions will interfere somewhat with shipments, and it seems that the flood tide of ore tonnage is past. Competent judges state that the season's shipments will scarcely exceed 45,000,000 tons.

Additional Rail Service for the Minnesota Steel Co.'s plant will be provided by the Duluth, Missabe & Northern Ry., which has leased the trackage of the Spirit Lake Transfer Ry., Interstate Transfer Ry. and the Duluth Terminal Ry., giving it the best terminal facilities of any of the Duluth rail lines. The transaction gives the Minnesota Steel Co.'s plant rail service on both sides and through its plant, and facilitates the handling of material to and from the Missabe docks, in Duluth. The lease also offers a reasonable solution as to why the steel company had not constructed docks for direct lake shipment. The D., M. & N. Ry., being a subsidiary of the U. S. Steel Corporation, now affords the latter unexcelled terminal and dockage facilities at the head of the lakes.

HOUGHTON, MICH.—Sept. 15

There is Not the Feeling of Optimism relative to the copper situation in the Michigan district that was evidenced a month ago. There are not, however, any accumulations of metal here. Certainly none that compares with this season in previous years. Most of the companies are sold through the present month of September but the fact is acknowledged that there have ben no heavy bookings beyond that date. It may be a waiting game. If such is the case there is every reason for believing that the large copper producers are in just as good condition to withstand lowered prices as are the consumers.

The Social-Welfare Idea, originating in this district in the Calumet & Hecla's long maintained policy of looking after the men with an almost paternal attitude, is impressing other corporaions in the Lake country. It may be noted that during the recent visit of John Stanton, head of the Wolverine and Mohawk properties, there was an evening reception to 100 heads of departments from the mines and mills, at which Mr. Stanton gave a fine address on the policy of "getting together" for mutual benefit. These same companies continue to pay their monthly bonus checks of 5% to the men. Calumet & Hecla continues its 10% advance in wages, over and above the $500,000 distributed in bonuses in July.

TORONTO—Sept. 11

Important Phosphate Deposits are reported to occur in the Banff National Park in the Rocky Mountains, according to Dr. Frank D. Adams, chairman of the committee on minerals of the Canadian Conservation Commission, and W. J. Dick, mining engineer of the commission. The discovery is regarded as of great importance in connection with the agricultural development of the West. The distribution and extent of these deposits will be studied by the Department of Mines.

The Sesikinika Gold Area has latterly attracted a good deal of attention and many American capitalists are acquiring interests in claims. A Buffalo syndicate has purchased the Malory claims adjoining the Labine for a figure stated at $35,000, and development is progressing in charge of J. Nelson of Haileybury. Frank Loring and associates are working the Gibson-Potvin claims at Goodfish Lake near Sesekinika, having taken up the option at $65,000. The Goodfish Lake Gold Mines Co. are operating the Costello claims, with excellent showings on partly developed veins.

The Kowkash Excitement shows no signs of abatement. The rush of prospectors and speculators, many of them from distant points, is unprecedented in the mining history of northern Ontario. A large area in the neighborhood of E. W. King Dodd's discovery has been staked, though some doubts are expressed as to whether there is much valuable territory outside of the original claim, from which all the rich gold samples that are being shown have been taken. The Ontario Bureau of Mines here is overwhelmed with applications for maps and information. Percy Hopkins, assistant provincial geologist, has been sent by the Bureau to Kowkash to make a preliminary investigation of the formation and mineralogy of the district. T. A. McArthur, inspector of mining recorders' offices for Ontario, has also been sent up to look into the situation and ascertain whether it is advisable to open a recording office in the district, as at present Port Arthur is the nearest point at which claims can be recorded. The department is preparing a map of the Kowkash field on a large scale, which will be issued in about two weeks.

The Mining News

ALASKA

SKEEN-LECHNER (Seward)—These properties sold at receivers' sale. Mill sold to L. V. Ray and mining claims to Harry Hobem.

FRANK SKEEN AND J. W. STEVENSON report finding a rich gold lode on the Champion and Gladiator claims in the Moose Pass district.

ALASKA-EBNER (Juneau)—New company formed in New York will probably start work on the Ebner and Hallum properties in the near future.

TAKU VS. GOLD BELT (Juneau)—Suit has been brought by the Taku Alaska company against the Alaska Gold Belt Co. regarding title to 11 claims.

LANDLOCK BAY (Valdez)—W. A. Dickey has shipped $40,000 worth of copper ore from his claims this summer. Development work will be pushed.

WILLIAM BARTHOF (Knik)—The original locator of most of the Willow Creek claims expects to install a small mill next spring at the Mabel mine on Archangel creek, Willow Creek district.

ALASKA-JUNEAU (Juneau)—New system of shooting large stopes is being experimented with to lower cost of stoping ore. No results given out as yet. John Richards is mine superintendent; P. R. Bradley, general superintendent.

JUALIN ALASKA GOLD MINES (Juneau)—Jean Vanophem and party, having left Brussels by special permission from the German Government on business, are examining the Jualin properties with Consulting Engineer H. G. Young. Mr. Vanophem is president of the Algunican Development Co., which is handling the Jualin property. Last year Mr. Vanophem had just arranged for big work at the Jualin when the war broke out and tied up the Belgian capital that was to be used in the work. No word is given out as to the magnitude of the work now contemplated.

ARIZONA

Gila County

IRON CAP (Globe)—Williams shaft will be put down from 8th to 10th level at once, and a larger hoist installed in near future.

Greenlee County

WESTERN FEDERATION OF MINERS has started strike for increased wages in the Clifton-Morenci district. Mines and reduction works of Detroit, Arizona and Shannon companies closed and 8,000 miners, machinists and electricians reported on strike. Company managers have declined to meet Western Federation representatives.

Mohave County

PAYROLL (Chloride)—Considerable new equipment is being installed by Thomas B. Scott.

NEW JERSEY (Chloride)—The mill is being remodeled and will soon be in commission.

OATMAN GOLD (Oatman)—This company reports cutting the Kokomo vein at a depth of 113 ft. Shaft still in ore at 130 ft.

GOLCONDA EXTENSION—Unwatering of the mine continues, the water having been lowered to the 180-ft. level. Sinking will soon be resumed.

E. R. HOLDEN, of E. R. Holden & Co., Cripple Creek, Colo., is planning to build a custom mill in the Oatman district to treat ores from the smaller mines.

TENNESSEE (Chloride)—Excellent ore has been opened on the 1,200-ft. level. The ore is being shipped to Utah. Shaft is being continued to the 1,500-ft. level.

JEROME-OATMAN (Oatman)—The company is installing a hoist, compressor, drills and drill sharpener. Several new buildings have been put up and roads built.

HAWKSHAW (Oatman)—E. H. Newland and N. C. D'Arcy of Colorado have taken over the Lucky Boy-Hawkshaw group of six claims and the controlling interest in the Tom Reed Annex.

Pinal County

RAY-ARIZONA (Kelvin)—The company is patenting its ground and will soon resume active operations.

WERNER (Price)—A mill is being erected on the property. A pipe line delivers water from the Gila River.

RAY-HERCULES (Ray)—About 40 men are already at work on the property making surface improvements.

KELVIN-SULTANA (Kelvin)—The No. 2 vein has been reached by the crosscut on the 500 level. Drifting east and west will be begun, and the crosscut continued southward.

CALIFORNIA

Eldorado County

BLUE ROCK (Georgetown)—New 10-stamp mill completed by James Flynn. Mine is near Georgia Slide.

FOWLAR (Placerville)—Smooth slugs of coarse gold ranging in value from $5 to $74.50 have recently been cleaned up at this gravel mine on Otter Creek.

Fresno County

COPPER KING (Academy)—Property leased to Charles Leavitt, of Fresno. Unwatering shafts and drifts and a general cleanup of surface has begun. Reported that about 8,000 tons of copper ore is in sight

Humboldt County

FRANK LUBBS (Scotia)—Has uncovered 18-in. vein of high-grade milling ore on placer claim near the Red Cap.

RED CAP (Scotia)—Lower tunnel is in 312 ft. and a 15-ft. crosscut has been driven which is in a diorite dike that parallels the vein.

MOUNTAIN LILY (Scotia)—Good body of milling ore has been disclosed above tunnel No. 2. The arrastre will run on this ore during winter.

Inyo County

MANGANESE ORES from a deposit said to be 100 ft. wide are being mined and shipped by Alexander Yeoman. Ore carrying 50% manganese is shipped to Baltimore, Md. Auto-truck haulage to the railroad costs $7.50 per ton; railroad freight to San Pedro $2.50 per ton and water freight via Panama Canal $3 per ton; extraction of the ore costs about $1 per ton, making a total cost of about $15 per ton.

SILVER KING MINING CO.—(Darwin)—Lease taken on the Lee mine by D. F. Shiveley, D. E. Staats, E. E. Simmons and J. H. Kohlbecker, who formed the above company. Zinc ore will be shipped at present.

CERRO GORDO (Keeler)—Aërial tramway has been rebuilt and is delivering more than 100 tons of zinc ore per day at Keeler. In four months, March, April, May and June, 1,681 tons of zinc ore were mined; zinc content, 1,109,481 lb. Most of this ore came from the 200, 400 and 500 levels. The vertical shaft has reached the 950-ft. point, from which a 250-ft. winze has been sunk.

CARBONATE (Zabriskie)—Ten auto trucks are employed hauling ore to the Tonopah & Tidewater R.R. Trucks carry from 4 to 6½ tons each. Additional trucks have been ordered. Haulage costs about $12 per ton over a distance of 42 miles. Reported that the ore runs about 37% lead, 20 oz. in silver and $5 per ton in gold. The mine has about 900 ft. of development, principally adits at a vertical depth of about 200 ft. The vein varies from 2½ to 15 ft. in width and is easily mined. John Salsberry is manager.

Kern County

OLD MILL (Caliente)—Los Angeles men offered to renew option for antimony claims. Shipment of ore to Magnolia Metals Co. of New York arranged for. Other mines in Amalie district reported to have contracted for shipments to same company.

Nevada County

GOLDEN CENTER (Grass Valley)—First dividend of 4¢ has been declared. The property has been in operation since June, 1914. New hoist in course of erection.

BAGLEY (Grass Valley)—Clyde G. Carr, formerly manager Candelaria Mining Co. of Nevada, and Howard Dennis, of Grass Valley, have bonded this property and retimbered the old shaft down to former tunnel level.

Plumas County

PLUMAS-EUREKA MINES CO. (Johnsville)—Voluntary petition in bankruptcy filed in the U. S. District Court, Aug. 25. Liabilities $133,633, assets $41,515. Principal creditors George W. Phillips, of Massachusetts, and Scheeline Bank and Trust Co. of Reno.

Shasta County

KEYSTONE DREDGING CO. (Kennett)—Reported to have purchased from W. P. Hammon 500 acres of land on west side of Sacramento River two miles above Kennett.

BELL COW (Ono)—Development work on the property on Arbuckle Mountain, west of Ono, progressing with satisfactory results. Grade of ore increasing as depth gained; some high-grade ore opened.

Siskiyou County

VICTORY GOLD MINES CO. (Etna)—New 50-ton tube mill being installed. J. E. Nefroney, superintendent.

Trinity County

UNION HILL (Weaverville)—Mine closed down for the season on account of lack of water.

GOLDEN JUBILEE (Coffee Creek)—Installing two Trent universal machines. Chester L. Proebstel, superintendent.

HORSE SHOE MINING CO (Lewiston)—Preparations being made to resume operations next season, under management of John M. Nicol.

UNION CONSTRUCTION CO. (San Francisco)—Paulsen's ranch, near Lewiston, being drilled. If ground warrants, dredge will be installed.

TONOPAH MINING CO. (Carrville)—Dredging ground being prospected with two Keystone drills. Walter J. Hufford, of Breckenridge, Colo., is in charge.

Tuolumne County

HARVARD (Jamestown)—G. Musente, a miner, was probably fatally injured by being caught between the skip and the timbers at the collar of the shaft.

SPRINGFIELD TUNNEL (Sonora)—Angelo Tuchich, a miner, was killed on Aug. 31 by fall of rock

COLORADO

Eagle County

A STRIKE OF GOLD ORE is reported from a new area in the southern part of this county around the heads of Brush and Lime creeks. Nearest railroad station is Thomasville on the Colorado Midland. District has been named Fool's Peak.

Lake County

ROBERT BURNS (Leadville)—Development in this property near Little Jonny on Breece hill, is still within oxidized zone. Large body of copper carbonate has been opened. Recent shipments have ranged from 7% to 26% copper.

PENROSE (Leadville)—The motor of one of the Providence centrifugal sinking pumps that are unwatering downtown district burned out recently while in operation. During repairs, water rose about 5 ft. in the Penrose shaft despite operation of the other pump.

ALADDIN (Leadville)—Manager Walter W. Davis of the Yak company confirms announcement that his company has secured this group under bond. Exploration performed some time ago through a drift at foot of 200-ft. winze near the breast of Yak tunnel disclosed attractive showings of ore in Aladdin ground. From this drift a new winze will be sunk an additional 150 ft. to reach certain contact or ore zone and, if results are satisfactory, the tunnel proper will be extended into the new territory. While it will be above the ore-bearing formations, its depth from surface will be about 1,250 ft. since the bore will be well into the Mosquito Range.

Park County

LONDON (Alma)—Sixty leasers are working in this lofty, high-grade mine that had been shut down by owners. Four 6-horse teams are busy hauling ore seven miles to station for shipment to Denver. While tonnage from this vein cannot be great, ore is of high quality. First 300 tons marketed this summer averaged 6.5 oz. gold per ton. Ore also runs well in silver and copper.

San Juan County

HIGHLAND MARY (Silverton)—This mine is now in combination with Trilby and Shenandoah mines. Group will be managed by Mr. McLean who plans system of underground connections.

Teller County

HONDO (Victor)—Ore shipped from the Sitting Bull vein runs about $17 per ton.

W. P. H. (Anaconda)—Clutch lease has struck shoot, 4 ft. wide, of high-grade ore.

DOCTOR-JACKPOT (Anaconda)—Five sets of leasers shipping good ore. Starkweather & Wilson lease marketing 2-oz. ore, occurring in a shoot developed more than 100 ft. along the drift.

TRACHITE (Independence)—This United Gold Mines Co. property on Bull Hill makes increasing shipments from its new shaft now about 75 ft. deep, all rock broken being ore averaging about $15 per ton.

PORTLAND-INDEPENDENCE (Victor)—New trestle connecting Portland surface and dumps with top of Independence mill is completed. Remodeling of mill is in progress, six carloads of new machinery having been ordered and some of it already delivered. About 40 blocks of Independence ground are worked under lease.

ISABELLA (Altman)—August tonnage from this mine reached a record; leasers and company shipments amounted to 105 carloads having an average value of about $24 per ton. Among the leases making large showing were the Klondike or Knuth and Theobold, Wolcott, and Dolzell and Comerford. The last-named lease has 7 ft. of high-grade ore.

TRAIL (Victor)—Being developed on 1200 level through Dexter shaft by Orrison & Eby. New orebody from 5 to 10 ft. wide and averaging about $30 a ton in gold has been opened up for distance of 200 ft. Leasers plan to do about 1200 ft. of drifting under stoping ground having depth of 700 ft. Robinson Leasing Co. is conducting its operations through Blue Bird shaft. Development is in progress on 1000 level where crosscut has been driven to cut trail vein and is now opening some encouraging pockets of ore.

LAST DOLLAR (Victor)—Joseph Crumby, leasing on 1,100 level, has settled carload shipment at $37 net per ton. On 1,200 level, leasers have opened a vein parallel to main Last Dollar vein but it has not been sufficiently developed to determine its character. Charles Ellison and James Constantine, miners engaged in shaft-sinking, were killed at the bottom of main shaft, Sept. 3, when the light rope—used temporarily in hoisting to the 1,200 level—broke and dropped the bucket containing them about 30 ft. into the blasts of 16 holes they had just fired.

GOLDEN CYCLE-VINDICATOR (Independence)—Carver lease, on Golden Cycle 400 level, maintains large output of $25 ore. Vein is 5 to 7 ft. thick and has produced steadily for a year and a half. Vust or Hayes lease, in Vindicator 1,100 level, ships high-grade ore from a vein having a core about 2 in. thick and extremely rich. Fish and Harris, Vindicator 700 level, are stoping in a shoot 4 to 7 ft. wide running about 1 oz. per ton. The Shatz leases in the Golden Cycle and Vindicator veins are both shipping. The Vindicator company has paid off 16 of its notes held by the Golden Cycle company. These notes have face value of $500,000, leaving notes amounting to $700,000 still to be met. Usual monthly 2% dividends are being paid by the Golden Cycle company.

IDAHO

Shoshone County

JACK WAITE EXTENSION (Murray)—Installing gasoline-driven compressor and will put on small crew for development work.

REINDEER-QUEEN (Mullan). Ore bins are nearly finished and stoping on small shoot of high-grade ore will commence at once. Main drift advanced 200 ft. in August. Vein, crosscut for 35 ft., is said to average 2 to 3% copper.

CARNEY COPPER (Mullan)—Two veins will be developed. Grading for new compressor has been completed and machinery will be installed at once. A contract has been let for driving No. 3 tunnel an additional 50 ft. No. 2 is in 1,500 ft.

BROWN & FINNELL (Kellogg)—Have cut a 12-ft. vein on their Pine Creek property assaying 40 to 70% antimony. They plan to install gravity tram, flume and sluice, to erect messhouse and bunkhouses, and to commence shipments as soon as possible.

NATIONAL (Mullan)—A shaft has been sunk from the main tunnel 200 ft. along the hanging wall. Vein will now be crosscut and explored by drifts. Quality of the ore is much improved in shaft, assays returning 37.7 oz. silver, 8.8% copper and $1.40 in gold. Mill will be started by Sept. 15. G. F. McCarthy, manager of Hecla mine, is in charge.

EVANS (Wallace)—Benjamin Evans, who has installed a Franz table for reworking the slime tailings below the Interstate-Callahan mill on Ninemile, is recovering from 3 to 5 tons of zinc concentrates a day. One 50-ton car was shipped Aug. 31 and it was planned to ship another by Sept. 10. Tailings are abnormally rich on account of the crowding of the Interstate mill to take advantage of high zinc prices.

CARBONATE HILL (Mullan)—It is understood that bond on this property four miles east of Mullan was taken for Butte & Superior company of Butte. Bonded Aug. 30 for $587,630, the first payment of $75,000 to be made on Sept. 1, 1916, and payments of equal amount to follow at intervals of three months, the final payment of $62,630 to be made on Oct. 1, 1918. Recent strike shows 4 or 5 ft. of high-grade zinc ore, accompanied by considerable lead; rest of vein, probably 10 ft., is lower grade ore. Since making strike, vein has been explored over 100 ft.

MICHIGAN

Iron

WALPOLE (Iron Mountain)—This mine being prepared for active operations. Some miners at the Pewabic will be transferred, and mine may be worked all winter.

SOUTH JACKSON (Negaunee)—Property has worked steadily all summer. Mine is only worked during summer. The ore is in good demand and more could be sold if it could be taken out.

ELECTRIC POWER for the Michigan ranges may be secured from a water power on the Flambeau River, 15 mi. northeast of Ladysmith, Wis., by a Boston syndicate headed by William H. Burgess. A dam is to be built creating a 68-ft. head for the development of 10,000 hp.

MAAS (Negaunee)—At the opening of navigation there were over 300,000 tons of ore in stock here. All but about 25,000 tons will be shipped. This will be left to support the trestles. Working with one full crew. Both this and the Negaunee, which adjoins, will be worked all winter.

MINNESOTA

Cuyuna Range

CUYUNA-DULUTH (Ironton)—Pres. W. H. Locker announces that this underground operation will be resumed shortly. Has been idle over a year.

ADBAR DEVELOPMENT CO. (Brainerd)—Company has started sinking a plank-lined shaft on its property in Sec. 22, 45-30, four miles east of Brainerd. The orebody is covered by till to a depth of 100 ft. The operation is a pioneer in its vicinity, the Wilcox mine two miles eastward being its nearest neighbor.

ROWLEY (Barrows)—Following customary Cuyuna Range plan, an excursion of stockholders (and others) was run from Duluth to shaft site at Barrows on Sunday, Aug. 22. Shaft was duly christened with spring water (the district being "dry"); the mine's namesake turned first shovel of dirt; ladies of town served dinner in grove on property; and excursion then visited other places of interest on Range. Property is held on lease from Northern Pacific Ry. Co. and contains comparatively small body of ore of good grade.

Mesabi Range

UNION (Virginia)—Recently 96 cars of ore were loaded in six hours by a single steam shovel. Said to be a record.

MONROE (Chisholm)—"A" shaft concrete lining now completed. From this shaft the village of Chisholm will procure its water supply from an unused portion of the workings.

Vermilion Range

DULUTH, MINN.—After years of litigation, Jacob and Amelia Stubler, of Duluth, have established title to a one-twelfth interest in a 40-acre tract adjoining the Grant Mine, at Buhl, on Mesaba Range. Tract is valued at $3,000,000. The acquisition came as result of purchase of the one-twelfth interest for $7.25 at forfeited tax sale in 1899.

MISSOURI-KANSAS

JOHN BARNES has encountered ore at Baxter Springs, Kan., at a depth of 15 ft., and already has a 5-ft. face with good ore in bottom of shaft. Will have to install pump, before going deeper.

SAVAGE (Galena, Kan.)—This mine on the Foster land, west of Galena, has been leased to Weir, Pepper and Vo, of Webb City, Mo. A mill will be built.

QUICK EIGHT (Galena, Kan.)—First car of ore shipped last week from 120-acre lease on the Glock land. Work is in new ground at 85-ft. level. W. A. Swan, superintendent.

LA NORA (Carterville, Mo.)—This mine on the Higgins land has been sold for $30,000. A drill will be put to work immediately to prospect the south part of the 52 acres. Meantime work will be continued at the old mine. George Bayless, superintendent.

MONTANA

Broadwater County

BLACK FRIDAY (Radersburg)—In view of proposed railroad from Three Forks to Radersburg, development work has been resumed to add to the ore reserves of 20,000 tons of milling rock. Gold veins vary from 2 ft. to 28 in. in width.

Jefferson County

MONARCH MINING AND MILLING (Clancey)—Work on King Solomon mine, a gold-silver-lead property recently acquired by this company, has progressed to such an extent that ore will be shipped regularly. Manager Moreland, after unwatering mine, has blocked out ore on 400-ft. level which will be tapped with 125 ft. of drift and crosscut. More men will be employed.

Granite County

GRANITE BI-METALLIC (Philipsburg)—Director John P. Meyer, after spending four months at mine, states that since development work was resumed another vein has been discovered, carrying from 60 to 90 oz. in silver and $3 to $5 in gold per ton. There is much low-grade ore on property.

Silver Bow County

BUTTE & SUPERIOR (Butte)—August was another record breaker. Total amount of zinc produced was 14,500,000 lb., nearly 1,000,000 lb. in excess of any previous month. Increase was brought about largely by increased efficiency from new machines in oil-flotation plant. Recoveries averaged 93%, while grade of concentrates was 56%, against 51% in former months.

TUOLUMNE (Butte)—Since unwatering shaft a few days ago, mining has been prosecuted vigorously and shipments have averaged 100 tons daily. This will be increased in near future. The 2,600-ft. level which was just beginning to show up well when mine was shut down, 10 months ago, is being further developed.

RAINBOW DEVELOPMENT (Butte)—Work of unwatering has shown no important damage was done to shaft. Company will push development work rapidly, three shifts having been put to work. Shaft is now down 1,300 ft. and will be sunk at least 200 ft. more.

NEVADA

Esmeralda County

KEWANAS (Goldfield)—A large low-grade vein was opened at a depth of 838 ft., at a point 200 ft. north of the winze from the east crosscut on the 700-ft. level of the Laguna shaft of Goldfield Consolidated.

KLONDYKE PORTLAND MINES CO. (Goldfield)—This recently organized company will run a crosscut from the 150-ft. shaft on its property in the Klondyke district, midway between Tonopah and Goldfield. M. F. Hill, secretary.

Humboldt County

ORE TRANSPORTATION for the camp of Rochester was improved by the opening on Sept. 8 of Nevada Short Line extension up Rochester Cañon to the portal of the Friedman tunnel.

SEVEN TROUGHS COALITION (Seven Troughs)—August production was only $48,000 owing to accident to engine. A 20-in. high-grade vein was opened on 1,200 level and record output would have been made in August but for accident. New 100-hp. gasoline engine has been installed.

ROCHESTER MINES CO. (East Rochester)—Most of the leases have been taken over by the company which is sending about 100 tons daily to the mill. New hoist on 300 level in Crown Point No. 1 was connected up on Sept. 8 and the Big Four winze, now down 160 ft., is supplying good ore from the 450-ft. level.

Lyon County

NEVADA-DOUGLAS (Ludwig)—Machinery of the new leaching plant is being given preliminary tryout.

Mineral County

PAMLICO PLACER CO.—This company has been formed by Sen. Key Pittman and S. H. Brady to operate placer claims at the junction of Neversweat and Pamlico creeks, 9 mi. southeast of Hawthorne. Washing plant and hoist will be installed.

Nye County

TONOPAH ORE PRODUCTION for the week ended Sept. 4 was 9,907 tons, of which Tonopah Mining produced 2,750 tons; Belmont, 3,187; Extension, 1,800; West End, 826; Jim Butler, 1,100, and miscellaneous leasers 244 tons.

BIG PINE (Manhattan)—The drift from the 200-ft. level of the Mushet-Wittenberg working shaft to the southern limits of the claim has been passing through the ore zone ever since leaving the shaft. The average of the drift face during this development was $5 per ton.

MANHATTAN-MUSTANG MINING CO. (Manhattan)—The sensation of the week was the phenomenal strike of high-grade ore in the Train-Chase lease on the Mustang. A series of vug holes containing a soft decomposed quart and talc averaged over $200 per ton. The ore is found in the limestone, but close to the shale contact, about 15 ft. below the surface. Following another small seam, with a winze, the ore makes directly against the hanging wall of shale and the leasers have carried the winze to an incline depth of about 18 ft. From the winze about 10 tons of high-grade ore has been taken and the chute is as strong in the bottom of the winze as elsewhere.

Storey County

MEXICAN (Virginia City)—East and west crosscuts on 2,700 level extended through porphyry and quartz of low assay. Mill treated 172 tons ore averaging $6.55 per ton.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Saved 40 cars ore from Belcher 1,200 level and 13 cars low-grade from Crown Point crosscut. Jacket mill received 676 tons dump rock and 156 tons mine ore.

UTAH

Cache County

A NEW ZINC DISCOVERY is reported 2½ mi. southeast of Hyrum, near the mouth of Blacksmith Fork Cañon. Zinc-carbonate ore of good grade has been opened in the old Moon mine, which years ago was worked as a gold prospect. The ore occurs in limestone, and the mineralized zone can be traced some distance up and down the valley. A shipment of 21½ tons has been made by J. Nolan and C. C. Manghan, of Logan.

Juab County

TINTIC SHIPMENTS for the week ended Sept. 3 amounted to 131 cars, by 16 shippers. The Chief Consolidated, Iron Blossom, Centennial-Eureka and Eagle & Blue Bell had the largest output.

YANKEE CONSOLIDATED (Eureka)—The recent strike at this property is attracting interest among Tintic operators, and work is being done on the north and south in search of an extension of the ore.

Salt Lake County

NEW UTAH BINGHAM (Bingham)—Vein No. 4 in the 150-ft. level is 4 ft. wide with 14 to 24 in. of ore on the hanging wall. Ore in bin from raise on this vein assayed 25.7 lb., 20 oz. Ag., $2 Au., 4% Cu. Main drift beyond No. 3 and No. 4 veins has encountered 2 ft. of $18 ore.

Weber County

WESTERN ZINC (Saline)—This company has taken a lease on a portion of the Lake View Mining Co.'s property on Promontory Point, and is doing active development work. J. C. York is manager. The Lake View company has shipped zinc ore valued between $25,000 and $30,000 since March and has paid $10,000 in dividends.

WISCONSIN

Zinc-Lead District

BELL (Platteville)—Shaft sinking has been started.

LONGHENRY (Benton)—Longhenry Brothers have started milling on the Spensley lease.

STAR (Platteville)—This company has acquired the Grant County mine and mill and begun operating.

VINEGAR HILL (Platteville)—This company has taken over the Hodge mine recently unwatered by the Ben Webster Mining Co.

LAKE SUPERIOR (Shullsburg)—This company of northern Wisconsin people has resumed operations at Shullsburg, after several years' idleness.

MILWAUKEE MINERAL (Highland)—Platte Whitman, of Highland, has purchased the property of this company and will begin mining operations.

GRITTY SIX (Cuba City)—A Chicago company has taken options on the Gritty Six, Raisbeck and Anthony properties and has begun pumping at the Gritty Six mine.

CANADA

British Columbia

YREKA—This property on Quatsino Sound, dormant for some years, will be reopened by Fred J. Rollands, of Spokane.

IVANHOE (Sandon)—The concentrator was destroyed by fire on Aug. 30. The plant, valued at $50,000, was treating ore from Lucky Jim and Surprise mines.

SILVER CUP (Hazelton)—A second carload of ore has been shipped to Trail by Clothier Bros., leasing this property on Nine Mile Mountain. The ore ran 135 oz. in silver and 30% lead.

SWAMP CREEK—Report of rich strike on Swamp Creek near Barkerville, in the Cariboo district, has not been substantiated. C. W. Grain, gold commissioner, states that there is nothing to justify a stampede to the diggings.

Ontario

TECK HUGHES (Kirkland Lake)—Buffalo Mines of Cobalt has finally purchased control for 5c. per share. Power plant and 100-ton mill are to be installed.

TIMISKAMING (Cobalt)—The Nordberg hoist is being installed. It has a capacity for 8,000 lb. from 2,500 ft. and is the largest hoist in the camp.

PORCUPINE CROWN—Drifting is being done at the 600-ft. level on vein 4 to 5 ft. in width with low gold content. Vein on 500-ft. level shows marked improvement in width.

ZINC CO. LTD. (Welland)—This company, backed by the Wooltop Mining Co., of Weedon, Que., is constructing an electrolytic refinery to have a capacity of 5 tons of spelter per day.

HOLLINGER—In sinking the main shaft, a vein, about 9 ft. wide, carrying ore stated to average between $8 and $9 per ton, has been cut. It is about 300 ft. to the southeast of the main vein and running parallel to it. Reported that mill will be enlarged to treat 2,000 tons per day.

DOME—The present shaft being entirely in ore, it has been decided to sink a new shaft on an incline between the office and the mill. The ore will be crushed to 6 in. underground and brought to the surface up the new shaft in skips. Production for August was 28,600 tons, yielding $133,928 or $4.65 per ton.

DOME (Munro Township)—Two gold bars, valued approximately at $50,000, were shipped on Sept. 1 by the Dominion Reduction Co. to the United States mint. The gold was produced from 750 lb. of ore, and it is estimated that the tailings contain gold to the value of $30,000. A previous shipment of about $26,000 was made to Cobalt.

AFRICA

Rhodesia

GOLD PRODUCTION in July is reported at [illegible] oz., being 5,100 oz. more than in June; total gold output for the seven months ended with July, 519,409 oz., or $[illegible]. Other metal output for July was 16,214 oz. silver, [illegible] tons copper and 3 tons lead. The mineral production included 64 tons asbestos, 5,432 tons chrome ore and 35,832 t[illegible] coal.

The Market Report

Metal Markets

NEW YORK—Sept. 15

The week was characterized especially by a noteworthy improvement in the copper market toward the close. On the other hand, lead and zinc were dull and declining right through the week.

Copper, Tin, Lead and Zinc

Copper—During the first four days of the last week, the copper market was dull and disappointing. Copper was freely offered at 17½c., regular terms, and some small sales were reported at that price, with sellers over. Eastern producers are said to have sold at the same price in Western markets, and after paying the back freight, netted only 17.22½c. Some sales for export were made on the basis of 17⅛c., cash, New York. On Tuesday the market woke up and good sales were made at 17⅝@17¾c., regular terms, while business for Europe was taken at £86, equivalent to about 17.35c. here at the current rate of exchange.

Some of the larger producers did no business in this market, but made large sales out of warehouse in Europe of copper that had previously been sent over and stocked there. France was a large buyer. There was some Russian business but the buying for Russian account was very much muddled and transactions with its agents are difficult to manage. The domestic business of the week, especially of the last two days, included some round lots, which were taken to a major extent by the brass manufacturers, although wire drawers were also buyers.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19@19½c. per lb. at mill. The chief maker does not quote base price.

Tin—The market was dull and featureless.

Lead—There was such sharp competition for a relatively small order on Sept. 8, and it was taken at so considerable a cut in price, that the A. S. & R. Co. apparently became disturbed over the situation in lead, and on Sept. 9, reduced its price to 4.70c., thus undercutting the outside producers. However, they immediately came forward with offers to sell at 4.65c., and then at 4.60c., whereupon the A. S. & R. Co. reduced to 4.50c. on Sept. 14. Although this second cut has so far failed to stimulate much buying, the outside producers do not for the moment seem to be disposed to go any lower, and at the close the market had become firm at 4.50c.

Spelter—The aggregate business was relatively small. At the beginning of our week of record the market stood at 13@14c., sales of September metal being made at approximately the higher figure, and of November-December, at the lower. From day to day the market fell off a little. Some of the new and small sellers were rather insistent upon disposing of their product, although what they had to offer was not large. On the other hand, there are signs that unsold stocks are beginning to accumulate in the hands of certain of the older and larger smelters, who are not making any special effort to sell, considering that any upturn of the market would rapidly clean them out. It is quite certain, however, that the position of the spelter market is becoming very much easier with respect to early deliveries. The outstanding feature of the week was the offering of spelter for immediate delivery by the principal buyer. These offers were limited to consumers only. The full meaning of this move is not yet understood.

Sales of brass special spelter are reported at 16c.

Sales of prime Western spelter for delivery in the first quarter of 1916 were made at 11½@11⅝ cents.

Zinc Sheets—Business has been on a considerable scale. The base price for carload lots is unchanged at $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 15

Aluminum—Demand continues good, and stocks are lower than ever. The price is firm at 45c. per lb. for No. 1 ingots, and 50c. is reported asked for a round lot for early delivery.

Antimony—The market remains quiet and no large business has been done. Sales of ordinary brands, principally in small lots, have been made at 28@30c. per lb. Cookson's is held at about 45c. but is rather nominal.

Nickel—Quotations for ordinary forms are 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—The market is rather quiet but pretty firm. New York price is $89@90 per flask of 75 lb., according to size of order. San Francisco reports by telegraph a fair but uncertain market; quotations $85@90 per flask. London price is off 10s. per flask, £16 10s. being named from both first and second hands.

DAILY PRICES OF METALS IN NEW YORK

Sept.	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Spot, Cts. per Lb.	Lead New York, Cts. per Lb.	Lead St. Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
9	4 6500	48⅞	17 12½ @17 37½	33¼	4 70 @4 80	4 55 @4 75	13.00 @13.00
10	4 6850	48¾	@17 37½ 17 12½	33¼	@4 70 4 60	@4 55 4.50	@13 75 12.75
11	4 6900	48¾	@17 37½ 17 12½	33¼	@4 65 4 55	@4.55 4.40	@13.50 12.75
13	4 6150	48¾	@17 37½ 17.35	33¼	@4 60 4 50	@4.50	@13.50 12.50
14	4 6550	48¾	@17 55 17 35	33⅜	@4 55	4.35	@13.00 12.50
15	4 6550	48¾	@17 55	33¼	4 50	4 35	@13.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Sept.	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos.	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts. per Lb.
9	23 11/16	67	68	82½	17 11	152½	154	22 13/16	4 76	72	14.94
10	23⅜	67½	68½	82½	17 21	153¼	154¼	23 1/16	4 81	72	15.03
11	23 5/16	..	..	..	..	..	..	..	..	..	..
13	23 5/16	68¼	69½	82½	17 10	154½	155⅞	23⅛	4.80	71	14.73
14	23½	68¼	70	84½	17.54	153½	154½	23 1/16	4 79	71	14.76
15	23 5/16	69⅛	70¼	84½	17.54	152½	153½	22 13/16	4 76	68½	14.21

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c. £60 = 12.85c. Variations, £1 = 0.21½c.

Gold, Silver and Platinum

NEW YORK—Sept. 15

Gold in the United States, Sept. 1, is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,260,979,669; in Treasury current balances, $211,925,634; in banks and circulation, $583,826,-835; total, $2,056,732,138, an increase of $50,332,599 in August.

Gold Sales from the New York Assay Office in August were $2,448,845, being $461,845 more than in July. For the eight months ended Aug. 31 the total sales were $21,900,416 in 1914 and $18,509,205 in 1915; a decrease of $3,391,211 this year.

Silver—The market has remained steady in London the past week around 23½d. Sellers have not been pressing and shipments from this side continue small. The U. S. Mint purchased 600,000 oz. on Sept. 10 and 500,000 on Sept. 14. The fluctuations in sterling exchange have affected the New York prices.

Coined Silver in the United States, Sept. 1, is estimated by the Treasury Department as follows: Standard dollars, $568,-271,655; subsidiary coins, $185,887,011; total, $754,158,666. Of the standard dollars $483,764,000 are held in the Treasury against silver certificates outstanding.

Platinum—The market is strong though demand has been rather checked by the recent advance. A sale at $45 per oz. is reported earlier in the week, but today dealers hold at $48@50 per oz. for refined platinum, and about $54 per oz. for hard metal. The shortage of supplies has not been relieved as yet.

Zinc and Lead Ore Markets

JOPLIN, MO.—Sept. 11

Blende, high price, $83; base per ton 60% zinc, premium ore, $80; medium, $79@75; lower grades, $74@70; calamine, base 40% zinc, $75@50; average, all grades of zinc, $78.58 per ton. **Lead,** high price, $51.90; base price, $50 per ton of 80% metal content; average, all grades of lead, $51.23 per ton.

SHIPMENTS WEEK ENDED SEPT. 11

	Blende	Calamine	Lead	Values
Totals this week	11,127,980	898,730	1,825,790	$519,350
Totals this year	396,844,390	31,991,540	61,294,510	17,408,010

Blende value, the week, $443,030; 37 weeks, $15,072,260.

Calamine value, the week, $29,480; 37 weeks, $718,780.

Lead value, the week, $46,840; 37 weeks, $1,616,970.

Owing to the lower price offerings a large portion of the premium ore was withheld from market this week. It was not definitely known until midafternoon today what would be the high price offering for next week's delivery. Buyers inclined toward $75, but it was necessary to pay $80 to secure any portion of the better product.

The Granby Mining & Smelting Co. and lessees on the company's land, are carrying nearly 3,200 tons of blende and calamine for a stronger market. The total stock is approximately 5,700 tons.

PLATTEVILLE, WIS.—Sept. 11

The base price paid this week for 60% zinc ore was $75 per ton, one sale being reported at $77. Medium grades sold at $70 and low grades at $65 per ton base. No sales of lead ore reported.

SHIPMENTS, WEEK ENDED SEPT. 11

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,597,840	.....	472,000
Year	133,501,080	4,463,160	19,200,750

Shipped during week to separating plants, 5,301,980 lb. zinc ore.

MONTANA ZINC ORE

During August the Butte & Superior Mining Co. mined and milled 45,140 tons of ore, producing 12,907 tons concentrates which averaged 54% zinc, the approximate content being 13,879,000 lb. zinc. The recovery is estimated at 91.6% for the month.

Iron Trade Review

NEW YORK—Sept. 15

Activity in the iron and steel trades has not abated, and conditions are practically unchanged, except that there is an improvement in domestic orders and more railroad buying.

The mills generally are busy and in some cases find it difficult to keep up with their orders. This is especially the case with some that are working on export business.

Pig iron continues to be strong and more active than for some time. There is good buying of basic pig at advanced prices, but foundry iron is rather slower. Not very much business has been done for next year.

Pig-iron production, which on Jan. 1 last was at the rate of about 18,000,000 tons a year, has now risen to a rate of 33,500,000 tons yearly. An unusually large proportion of the present iron-making capacity belongs to the steel works furnaces. Of the active capacity on Sept. 1 only 24.4% belonged to the merchant furnaces.

The United States Steel Corporation reports the total of unfilled orders on its books Aug. 31 at 4,908,455 tons, or practically the same as on July 31, the decrease being only 20,095 tons.

The final decree of the Circuit Court dismissing the suit against the Steel Corporation was filed at Trenton, N. J., Sept. 10. The United States has 60 days in which to appeal.

Pig-Iron Production shows a further increase in August. The reports of the blast furnaces, as collected and published by the "Iron Age," show that on Sept. 1 there were 249 coke and anthracite stacks in blast, having a total daily capacity of 91,075 tons of iron, an increase of 4,275 tons over Aug. 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in the United States in August was 2,809,000 long tons; for the eight months ended Aug. 31 it was 17,636,300 tons. Of this total 12,943,250 tons, or 73.4%, were made by furnaces owned or operated by steel works.

PITTSBURGH—Sept. 14

The steel mills are falling farther behind in deliveries, despite the fact that strictly new business is relatively light and the orders booked are chiefly in the form of specifications on old contracts. Recent inquiries as to contracts for bars, plates and shapes for fourth quarter have elicited the reply from mills that such contracts would really involve deliveries in the first quarter, as the mills are filled up already, and 1.40c. has lately been named by such mills as care to quote at all. For weeks bars have been 1.35c. for delivery at mill convenience and plates and shapes have lately firmed up to that level.

The decrease of 20,085 tons in the Steel Corporation's unfilled obligations during August confirms what has been stated for some time, that the mills are so well filled that they are curtailing the contract obligations accepted. In July the corporation's obligations increased 250,344 tons and in June 413,-598 tons.

Earnings of all the steel companies have been increasing rapidly. All estimates are that the Steel Corporation will report more than $40,000,000 for the current quarter, and some estimates run up to $48,000,000. Even with $40,000,000 the corporation could wipe out the deficit accumulated since the beginning of last year and have enough left for a 1% common stock dividend.

The war demand for steel is unabated as to total tonnage. A new feature is the sharp increase in demand for steel for large shells, 4-in., 5-in. and 8-in., the last named involving forged steel rather than the rolled rounds of which so large a tonnage is being made.

Idle railway cars decreased from 265,364 on Aug. 1 to 183,-659 on Sept. 1 and a shortage is fully expected at crop-moving time. The railroads have lately been sounding the steel market as to 1916 deliveries, fearing they cannot get material if they do not early. The car shops are very busy, but can work out their present orders in a few months and a fresh burst of freight-car buying is expected for the near future.

Pig Iron—A sale of upwards of 1,000 tons of basic iron was made Saturday at $15, Valley, and yesterday a sale of 2,000 tons was made at the same figure. Producers have been quoting $15 for some time, but these are the first sales definitely reported. Foundry iron is strong but not in very active demand. Demand for bessemer is chiefly for export. There are several idle merchant furnaces in the Valleys and the question before the market now is whether advances can continue with these furnaces seeking to accumulate a back log of tonnage upon which to blow in. We quote: Bessemer, $16; basic, $15; foundry and malleable, $14.50@15, depending on delivery; gray forge, $14.25@14.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—It is understood that some of the English producers have resumed quoting $100 on contract, with time of delivery rather uncertain. The prompt market continues to fluctuate between $100 and $110 per ton.

Steel—The scarcity of steel, particularly openhearth, is daily growing more acute. Even Steel Corporation subsidiaries have paid $26 at maker's mill for basic openhearth billets, and any odd lots that can be found at this figure are quickly absorbed. There is no active demand for bessemer billets. We quote basic openhearth billets nominal at $25@26, Pittsburgh, and bessemer billets nominal at $25@26. Sheet bars would hardly be sold at less than billets, but buyers could be found at several dollars a ton less as prices obtainable for sheets or tinplates would not warrant paying the price. Rods are very scarce. Makers regard the market as $29@30, but there are practically no sellers at that price.

Foreign Trade of the United States in iron and steel and manufactures thereof is valued by the Department of Commerce as below for June and the fiscal year ended June 30:

	June		Fiscal Year	
	1914	1915	1913-14	1914-15
Exports	$18,927,958	$31,757,103	$251,480,677	$225,888,350
Imports	2,835,110	2,003,234	31,790,851	22,712,868
Excess exports	$16,092,848	$29,753,869	$219,689,826	$203,175,498

April, May and June showed heavy gains in exports, but not sufficient to offset the losses of the earlier part of the year. Imports showed a steady decline throughout the year.

FERRO-ALLOYS

Ferromanganese is quoted at $110@112.50 per ton for domestic 80% material.—**Spiegeleisen** has been sold at $27 per ton for 20%, at furnace.—**Ferrosilicon,** 50%, is quoted at $73@75 per ton at Pittsburgh. Bessemer ferrosilicon is from $20 per ton for 10% up to $24 for 14%, all at furnace.—**Ferrotitanium** is 8@12½c. per lb., according to size of lots and delivery.—**Ferrovanadium** is $2@2.25 per lb. of contained vanadium.

FOREIGN IRON

Pig-Iron Production in Germany in June was 993,496 metric tons, being 7,528 tons more than in May. For the six months ended June 30 the total make was 9,288,196 tons in 1914 and 5,534,337 in 1915, a decrease of 3,753,859 tons this year.

Steel Production in Germany in June was 1,080,786 metric tons, being 36,679 tons more than in May. For the six months ended June 30 the total production was 9,380,867 tons in 1914 and 6,121,889 tons in 1915; a decrease of 3,258,978 tons.

Pig-Iron Production in Canada for the first half of 1915 is reported by the American Iron & Steel Association as follows: Basic, 292,556; bessemer, 5,238; foundry, 59,646; other kinds, 9,385; total, 366,825 long tons. This compares with 263,512 tons in the second half of 1914, and 442,430 tons in the first half. Of the make this year 287,818 tons were for the use of the makers and 69,007 tons for sale as pig iron. There were 360,530 tons made with coke and 6,295 tons with charcoal as fuel. The province of Ontario made 205,368 tons, or 56% of the total, the balance being made in Nova Scotia and Quebec—chiefly Nova Scotia.

SAULT STE. MARIE CANALS

The total freight passing through the Sault Ste. Marie Canals in August was 10,540,781 short tons. For the season to Sept. 1 the total freight was: East bound, 28,721,967; west bound, 8,682,185; total, 37,404,152 tons, an increase of 2,788,193 tons over last year. The number of vessels was 11,766, showing an average cargo of 3,179 tons. Of these vessels 9,618 used the United States canal and 2,148 the Canadian. The mineral freights included were, in short tons, except salt which is in barrels:

	1914	1915	Changes
Anthracite	1,426,591	1,274,174	D. 152,417
Bituminous coal	7,900,621	6,552,627	D. 1,437,994
Iron ore	20,633,194	25,962,787	I. 5,329,593
Pig and m'f'd iron	173,907	118,360	D. 55,547
Copper	40,278	79,254	I. 38,976
Salt, bbl.	496,108	393,853	D. 102,255

Iron ore was 69.4% and coal 20.7% of the total freight reported this year.

IRON ORE

Eastern iron ore prices are rather stiffer, and some sellers have made small advances. Current prices are 7@7½c. per unit of iron, delivered at eastern Pennsylvania furnaces.

Lake ore shipments in August, as noted last week, were 8,081,117 long tons, an increase of 2,211,640 tons over August, 1914. For the season up to Sept. 1 shipments by ports are reported by the "Iron Trade Review" as follows:

Port.	1914	1915	Changes
Escanaba	2,165,692	2,935,862	I. 530,172
Marquette	1,719,791	1,773,653	I. 723,860
Ashland	2,079,776	2,801,219	I. 721,443
Superior	7,776,831	4,439,088	D. 3,137,743
Duluth	4,112,367	9,378,530	I. 3,226,163
Two Harbors	3,953,650	5,418,068	I. 1,464,168
Total	21,278,107	26,806,420	I. 5,528,313

Of the August shipments 6,504,987 tons, or 80.5% of the total, went to Lake Erie ports. Stocks on Lake Erie docks Sept. 1 were 7,118,847 tons, a decrease of 166,303 tons as compared with last year.

Duluth shipments were 35% of the total against 19.5% last year, while the Superior shipments fell from 33.6% of the total in 1914 to 14.3% this year.

Imports at Baltimore for the past week included 6,600 tons manganese ore from Brazil.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 391,310 short tons; shipments, 388,107 tons. Production of Greensburg and Upper Connellsville districts, 42,905 tons.

Connellsville Coke—There is inquiry for furnace coke for the first half of 1916, but with prompt coke available at $1.60@1.65 and operators feeling that they should obtain much higher prices for next year it is very hard for buyers and sellers to get together. There is much talk of sliding-scale contracts, a favorite idea apparently being to make coke $1.75 minimum with basic pig iron at $13.75, Valley, and settle each month on the basis of 5c. rise in coke for every 25c. rise in pig iron. Foundry coke is $2.30@2.60 for prompt and $2.40@2.60 for contract.

Anthracite Shipments in August were 5,330,831 long tons, being 396,622 tons more than in July, but 152,912 tons less than in August, 1914. For the eight months ended Aug. 31 the total shipments were 43,321,389 tons in 1914 and 41,860,340 tons in 1915, a decrease of 1,461,049 tons, or 3.4%, this year.

French Coal Production in 1914 is reported by the Comite Central des Houilleres at 29,786,505 metric tons, a decrease of 11,057,113 tons from 1913. The decrease is entirely due to the war operations, which cover important coal producing districts.

Imports of coal and coke into Chile in 1914 were, in metric tons:

	Coal	Coke	Total
Great Britain	527,576	9,588	537,164
Australia	516,889	6,720	523,609
United States	143,404	1,885	145,289
Other countries	69,690	28,718	98,408
Total	1,257,559	46,911	1,304,470

Owing to the opening of the Panama Canal and the stoppage of exports from Great Britain, it is expected that in 1915 there will be a large increase in American coal.

Chemicals

NEW YORK—Sept. 15

The general markets are steadier than they were, with fair demand reported in most lines.

Arsenic—Business remains rather quiet but the market is steady. Prices are about $3.50 per 100 lb. for large lots, up to $4 per 100 lb. for small orders.

Copper Sulphate—The market is steady, with a fair business doing. Prices are $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is steady on a good business for the season. Prices are unchanged at 2.42½c. per lb. for spot and 2.45c. for futures.

Potash Salts—Imports of potash salts into the United States for the seven months ended July 31 are reported by the Department of Commerce as below, in pounds:

	1914	1915	Changes
Carbonate	12,351,589	8,582,016	D 3,769,573
Hydrate	4,718,257	2,028,142	D 2,690,115
Nitrate	1,917,047	14,855	D 1,902,192
Cyanide	301,175	862,127	I 560,952
Other potash salts	3,753,901	2,075,545	D 1,678,356
Total	23,041,969	13,562,685	D 9,479,284

Imports of crude salts used chiefly as fertilizers were as follows for the seven months, in long tons:

	1914	1915	Changes
Kainit	201,878	6,646	D 195,232
Manure salts	135,422	13,647	D 121,775
Sulphate of potash	27,765	10,101	D 17,664
Muriate of potash	142,896	56,721	D 86,175
Total	507,961	87,115	D 420,846

The large decreases shown were due to the interruption of shipments from Germany by the war.

PETROLEUM

Exports of mineral oils from the United States in June were 209,368,274 gal. For the fiscal year ended June 30 the total exports were 2,269,218,073 gal. in 1913-14, and 2,176,427,305 gal. in 1914-15, a decrease of 92,790,769 gal., or 4.1%, last year.

Oil prices are again advancing. An increase of 5c. has been announced in Pittsburgh, bringing the price up to $1.65 per bbl. for Pennsylvania grade.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt
Acacia, g	Colo	1,438,989	$ 1	$ 122,004	Jan '11	$0.01
Adams, s.l.c.	Colo	80,000	10	778,000	Dec. '09	0 04
Ahmeek, c.	Mich.	50,000	25	3,050,000	July '15	10 00
Alaska Mexican, g.	Alas	180,000	5	3,489,381	May '15	0 20
Alaska Treadwell, g.	Alas.	200,000	25	15,435,000	Aug. '15	0.75
Alaska United, g.	Alas.	180,200	5	1,937,150	Aug. '15	0.40
Am. Zinc, Lead & Sm.	U. S.	171,200	25	983,320	Jan. '14	0 50
Anaconda, c.	Mont.	4,992,500	25	97,741,875	July '15	0.50
Argonaut, g.	Calif.	200,000	5	1,660,000	June '15	0 10
Arizona Copper, pf.	Ariz.	1,426,120	1 20	2,121,274	May '15	
Arizona Copper, com.	Ariz.	1,519,896	1 20	18,461,338	July '15	0.24
Bagdad-Chase, g., pf.	Calif.	184,819	5	202,394	Jan. '09	0 10
Baltic, c.	Mich.	100,000	25	7,950,000	Dec. '13	2 00
Bingham N. H., c.	Utah.	228,690	5	408,564	Mar. '15	0 10
Bonanza Dev., g.	Colo	300,000	1	1,425,000	Oct. '11	0 20
Brunswick, g.	Calif.	395,287	1	179,597	June '15	0.06
Bunker Hill Con., g.	Calif.	200,000	1	850,000	Aug. '15	0 02½
Bunker Hill & Sul., l.s.	Ida.	327,000	10	16,416,000	Sept. '15	0 25
Butte-Alex Scott, c.	Mont.	74,000	10	148,000	Oct. '13	0 50
Butte-Ballaklava, c	Mont	250,000	10	125,000	Aug. '10	0 50
Butte & Superior, z.	Mont.	271,136	10	1,700,348	June '15	3 25
Caledonia, l.s.c.	Ida	2,605,000	1	650,300	Aug. '15	0.03
Calumet & Arizona, c.	Ariz	617,385	10	21,559,443	June '15	0 50
Calumet & Hecla, c.	Mich.	100,000	25	126,250,000	June '15	15 00
Camp Bird, g.s.	Colo.	1,100,051	5	10,428,674	July '15	0 08½
Centen'l-Eur., l.s.g.c	Utah.	100,000	5	4,050,000	Apr. '14	1 50
Center Creek, l.z.	Mo	100,000	10	535,000	July '15	0.15
Champion, c.	Mich.	100,000	25	10,300,000	Aug. '15	1.00
Chief Consolidated, s.g.l.	Utah	871,384	1	306,821	Aug. '15	0 05
Chino, c	New Mex.	869,940	5	5,175,560	June '15	0 75
Cliff, g	Utah.	300,000	1	90,000	Jan. '13	0.10
Cliff, g.	Alas.	100,000	1	210,000	Oct. '13	0 01
Colo. Gold Dredging	Colo	100,000	10	650,000	Sept. '14	1 00
Colorado, l.s.g.	Utah.	1,000,000	0.20	2,570,000	Dec. '12	0 03
Columbus Con., g.s.	Utah.	285,540	5	226,832	Oct. '07	0 20
Commercial Gold	Ore.	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercur, g.	Utah.	1,000,000	1	3,445,313	July '13	0 03
Continental, z.l.	Mo.	22,000	25	341,000	July '15	0 50
Copper Range Con., c.	Mich.	393,692	100	13,986,746	Oct. '13	0 75
Daly Judge, s.l.	Utah.	300,000	1	1,020,000	July '15	0.25
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	45,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,783	100	3,550,969	Dec. '13	0.76
Eagle & Blue Bell, g s l.	Utah.	893,146	1	401,916	Aug. '15	0.05
Elkton Con., g.	Colo.	2,500,000	1	3,579,460	May '15	0.02
El Paso, g	Colo.	490,000	5	1,707,545	Feb. '14	0.10
Ernestine, g.s.	N. M.	300,000	5	150,000	July '15	0.10
Fed. M. & S., com.	Idaho.	60,000	100	2,708,750	Jan. '09	1 50
Fed. M. & S., pf.	Idaho.	120,000	100	9,856,503	June '15	1.00
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	258,000	Oct. '14	0.02
Frontier, z.	Wis.	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,305,000	Dec. '14	10.00
Gold Chain, g.	Utah.	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor	Colo.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con.	Colo	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g	Colo	1,500,000	1	4,080,000	Sept. '15	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,559,148	10	28,288,001	July '15	0.10
Grand Central, g.	Utah.	500,000	1	1,620,750	Sept. '14	0.05
Granite, g.	Colo.	1,650,000	1	270,000	Nov. '12	0.01
Hazel, g.	Cal	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s.	Idaho.	1,000,000	0.25	3,370,000	Aug. '15	0.02
Hercules, l.s.	Idaho.	1,000,000	1	5,725,000	June '15	....
Homestake, g.	S. D	251,160	100	38,150,986	Sept. '15	0.65
Horn Silver, l.s.z.	Utah.	400,000	25	5,642,000	Sept. '07	0.05
Iowa, g.s.l.	Colo.	1,666,667	1	233,499	Aug. '14	0.00½
Iowa-Tiger, g.s.	Colo	3,000	1	9,250	Dec. '14	1.00
Iron Blossom, s.l.g.	Utah.	1,000,000	0.10	2,420,000	July '15	0.05
Iron Silver, s.l.g.	Colo.	500,000	20	4,950,000	Dec. '14	0.10
Jamison, g.	Cal.	390,000	10	378,300	Jan. '11	0 02
Jerry Johnson, g.	Colo.	2,500,000	0.10	187,500	Nov. '14	0.01
Kendall, g.	Mont	500,000	5	1,505,000	July '14	0 06
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug. '09	0 12
Klar Piquette, z.l.	Wis.	20,000	1	259,000	Apr. '13	0 50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct. '13	0.00½
Liberty Bell, g.	Colo	133,552	5	1,559,179	Sept. '13	..
Little Bell, l.s.	Utah.	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah.	400,000	2.50	2,300,000	July '13	0.05
Mary McKinney, g.	Colo	1,309,252	1	1,169,308	July '14	0.02
May Day, g.s l.	Utah.	800,000	0.25	220,000	Aug. '15	0.02
Mexican, g.s.	Nev.	201,600	2.50	161,910	June '14	0 75
Miami, c.	Ariz.	747,112	5	5,645,698	Aug. '15	0.75
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk, c.	Mich.	100,000	25	3,575,000	Feb. '15	2.00
Monarch-Mad'a, g.s.l	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	488,588	Dec. '12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,457	5	18,226,345	June '15	0.37½
New Century, z.l.	Mo.	330,000	1	237,600	Oct. '09	0 01
New Idria, q.	Cal.	100,000	5	1,680,000	Apr. '14	0.10
North Butte, c.	Mont.	430,000	15	11,890,000	July '15	0.50
North Star, g.	Cal	250,000	10	4,637,040	June '15	0.20
Old Domin'n, M. & Sm.	Ariz.	162,000	25	7,290,000	June '15	0.50
Ophir, s.g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah.	898,978	0.25	80,907	Jan. '13	0 02
Oroville Dredging	Cal	700,000	5	1,692,568	June '15	0 12
Osceola, c.	Mich.	96,150	25	12,660,425	July '15	3.00
Parrot, c.	Mont.	229,850	10	7,871,839	July '15	1.63
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0 02
Pharmacist, g.	Colo.	1,500,000	1	7,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida.	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g	Nev.	2,790,000	1	771,200	July '14	0.02
Portland, g.	Colo.	3,000,000	1	9,993,080	July '15	0.02
Quilp	Wash.	1,500,000	1	67,500	Feb. '12	0 01

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt
Quincy, c	Mich.	110,000	$ 25	$21,227,500	June '15	$2 00
Ray, c	Ariz	1,485,333	10	3,814,995	June '15	0.37½
Republic, g	Wash.	1,000,000	1	170,000	Nov. '12	0 01½
Rochester, l z	Mo	4,900	100	190,846	Jan. '12	0 50
Round Mountain, g	Nev.	1,188,019	1	369,365	Aug. '1[illegible]	0 04
Seven Troughs Coal., g	Nev.	1,500,000	1	108,226	June '15	0 02½
St. Joseph, l	Mo	1,472,252	10	9,573,180	June '15	0 15
Shannon, c	Ariz.	300,000	10	750,000	Jan. '13	0 50
Shattuck Arizona, c	Ariz.	350,000	10	2,625,000	Aug. '15	0 50
Silver King Coal., l s	Utah.	1,250,000	5	2,909,885	July '15	0 15
Silver King Con., l s	Utah.	627,582	1	685,338	July '15	0.10
Sioux Con., s l g	Utah.	745,389	1	872,097	July '11	0 04
Skidoo, g	Cal	1,000,000	5	365,000	Oct '14	0 01
Snowstorm, c g.	Ida	1,500,000	1	1,192,103	Oct '13	0 02
South Eureka, g.	Calif.	299,981	1	411,680	July '15	0.03
Standard Con., g s	Cal	178,394	10	5,274,407	Nov. '13	0 25
Stewart, s.l.	Ida.	1,238,362	1	1,826,417	July '15	0 25
Stratton's Ind., g	Colo.	1,000,000	0.60	456,625	Dec '14	0 03
Success, z.	Ida	1,500,000	1	780,000	Aug. '15	0.04
Superior & Pitts., c	Ariz.	1,499,792	10	9,178,736	June '15	0 20
Tamarack, c	Mich.	60,000	25	9,420,000	July '07	4 00
Tennessee, c.	Tenn.	200,000	25	4,756,250	July '15	0 75
Tomboy, g s.	Colo	310,000	4 85	3,709,395	June '15	0 24
Tom Reed, g	Ariz.	909,555	1	2,443,757	Apr '15	0.06
Tonopah Belm't, s g.	Nev.	1,500,000	1	7,455,510	July '15	0 12½
Tonopah Ext., g s.	Nev.	943,433	1	896,259	July '15	0.10
Tonopah of Nev., s g	Nev.	1,000,000	1	12,850,000	July '15	0 25
Tri-Mountain, c.	Mich.	100,000	25	1,450,000	Dec. '13	2 00
Tuolumne, c	Mont.	800,000	1	520,000	May '13	0.10
Uncle Sam, g s l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov. '12	0 01
United (Crip. Ck.) g.	Colo	4,000,100	1	440,435	Jan. '10	0 04
United Globe, c.	Ariz.	23,000	100	2,265,500	June '15	6.00
United Verde, c.	Ariz.	300,000	100	35,497,000	Aug. '15	0 75
Utah, s.l.	Utah.	100,000	10	281,860	Dec. '10	0 02
Utah, c.	Utah.	1,624,490	10	28,650,671	June '15	1.00
Utah Con., c.	Utah.	300,000	5	8,850,000	July '15	0 50
Valley View, g.	Colo.	1,000,000	1	240,000	Dec. '10	0 04
Victoria, g s l.	Utah.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo	1,500,000	1	3,217,000	July '15	0.03
Wasp No. 2, g.	S. D.	500,000	1	484,466	Aug. '15	0 01
Wellington Mines, g	Colo.	10,000,000	1	450,000	Aug '15	0.00½
Wolverine, c.	Mich.	60,000	25	8,220,000	Mar. '15	4 00
Yak, s.l.	Colo.	1,000,000	1	1,907,685	June '14	0.03
Yankee Con., g.s.	Utah.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,163,789	May '15	0.02
Yellow Pine, l z.s.	Nev.	1,000,000	1	583,008	Aug. '15	0.05
Yukon Gold, g	Alas.	3,500,000	5	7,087,500	June '15	0.07½

Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,879	$100	103,495,183	Aug '15	$0.50
Am. Sm. & Ref., com	U. S.	500,000	100	28,333,333	June '15	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	52,208,333	June '15	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	10,274,800	July '15	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	15,125,000	July '15	1.25
Greene Cananea	U. S.	450,642	100	4,371,646	June '14	1.00
Guggenheim Expl.	U. S.	831,732	25	22,489,595	July '15	1 00
Inter'l Nickel, com.	U. S.	380,315	100	17,704,109	June '15	5.00
Inter'l Nickel, pfd	U. S.	89,126	100	8,525,869	Aug. '15	1.50
National Lead, com.	N. Y.	206,554	100	8,735,716	June '15	0.75
National Lead, pf.	N. Y.	243,676	100	30,119,526	June '15	1.75
Old Dominion, c.	Ariz.	293,245	25	6,393,744	June '15	1.00
Phelps, Dodge & Co.	U. S.	450,000	100	41,709,334	June '15	5.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	222,369,438	Dec. '14	0.50
U. S. Steel Corp., pf	U. S.	3,602,811	100	383,208,093	Aug. '15	1.75
U. S. S., R. & M., com.	U.S.-Mex.	351,114	50	6,362,188	July '14	0.75
U. S. S., R. & M., pf.	U.S.-Mex.	486,348	50	15,944,131	July '15	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g s.	Mex.	2,000,000	1	1,580,884	Feb. '15	0.03
B. C. Copper	B. C.	591,709	5	615,198	Jan. '13	0.15
Beaver Con., s	Ont.	1,996,490	1	529,857	Apr. '15	0.03
Buffalo, s	Ont.	1,000,000	1	2,757,000	July '14	0.03
Canadian Goldfields, g	B. C.	600,000	0.10	290,000	July '14	0.001½
Chontalpan, g s l z	Mex	7,000	25	59,500	May '14	0.75
Cobalt Townsite, s	Ont.	45,000	1	1,042,259	May '14	0.10
Coniagas, s.	Ont.	800,000	5	7,720,000	Aug. '15	0.30
Con. M. & S. Co. of Can	B. C.	58,052	100	2,058,907	July '15	2.00
Crown Reserve, s.	Ont.	1,768,814	1	6,067,030	July '15	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dos Estrellas, g.s.	Mex.	300,000	0.50	10,335,000	Dec. '13	1.50
El Oro, g s	Mex.	1,147,500	4 85	8,668,418	July '13	0.24
Esperanza, s g.	Mex.	455,000	4.85	13,327,999	July '15	0.24
Granby, s.l c.	B C.	148,496	100	5,756,178	Aug. '14	1.50
Greene Con., c	Mex.	1,000,000	10	9,544,400	May '14	0.50
Guanajuato D., pf., s	Mex.	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold	B. C.	120,000	10	1,644,000	June '15	0 50
Hollinger, g.	Ont.	600,000	5	3,693,000	Sept. '15	0.20
Kerr Lake s.	Ont.	600,000	5	5,670,000	Mar. '15	0.25
La Rose Con., s	Ont.	1,498,627	5	5,387,122	July '15	0.25
Le Roi No. 2, g.	B. C.	120,000	24.30	1,501,740	May '15	0 24
Lucky Tiger Com., g.	Mex.	715,337	10	3,198,720	Aug '15	0.09
McK.-Dar. Sav. s.	Ont.	2,247,692	1	4,540,333	July '15	0.03
Mines Co. of Am. (new)	Mex.	1,700,000	10	1,215,000	July '13	0.12½
N. Y. & Hond. Ros., g	C. A.	200,000	10	3,730,000	July '15	0 30
Nipissing, s.	Ont.	1,200,000	5	13,290,000	July '15	0 25
Peñoles, s l g	Mex.	80,000	25	6,361,688	June '13	1 25
Pinguico, pf., s	Mex.	20,000	100	840,000	Oct '13	3 00
Right of Way Mns, s.	Ont.	1,685,500	1	219,115	Nov '14	0 02
Rio Plata, s.	Mex.	374,518	5	345,74[illegible]	Feb. '13	0 05
San Rafael, g s	Mex.	2,400	25	1,442,38[illegible]	Jan. '14	0 50
San Toy, g s.	Mex.	5,750,000	1	530,[illegible]	July '13	0.01
Sorpresa, g s	Mex.	19,200	20	3,979,24[illegible]	Jan. '11	34.00
Stand'd Silver-Lead	B. C.	2,000,000	1	1,550,[illegible]	Sept. '14	0.02½
Temiskaming, s.	Ont.	2,500,000	1	1,38[illegible]	Apr. '13	0 06
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,94[illegible]	Nov. '14	3 00
Trethewey, s	Ont.	1,000,000	1	1,06[illegible]	July '14	0 05
Wettlaufer-Lorrain, s	Ont.	1,416,590	1	637,[illegible]	Oct '13	0 05

Assessments

Company	Delinq.	Sale	Amt.
Bonanza Con., Utah	Sept. 15	Oct. 6	$0.015
Bullion, Ida	Aug. 30	Sept. 25	0.005
Cash Boy, Nev	Sept. 29	Oct. 30	0 01
Cedar Creek, Ida	Aug. 28	Sept. 29	0.005
Comet, Ida	Aug. 30	Sept. 30	0 0005
Con. Virginia, Nev	Sept. 28	Oct. 19	0 05
Copper Chief, Ida	Aug. 30	Sept. 25	0.005
Diam'field Black Butte, Nev.	Oct. 4	Nov. 4	0 01
Exchequer, Nev	Oct. 4	Oct. 25	0 02
Gethin Le Roy, Utah	Sept. 25	Oct 13	0.01
Goldstrike M. & L., Utah	Oct. 1	Oct. 20	0 01
Great Bend, Nev.	Sept. 10	Oct. 10	0 01
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1 00
Happy Day, Ida	Aug. 26	Sept 30	0.0025
Hector, Ida	Sept. 4	Oct. 4	0 005
Hennessy-Burns, Ida	Aug. 20	Sept. 24	0.005
Idaho Los Angeles, Ida	Sept. 3	Sept 25	0 005
Idaho Montana, Ida	Sept 3	Sept 25	0 001
Idaho Nevada, Ida	Sept. 7	Oct. 1	0 002
Imperial, Ida	Aug 31	Oct. 1	0 005
Keweenaw, Mich	Sept. 1	...	1.00
Laclede, Ida	Sept. 3	Sept. 27	0 003
Lake Superior & West., Ariz.			0.02
LeRoy, Ida	Sept. 25	Oct. 25	0 002
Liquidator, Ida	Aug. 28	Sept. 28	0 003
Lucky-Calumet, Ida	Aug. 27	Sept. 27	0.005
MacNamara, Nev	Aug 23	Sept. 13	0 02
Nevada Cooperative, Nev	Sept. 15	Oct. 15	0.01
Nevada-Douglas, Nev	Sept. 27	Oct. 20	0.10
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0 50
New Quincy, Utah	Sept. 2	Sept. 23	0.01
Northern Light, Ida	Nov. 2	Dec. 2	0 004
Old Veteran, Ida	Sept. 2	Sept. 30	0 002
Oom Paul, Ida.	Aug. 28	Sept. 28	0 01
Oom Paul Con, Ida	Aug. 30	Oct. 4	0 01
Ophir, Nev	Oct. 12	Nov. 2	0 05
Phedora, Ida	Sept. 21	Oct. 21	0 0005
Phoenix, Mich	Sept. 1	....	1 00
Phoenix, Mich	Jan. 1	....	1 00
Revelator, Utah	Oct. 4	Oct. 25	0 00½
Royal, Ida	Sept. 1	Oct. 1	0 001
Sandstorm Kendall, Nev	Aug. 23	Sept. 27	0 01
Selma Utah	Sept. 8	Sept. 25	0 005
Snowshoe, Ida	Aug. 26	Sept. 27	0 005
Sunset Dev., Wash	Aug. 25	Sept. 18	0 002
Syndicate, Utah	Sept. 11	Oct. 2	0.001
Tonopah Bonanza, Nev	Sept. 13	Oct. 11	0.01
Tonopah Midway, Nev	Aug. 18	Sept. 18	0 01
White Caps, Nev	Aug. 14	Sept. 18	0.015

Stock Quotations

There were no sales at auction reported in either New York, Boston or Philadelphia during the week ended Sept. 15.

COLO. SPRINGS Sept. 14 Name of Comp.	Bid.	SALT LAKE Sept. 14 Name of Comp.	Bid.
Acacia	02¼	Beck Tunnel	06
Cripple Cr'k Con.	.008	Black Jack	.05
C. K & N	.02	Colorado Mining	.09½
Doctor Jack Pot	.09½	Crown Point	01
Elkton Con.	25	Daly-Judge	6 75
El Paso	76	Gold Chain	15
Findlay	.02½	Grand Central	.54
Gold Dollar	‡.02	Iron Blossom	67
Gold Sovereign	.03	Little Bell	‡ 10
Golden Cycle	1.77	Lower Mammoth	03½
Isabella	15¾	Mason Valley	1 50
Jack Pot	06¾	May Day	.16
Jennie Sample	‡ 02	Opohongo	00¾
Jerry Johnson	04½	Prince Con	.60
Lexington	005	Seven Troughs	01½
Mary McKinney	35	Silver King Coal'n	3 37½
Pharmacist	008	Silver King Con.	2 05
Portland	1 50	Sioux Con.	.01½
Raven B. H	02	Uncle Sam	05½
Vindicator	1 55	Yankee	.24

TORONTO Sept. 14			
Bailey	03½	Dome Exten	26
Coniagas	3 75	Foley O'Brien.	28
Peterson Lake.	18	Hollinger	25 00
Right of Way	04	Imperial	05½
Seneca Superior	‡.78	Jupiter	10
Silver Queen	01	McIntyre	47
T. & Hudson Bay	20 00	Pearl Lake	‡ 00½
Timiskaming	52	Porcu Crown	.70
Wettlaufer-Lor	15	Preston E. D	05
Dome Mines	2 50	Rea	‡ 09

SAN FRANCISCO Sept 14			
Comstock Stocks		Misc. Nev. & Cal	
Alta	06	Belmont	3 80
Andes	07	Jim Butler	77
Best & Belcher	06	Lone Star	04
Caledonia	50	MacNamara	02
Challenge Con	.05	Midway	10
Chollar	03	Mont.-Tonopah	30
Confidence	16	North Star	10
Con. Virginia	10	Rescue Eula	18
Gould & Curry	.03	West End Con	53
Hale & Norcross	.03	Atlanta	28
Julia	‡.03	Booth	45
Mexican	.37	C.O.D. Con	04
Occidental	.79	Comb. Frac	08
Ophir	.22	D'field Daisy	03
Overman	.09	Jumbo Extension	1 12½
Potosi	.03	Pitts.-Silver Peak	‡ 06
Savage	.06	Round Mountain	41
Sierra Nevada	.20	Sandstorm Kendall	12
Union Con	.34	Silver Pick	07
Yellow Jacket	13	Central Eureka	10

N. Y. EXCH. Sept. 14 Name of Comp.	Clg.
Am.Sm.&Ref.,com	81
Am. Sm. & Ref., pf.	106
Am. Sm. Sec., pf. B.	81½
Anaconda	70¾
Batopilas Min	1⅛
Bethlehem Steel	349
Bethlehem Steel, pf.	150
Chino	44⅜
Colo. Fuel & Iron.	46⅞
Crucible Steel	95⅜
Federal M. & S., pf.	44
Great Nor., ore., ctf.	40⅞
Guggen. Exp	64¼
Homestake	117
Inspiration Con.	34⅞
Mex. Petroleum	84½
Miami Copper.	26¾
Nat'l Lead, com.	63½
National Lead, pf.	110
Nev. Consol	14⅞
Ontario Min	3
Quicksilver	2⅜
Ray Con	22¼
Republic I&S, com.	43⅞
Republic I&S, pf.	101⅞
SlossSheff'd, com	52
Tennessee Copper.	56
Utah Copper	66⅞
U. S. Steel, com	75¼
U. S. Steel, pf.	113½

N. Y. CURB Sept. 14	
Alaska Juneau	12⅞
Alta Con	.31
Beaver Con	27
Big Four	.05
Blue Bell	02
Braden Copper	8½
Buffalo Mines	.50
Can. Cop. Corpn.	⅛
Cashboy	.05
Chambers Ferland.	.12
Chile Cop.	18⅞
Con. Ariz. Sm.	⅞
Con. Coppermines	2¼
Con. Nev.-Utah	5/16
Dia. Black B.	.02
Florence	.46
Goldfield Con	1 5/16
Goldfield Merger	19
Greene Cananea	38½
International Nickel	190
Kennecott Cop.	53⅛
Kerr Lake	3½
La Rose	7/16
Magma	15⅞
McKinley-Dar-Sa.	.25
Mines of Am	‡2⅞
Nevada Hills	.20
New Utah Bingham	3½
Nipissing Mines	6⅞
Oro.	.06½
St. Joseph Lead	12⅞
South Utah	.15
Stand'd Oil of N.J.	448
Standard S. L	1 9/16
Stewart	1 1/16
Success	.88
Tonopah	5⅛
Tonopah Ex	2 7/16
Tonopah Merger	.36
Tribullion	⅞
Tularosa	‡⅞
Yukon Gold	2⅛

LONDON Aug. 29	
Alaska Tre'dwell	£6 17s 6d
Burma Corp.	1 13 9
Cam & Motor	0 12 0
Camp Bird	0 5 3
El Oro.	0 7 3
Esperanza.	0 7 3
Mexico Mines	3 11 3
Nechi, pfd.	0 12 3
Oroville.	0 14 9
Santa Gert'dis	0 7 6
Tomboy	1 0 3
Tough Oakes	0 6 6

BOSTON EXCH Sept. 14 Name of Comp.	Clg.
Adventure	1½
Ahmeek.	398
Alaska Gold M.	33½
Algomah	2⅜
Allouez	54
Am. Zinc	52¾
Ariz. Com., ctfs	8⅜
Bonanza	.35
Butte-Balaklava	3½
Butte & Superior	66¼
Calumet & Ariz	62¾
Calumet & Hecla	545
Centennial	17
Cliff	‡.90
Copper Range	54¼
Daly West	2½
East Butte	12
Franklin	9
Granby	83
Hancock	16⅜
Hedley	27
Helvetia	33
Indiana	5
Island Cr'k, com.	47
Island Cr'k, pfd.	89
Isle Royale	27
Keweenaw	2⅞
Lake.	13
La Salle.	5¼
Mass	10
Mayflower	3¼
Michigan	2¼
Mohawk	71½
New Arcadian	9½
North Butte.	29½
North Lake	1¼
Ojibway.	1½
Old Colony.	3
Old Dominion	52½
Osceola	81¼
Quincy	81
Santa Fe	2⅜
Shannon	7
Shattuck-Ariz	24⅜
Superior.	26½
Superior & Bost.	2½
Tamarack	55½
Trinity	3½
Tuolumne.	‡.45
U. S. Smelting	40½
U. S. Smelt'g, pf.	45⅜
Utah Apex.	3⅞
Utah Con	12¼
Victoria.	2¼
Winona	3
Wolverine	58
Wyandot	1½

BOSTON CURB Sept. 14	
Alvarado.	.60
Bingham Mines.	7¼
Boston Ely.	.21
Butte & Lon'n Dev	.31
Calaveras	1¾
Calumet-Corbin.	.04
Chief Con	.92
Cortez	.45
Crown Reserve	.35
Davis-Daly	1¼
Eagle & Blue Bell	1⅞
First Nat. Cop.	2⅞
Houghton Copper.	2½
Iron Cap Cop., pf	5
Majestic.	45
Mexican Metals.	20
Nevada-Douglas.	63
New Baltic	2¾
Ohio Copper	.10
Oneco	.09
Raven Copper	.12
Rex Cons.	.52
Smokey Dev.	.15
So. Lake	5½
Tonopah Victor.	.27
Trethewey	12
United Verde Ext	6

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26 553	22.731
February	61.642	57.506	48.477	28.357	26 573	22.753
March	57.870	58.067	50.241	26.669	26 788	23.708
April	59.490	58.519	50.250	27 416	26 958	23.709
May	60.361	58.175	49.915	27 825	26 704	23.570
June	58 990	56.471	49.034	27.199	25 948	23.267
July	58 721	54.678	47.519	27 074	25.219	22.597
August	59 293	54.344	47.163	27 335	25 979	22.780
September	60 640	53.290	..	27 986	24 260	.....
October	60.793	50.654	.....	28 083	23 199	.....
November	58.995	49.082	......	27.263	22 703	.....
December	57.760	49.375	......	26.720	22 900	...
Year	59 791	54 811	...	27 576	25 314	...

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14 223	13.641	64.304	60. 756	69.488	65.719
February	14 491	14.394	65.259	63 494	70.188	*
March	14.131	14.787	64.276	66. 152	69.170	*
April	14.211	16.811	64.747	75. 069	69.313	*
May	13.99	18.506	63.182	77. 600	67.786	*
June	13.603	19.477	61.336	82 574	66.274	95.333
July	13.223	18.796	60. 540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*		‡		‡	..
October	*		‡		‡	..
November	11.739		53. 227			.....
December	12.801	..	56. 841	..	*	.....
Year	....	..		.	......	......

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40 288	138.321	167.636
July	31 707	37 423	142 517	167.080
August	*	34.389	‡	151.440
September	32.675		‡	.....
October	30.284		‡	.
November	33.304	.	139.391	.
December	33.601	.. ..	147.102	..
Av. year	34 301	..	....	....

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4 048	3.827	3 937	3.718	19.606	19.122
March	3 970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3 715	4.520	‡	21.946
September	3.828	......	3 658	....	‡	......
October	3.528	......	3.384	......	‡	.....
November	3.683	.....	3.585	......	18.500	.....
December	3.800	.....	3.662	.....	19 097	.....
Year	3 862	... ...	3.737	.. ..	....	... ..

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21.413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5 074	14.781	4.924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	19.026	4.770	18 856	21.568	97.250
August	5 568	12.781	5.418	12.611	‡	67.786
September	5 380	.	5.230		‡	....
October	4 909	....	4 750	.	‡	....
November	5 112	.....	4 962		25.016	......
December	5 592	......	5.430	. .	27.369	......
Year	5.213	......	5.061	... ..	....	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14 94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.96	13.45	14.13	13.95
May	14 90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14 08	14.75
September	14 90	.. ..	13.90	.....	14.03	..
October	14 81		13.75		13.97	
November	14.59	....	13.43	.....	13.83	
December	14.70	....	13.45	......	13 83	
Year	$14.88	......	$13 78	......	$14 01	. .

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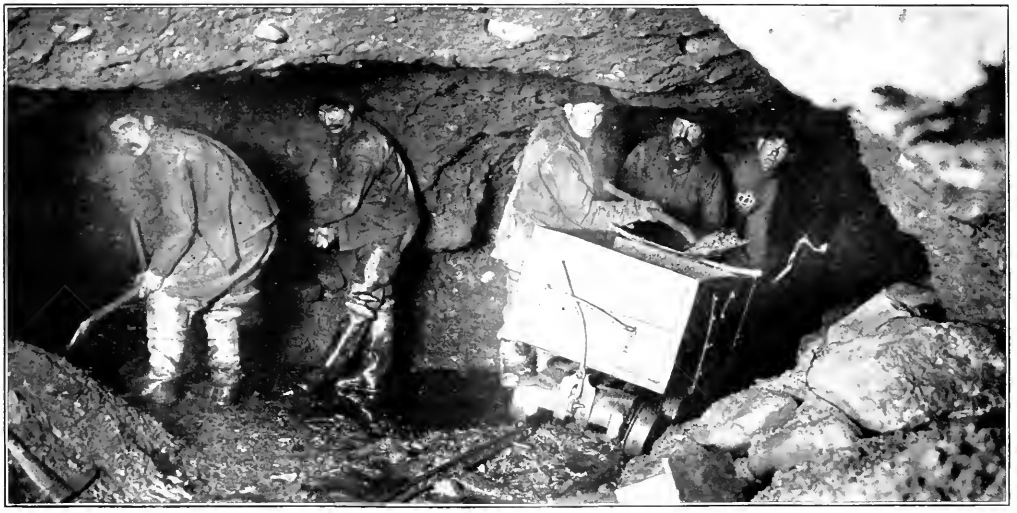
Stoping Methods at Fairbanks

By Hubert I. Ellis*

SYNOPSIS—Efficient extraction of gravel from the Fairbanks mines depends upon the thawing of the ground and upon the proper handling of material. Shoveling is the crucial feature, and in it the best men and tools are employed. The frozen ground holds well, since it resembles concrete in strength.

In the typical drift mine, stoping commences at the crosscuts, about 200 ft. from the shaft, and is carried on toward the shaft. For the first thaw, short points 4 or 5 ft. long are used and these are driven in both sides of the crosscuts—one set pointing upstream and the other downstream—thus virtually making two thaws at one operation, as shown in Fig. 1. This is possible only with the first thaw, since it is impossible to shovel into one car from two faces that are constantly becoming farther apart and since the accumulation of waste and the slabbing of the roof prohibit the use of two cars under ordinary circumstances.

By running the crosscuts at a distance of 100 ft. from the shaft instead of 200 ft., by leaving frozen pillars along the runway in the stoped-out area and by working both toward the shaft and away from it, it would be possible to save part of the time and expense of opening up and at the same time to double the area of working face. So far as known, however, this scheme has never been tried in spite of certain obvious advantages. There is no evident reason why it should not be applied with success to small mines where only a small crew can be worked on account of lack of room at the face, but it is generally considered the best practice to commence stoping at the farthest point from the shaft and to work inward at all times, thus keeping away from the waste and the dangerous portion of the roof. The proposed combination method of stoping for small mines, whereby the number of shovelers can be doubled, is shown in Fig. 8.



MINING UNDER UNFAVORABLE CONDITIONS

Workmen are crowded, the car is small and on a poor track, and pools of water stand on the floor

Fairbanks placer miners are wont to consider all workmen "dead-heads" except the shovelers and it is therefore planned to have as large a proportion of them on the crew as possible. Consequently it is always desired to work as many men at a given face as can be done without interference, other things being equal, and the method of mining is devised with this end in view. Cuts at the face are at a disadvantage in this respect, since [illegible] men are all that can conveniently shovel into one [illegible] the same

*Kellogg, Idaho.

time. Where the gravel is tight, however, and picking takes up a considerable portion of the shoveler's time, it is sometimes possible to use six or even eight men to the car. With the ordinary mine with an upstream and a downstream face—each divided into two parts by the main drift—only two cars can be used at a time, since switches and turnouts are rarely included in the equipment. With wheelbarrows more men can be worked in a small space and they thus have an important advantage over cars for small mines. When using an eight-wheelbarrow bucket eight shovelers can work in each crosscut without interference, and by having one gang shoveling while the others are dumping their loads at the shaft this number can easily be doubled. For wide paystreaks, where there is ample face area, however, cars are to be preferred.

Type of Mine Cars in Use

To avoid raising the gravel farther than is absolutely necessary, cars must be as low as possible, and for this reason the ordinary mine car is unsatisfactory. Cars are usually built to hold four or five wheelbarrow loads of gravel and are made of light lumber lined on the inside with light sheet iron. The bodies are set directly on the trucks and are fastened firmly to them, so that in dumping it is necessary to raise the whole car, the front wheels serving as a pivot. Considerable skill is required to dump these cars without loss of time, since the forward part of the load frequently slides out, shifting the center of gravity well behind the front wheels and causing the rear wheels to settle back on the rails, from which position it takes a heavy lift to raise them. With experience the car man learns just the right speed required for the car to dump itself, but constant care is necessary lest the car over-ride the dumping obstruction and pile into the bucket-hole, load and all, in which event the shovelers must be summoned from the face, with consequent ill-feeling and loss of time.

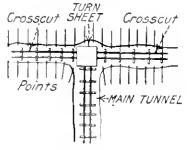


FIG. 1. METHOD OF PUTTING IN FIRST THAW

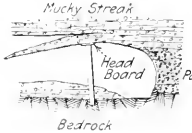


FIG. 2. STILL SET TO THROW SLAB AWAY FROM ROOF

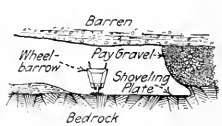


FIG. 3. METHOD OF UNDERCUTTING THE FACE

Effect of Thawing on Exposed Faces

For all thaws after the first, longer points are used and these are driven in the face toward the shaft. To shift the car track near the face the workmen scatter along it, drive their picks into the ties, and drag the entire section over at one time. When wheelbarrows are used at the face and dumped into cars in the main drift, the leader usually dumps his load and continues straight ahead into the other crosscut, thus becoming the last man on the next trip. This saves delay and serves to equalize the distance so that each man has the same average length of wheel.

In putting on a thaw it is impossible to avoid thawing some of the barren roof exposed by the removal of previous thaws, and this thawed portion either falls at once or hangs so precariously as to be dangerous to work under. In either case the part close to the face must be removed and it is thrown back where it is out of the way and where it serves in a measure to support the roof. The amount of waste thawed varies with the nature of the material and the care with which the points have been tended, but there is frequently a depth of two feet or more to be shoveled back before it is possible to attack the face. One advantage in the use of long points is that there is a proportionately smaller quantity of waste to handle.

After the pay has been stoped over a large horizontal area the roof, being left without adequate support, commences to slab. The gravel, especially that above the pay, always contains layers—of greater or less size and thickness—of muck or gravel consisting of a large proportion of muck and it is along these lines of weakness that the slabs form, as shown in Fig. 2. The slabs form very slowly. Starting as a mere crack, the opening gradually enlarges, the slab increasing in area and becoming thicker and thicker. Usually little change can be noticed from day to day, but they are a menace at all times to those working under them. If the face remains stationary for some time they break off close up against it and in the course of a week or two it becomes inaccessible. It is then necessary to drive a new crosscut to obtain a stoping base. Even when work is carried on continuously, if the face is not advanced very rapidly, the slabs may catch up while thawing is in progress and come down while the shovelers are at work. Fatalities from this cause are rare, however, since the slabs give warning a few minutes before they fall by a steady shower of small rocks sounding like a gentle rain. When the foreman receives this warning he moves the crew to another face, bringing them back after the slab falls, usually within half an hour or so.

Slabs continue to fall at intervals, the roof becoming higher and higher, until the whole space becomes filled and the roof is firmly held. In some cases subsidence extends to the surface, but this is usually not noticeable for several years after stoping, if at all. In a few years the entire mass usually settles so firmly that mining may be carried on underground exactly as before in case pay has inadvertently been left in the roof or in bedrock. Indeed, it would sometimes be difficult to tell that the area had ever been mined were it not for broken timbers and other such foreign material.

Holding Roof with Frozen Pillars

Many attempts have been made to hold the roof over stoped-out areas by artificial support, but without material success. Posts, plain timber bulkheads, bulkheads filled with gravel, drift sets, and other methods have consistently failed of their purpose, except where temporary support only was desired. The only sure way to hold the roof is to leave pillars of frozen gravel. These need not be large, 3 ft. in diameter at the small point usually being sufficient, and they need not be closely spaced. A few such pillars will hold as much as all the bulkheads that could be crowded into the mine. Observation indicates that pillars of concrete have no advantage over the frozen gravel

of the North when it comes to supporting weight. The most modern practice, however, is to make no attempt to support the workings except around the shaft and where it is desired to keep certain drifts open for communication with other workings. A row of stulls is sometimes placed parallel with the face a few feet back and these are canted backward at the top, as shown in Fig. 2, so as to throw any slabs that may chance to fall away from the face. Most of the stulls are recovered and used again and again.

The most expensive detail of placer mining is the picking of the gravel and the shoveling into wheelbarrows or cars. Refinements of methods are impossible and chief dependence is on the strength and endurance of the workmen. Men of an ingenious turn of mind have tried here as in other parts of the world to invent a satisfactory shoveling machine, but without success. One such machine worked to the entire satisfaction of the inventors in a snowbank at surface but balked when taken underground. The best the operator can do is to keep plenty of gravel before the shovelers, to furnish them with the best of tools in the best of condition and to eliminate delays by keeping runways, hoist and car tracks in good shape. The men

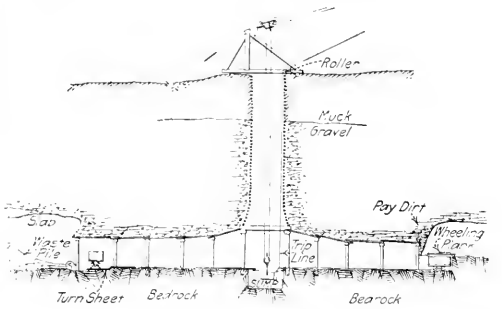


FIG. 4. GENERALIZED SECTION OF A PLACER MINE

are driven at top speed from morning till night. Very few members of the English-speaking nationalities are employed for work of this character. Russians, Scandinavians and natives of southern Europe make up the greater part of the shoveling gang, and the placer crew is comparatively homogeneous that does not represent half a dozen nationalities.

Shoveling the Most Important Operation

The output for each shoveler varies from 75 to 150 wheelbarrows per day of 10 hr., depending on working conditions, the length of trips and—chiefly—on the character of the gravel. For most mines the average ranges from 100 to 120, with the emphasis on the lower figure. In estimating working costs it is usually counted that a shoveler will strip from 30 to 35 sq.ft. of bedrock per day—equivalent to about 7 cu.yd. of material in place. The steady grind, day in and day out, is extremely hard on the crew and many are unable to stand the work. Some of the men have to force themselves to eat more than they want to keep from becoming hungry and weak a short time before noon and evening, and the scheme has been tried with moderate success of giving the shovelers a light lunch of coffee and doughnuts, pie, or cake at 10 a.m. and 4 p.m. The first Alaska Legislature, which met in 1913, established the 8-hr. day for all quartz mines, but the attempt to pass a similar law for placer mines was defeated by the members from Nome and Fairbanks. As was predicted at that time, the question came up at the second session and the law was extended to apply to placer as well as to lode mines. The new law is a step in advance, for no one who has worked alongside the shovelers of Fairbanks can deny that eight hours of such work is sufficient.

The No. 2 round-pointed shovels 5 ft. long over all are used and these are discarded as soon as the point becomes slightly rounded or the shovel wears so thin as to become too limber for efficient work. The life of a shovel, barring accidents, is from two weeks to a month. It is considerably less when shoveling plates are used than otherwise. Picks weighing 6, 7 and 8 lb. are used, the heavier ones being preferred at most mines. These are kept in good repair at all times and are laid aside for resharpening as soon as they become worn and dull. One man will dull from two to five or six in a shift, one for each half-day being a common allowance, with plenty of extras in case the point breaks or bends. Many picks are lost through carelessness on the part of the shovelers, who usually toss their dull picks behind them on the waste pile when taking sharp ones. These are often forgotten and are buried.

Shoveling to Clean the Bedrock

Bedrock gives the shoveler the most trouble. It is frequently tight and blocky and is difficult to remove, and there is a tendency for the green shoveler, in order to keep his turn, to remove the top gravel ahead of bedrock. Then when he comes to take up bedrock he finds that he has a tough proposition on his hands and must either drop out for a turn or two or must delay the rest of the gang. He soon learns that the easiest and most satisfactory way is to remove the bedrock first, undermining the gravel as shown in Fig. 3 until it caves onto the shoveling plate, when he may be able to work as much as an hour without additional picking. Some operators object to the use of shoveling plates on the ground that they wear out the shovels too rapidly and cause loss of time in leveling off for them and putting them in place. Where bedrock is composed of soft, decomposed schist through which the shovel can be pushed with ease there is some point to this objection, but for the great majority of mines—which have blocky bedrock—the use of plates is to be recommended. Fig. 4 shows a generalized section through a placer mine arranged to use cars at the downstream face and wheelbarrows at the upstream face.

Different Methods on Vault Creek

Different conditions on Vault Creek and its tributaries from those prevailing in the rest of the district have led to the development of a slightly different method of mining. The ground is deep—much of it being 200 ft. to bedrock—and the paystreaks are narrow and irregular. Owing to the time and cost of sinking, prospecting must be done with as few shafts as possible. Similarly, owing to the narrow paystreaks and the way they twist and turn, it is not feasible to drive long tunnels and crosscuts to prepare for stoping, as is the usual practice in the Fairbanks district. The first rule becomes "follow the pay," and it is often impossible to do this and keep the drifts straight. There is probably no other place in Alaska where ground stands as well after stoping as it does on Vault Creek and its most important tributary, Treasure

Creek. Slabs rarely form and when they do they are small and cause little trouble. These factors have combined to make it desirable to start the stopes near the shaft and carry them away from it in both directions. A pillar must of course be left around the shaft, but it need not be of great extent.

The method is illustrated in Fig. 5. The runways are kept open by timbering with three-piece sets and lagging tightly. If this is not done the waste that comes down with each new thaw must be shoveled away, and in time it accumulates in such quantity as to form a sort of large hopper with the wheeling-plank in the center and with sides reaching to the roof, as shown in Fig. 6. After this stage is reached all the gravel that falls over a wide area collects on the running-plank and must be removed by hoisting. Small timbers only are required, since they soon become covered on all sides with waste and confine much of the heat of the pipe line, thus insulating the frozen roof. Consequently the weight of the thawed gravel resting on the sets is comparatively slight.

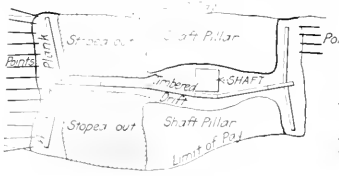


FIG. 5. METHOD OF WORKING AWAY FROM SHAFT

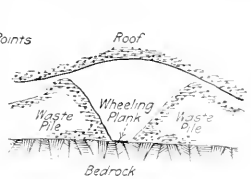


FIG. 6. WASTE ACCUMULATION ALONG UNTIMBERED RUNWAY

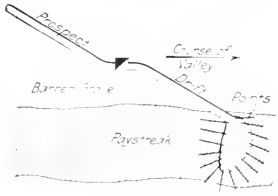


FIG. 7. VAULT CREEK METHOD OF PROSPECTING

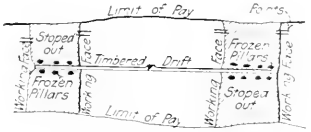


FIG. 8. COMBINATION METHOD FOR NARROW PAYSTREAKS

Wheeling Gravel on Bad Grades

Bedrock surface is irregular and in following it the floor of the tunnel rises and falls, making a variable grade. The pay is likely to swing from side to side and the drift must twist and turn in order to keep near the center of the pay-streak. It is evident that this is one place where wheelbarrows for transport, on account of their greater flexibility, have a great advantage over cars and they are used almost exclusively. When, owing to lack of grade, water will not flow in away from the face, it is removed by means of siphons and injectors. After a depression in bedrock has been crossed, however, it is gradually allowed to fill as the roof thaws, the wheeling-plank being raised correspondingly. Timbering is necessarily delayed in this case, but the advantages of having a runway of even grade through which the water will drain to the sump at the shaft outweigh this disadvantage. There is nothing, aside from working under a low roof, that tires a workman and decreases his output so much as wheeling up a grade. On the level he need only hold the handles of the wheelbarrow at the proper elevation and it virtually runs itself, but on an upgrade it is necessary to push from an awkward angle and on a steep downgrade it is necessary to hold back, which is hardest of all. Owing to the fact that most shovelers doing their own wheeling play out first in the wrists it is desirable to avoid wrist strain as much as possible.

Prospect shafts are usually sunk of such size as to be suitable for actual mining and if no pay is found at bedrock it is difficult or impossible to tell whether the pay-streak is toward the creek or toward the hill, or whether the shaft is merely in a low-grade area in the main pay-streak. Since the pay is often not rich enough to permit of much expense for prospecting and development—and this is one of the chief reasons for adopting the method of mining under discussion—every foot of work must be done with a view to possibilities for further use. Crosscuts are therefore not driven directly across the creek in looking for pay but are run diagonally so that they will serve as runways in case pay is discovered, one angling up the hill, the other toward the creek, as shown in Fig. 7. This serves to prospect the channel in all four directions at once. Although one drift will usually be in waste the operator generally considers himself lucky to have one face in good pay all the time.

Manchurian Iron Developments

An iron industry in Manchuria is to be built up by Japanese capital. Consul-General S. P. Heitzleman at Mukden writes that "among the nine mining areas in South Manchuria where Japanese are permitted, by an exchange of notes between the Japanese and Chinese Governments on May 25, 1915, to prospect for and operate mines, one of the largest and most promising is the iron mine in the Anshanchan region, between Liaoyang and Penhsihu, in the central part of Shengking Province." The extent of the deposits is said to equal that of the Hupeh mines. "The working of this mine is to be intrusted to the South Manchuria Ry. Co. The railway company will not confine its labors to mining ore, but proposes to manufacture iron as well. For smelting purposes neither Fushun nor Yentai coal is suitable, and it is said Penhsihu coal will be used. A site for the smeltery on the opposite side of the Penhsihu River which comprises about 83 acres of land has been chosen and the negotiations for its purchase are about concluded. The undertaking is to assume considerable proportions, and the capital for investment is estimated to be not less than $5,000,000."

A Process for Producing Tungsten Powder has been patented by Robert Rafn, of Porsgrund, Norway, and assigned to the General Electric Co., says "Engineering." The production of amorphous tungsten powder by reduction of tungsten trioxide is usually difficult of accomplishment, as a crystalline product most often results. The inventor has shown, however, that by making the reduction in two stages—first with ammonia gas at red heat, producing the so called blue tungsten oxide, and then with hydrogen at cherry-red heat—the resulting product is a tungsten powder of remarkable fineness.

Explosives Used in War and Metal Mining

By Percy E. Barbour

SYNOPSIS—Guncotton is the basis of the most important military explosive and of the second most important mining explosive. Benzol and toluol are important coal-tar products which furnish bases for manufacture of picric acid used in military explosives and nitro-substitution compounds used in low-freezing dynamites. Dynamites graded into five distinct classes, each of which has advantages and disadvantages. Low-freezing dynamites without ammonium nitrate give excessive amounts of noxious gases, and with ammonium nitrate are decidedly hygroscopic. Straight dynamite is best adapted for the widest range of work; gelatin dynamite for wet work. Least amount of obnoxious gases is given off by the gelatin dynamites. Correct explosives to use not determined by any fixed rule but by experience and judgment of the mining engineer.

Although the munitions of war are almost never used by the mining engineer (unless he happens to be operating in Mexico at present), and the explosives common to mining are only to a slight extent used in war, yet the requirements of the two have an inter-relation which is not distant. Dynamite, the commonest of mine explosives, is used in war only for demolitions, as in the case of bridges, structures, etc., and to a comparatively limited extent in the present war for the destruction of the enemy's trenches, and in hand grenades. But the basis of the most important explosive used in war and the basis of the second most important explosive used in mining is the same—guncotton—which is the essential ingredient of all smokeless powders, of blasting gelatin and of all gelatin dynamite.

Smokeless Powder and Guncotton

The manufacture of this explosive is complicated only from a mechanical standpoint. There are no chemical mysteries about it. Smokeless powder is also called nitrocellulose, the principal ingredients of which consist of cotton or cellulose, nitric acid, sulphuric acid, ether and alcohol.

Smokeless powder in the chamber of a gun is not intended to be detonated, but to be exploded by a progressive combustion, the result of which is determined by the characteristics of the gun or the service expected of it. The rate of the combustion depends upon the amount of surface exposed, hence the perforations which give this added surface to the powder grains.

Nitrocellulose is a general term applied to products resulting from the action of nitric acid on cellulose, in which the organic cellular structure of the original cotton fiber has not been destroyed. Guncotton is a nitrocellulose of high nitration, consisting of a mixture of insoluble nitrocellulose with a small quantity of soluble nitrocellulose, and a very small quantity of unnitrated cellulose. The chemical name for guncotton is tri-nitrocellulose, and the formula is $C_{12}H_{14}O_4\ (NO_3)_6$.

Owing to the fact that guncotton ordinarily contains a large percentage of water, it is most suitably adapted for use in military mines and submarine or other work of wet nature. Dry guncotton is used to detonate charges of wet guncotton. When dry it is very sensitive and is classed as a detonator and must be handled carefully, while wet guncotton, contrary to general impression, is one of the safest explosives to handle.

Nitrocellulose Compounds

In the manufacture of nitrocellulose, by varying the strength and the proportions of the nitric and sulphuric acids, their temperature and the length of time that the cotton is in them, a number of different products are obtained varying in the rate at which they will burn and the effects produced, and in the degree to which they are soluble in various solvents. This gives many different grades of explosives to which various names are applied at the will of the manufacturer and which are capable of a wide latitude of adaptability to different requirements.

Cordite is a British smokeless powder consisting of 37 parts of guncotton, 58 parts nitroglycerin and 5 parts vaseline. This powder gives a very high muzzle velocity with a low pressure in the powder chamber, but the temperature of its explosion is so high that it causes a rapid erosion of the bore of the gun. Therefore, another form of this powder known as Cordite M.B., in which the ratio of the guncotton and nitroglycerin is reversed, has been made which overcomes these disadvantages. This illustrates the possibilities of different combinations of the same materials to effect different purposes.

Benzol and Toluol and Derivatives

Increased interest attaches to benzol and toluol at the present time on account of the number of plants being constructed to manufacture them. They are used in the manufacture both of dyestuffs and high explosives for war munitions. The United States Steel Corporation has three plants nearing completion—one at Farrell, Penn., one at Gary, Ind., and one at Birmingham, Ala. The Lehigh Coke Co. is building a benzol plant at South Bethlehem, Penn.; the Woodward Iron Co., Woodward, Ala., has a new benzol plant in operation; the Lackawanna Steel Co. has a benzol plant at Buffalo; and the Benzol Products Co., working with the General Chemical Co., the American Coal Products Co. and the Semet-Solvay Co., is building a plant at Marcus Hook, Penn., which will soon be in operation. The Dominion Steel Co. of Canada is manufacturing benzol on a large scale, and the Crows Nest Pass Coal Co. is also contemplating the building of a similar plant.

Benzol is a coal-tar distillation product comprising a mixture of benzene with variable quantities of toluene and other homologues of the same series. The Rittman process, of which we have heard so much lately, is a process whereby these products may be obtained from the distillation of petroleum, but at the present time they are only obtained commercially by distillation of

coal-tar products, principally as a byproduct from coke ovens. The product known as "crude benzol" is further fractionally distilled, and by this means separated into pure benzene, toluene and other true chemical compounds. Benzene[1] is C_6H_6 and toluene is C_7H_8. A 90% benzol is a product of which 90% by volume distills before the temperature rises above 100 deg. C. The composition of a 90% benzol is about 70 benzene, 24 toluene, and 4 to 6 of lighter hydrocarbons. Toluol is an impure form of toluene, so alike that the difference is only detected by a slight discoloration on the addition of sulphuric acid.

Toluene possesses the property of rendering oxygen very active and when treated with nitric and sulphuric acid and heated for several days yields tri-nitro-toluene, an explosive of a high order which is superseding the use of picric acid as a base for shell fillers for artillery use.

Tri-nitro-toluene and tri-nitro-toluol are practically the same, and have been abbreviated to trotol or t.n.t. in United States Army parlance. This explosive, trotol, is also used, especially for submarine mines and in the German 42-cm. guns and is, next to picric acid, the most terrific explosive in the service.

Picric Acid

Benzene, a redistillation product from benzol, is used in the manufacture of carbolic acid or phenol; this in turn is the basis of picric acid, which latter is the base of most of the high explosives used at the present time in the European conflict. When phenol (carbolic acid) is treated with nitric acid, a nitrate called tri-nitro-phenol is formed. Its only use is as an explosive. It is not only an explosive of itself, but more particularly is used as an ingredient of special explosive mixtures. Most of the new so-called shell-filler explosives are either picric acid or mixtures of picric acid salts called pierates. Among these are ecrasite (Austrian), lyddite (English), melinite (French), shimose (Japanese), etc. The exact compositions of these are secrets carefully guarded by the different governments.

The explosive used in the United States Army as a shell filler is known in the service as "Explosive D." This is a picric-acid derivative, the exact composition of which is maintained a secret by the Government. Its relative force of explosion is twice as great as that of guncotton, which of course is ample recommendation for its use in armor piercing shells.

Picric acid, although a powerful explosive, forms in connection with lead, iron and some other metals, some very sensitive and dangerous compounds. This is true to such an extent that it is dangerous to paint the interior of a shell—which is to be loaded with a picric acid derivative—with a paint which has either red or white lead in it, and it is also dangerous to use red or white lead in screwing in a shell plug. Trotol does not have this disadvantage, and it is for this reason that it is displacing, in this country at least, picric-acid explosives.

Dynamite

Dynamite is a general term for all high explosives composed primarily of nitroglycerin and some solid matter as an absorbent. Low explosives comprise the saltpeter mixtures, such as gunpowder, in which explosion is brought about by simple but rapid combustion, giving rise to a large volume of highly heated gases but leaving almost one-half of the original mass as a solid residue. In the high-explosive class, explosion is the result of the compound being wholly resolved into a large volume of highly heated gases, with little or no solid residue, the change taking place many times faster than the combustion in the saltpeter (KNO_3) class of low explosives. Low explosives exert a relatively slow pushing effect upon the substances on which they act at the moment of explosion, while high explosives, on account of the high rate and power of detonation, have a shattering effect upon the substances with which they are in contact.

Dynamite was originally invented as the result of an attempt to saturate black powder with nitroglycerin, in order to get a powder of increased intensity, it being inconvenient to use the nitroglycerin itself alone, as the explosive. The disadvantages of this early attempt were overcome by using kieselguhr as absorbent for the nitroglycerin and the original brand of dynamite was evolved. This original absorbent, base or "dope" as it is commonly called, was a porous, lightweight earth and added in no way to the explosive force of the nitroglycerin and remained as a solid residue after the explosion. If this dope is a substance which will neither burn nor explode, it is called an inactive base; if it will burn or explode it is called an active base, and may be either an explosive compound, a combustible compound, or a mixture of a combustible and an oxygen carrier. Experiment developed the fact that if a dope was used which was an active base, and which would either explode or furnish oxygen for the other explosives, the force of the explosion was greatly increased. It was also found that with an inactive base a dynamite containing less than 30% nitroglycerin could not be exploded, but with an active base a satisfactory explosive could be made containing as low as 5% nitroglycerin. If it were not for this fact the popular 5% nitroglycerin powder, sometimes called granulated nitroglycerin powder, largely used in quarrying operations, could not be detonated.

The character of this active base is possible of an almost infinite number of commutations, with an equal number of brands of dynamite possessing varying characteristics, and here is the labyrinth into which the mining engineer has been hopelessly plunged heretofore.

Nitroglycerin consists of glycerin, nitric acid, and sulphuric acid, and is made by allowing a small amount of glycerin to enter into the presence of the strongest acids, chemically pure, mixed in the proportion of two parts sulphuric to one part nitric.

Modern Grading of Dynamite

There are only five important grades of dynamite which need be considered in mining engineering work: Judson powder, straight nitroglycerin dynamite, ammonia dynamite, low-freezing dynamite, and gelatin.

Judson powder is a low-grade granulated nitroglycerin powder, containing about 5% nitroglycerin, which is used for quarrying or road work or railroad excavation. An average composition of such powder is 5% nitroglycerin, 35% combustible material composed of sulphur, coal and resin, and 60% sodium nitrate, the latter being used as an oxidizer. Except that this powder has nitroglycerin for its base, it would hardly count in the class of dynamite, as it so much more closely resembles

[1]Benzine is a distillation product from petroleum.

black powder, the composition of which is 16% charcoal, 11% sulphur, 73% sodium nitrate.

Straight nitroglycerin dynamite is graded according to the nitroglycerin content, which varies in commercial brands from 15 to 60%. The following compositions are given by analyses by the Bureau of Mines.[2]:

COMPOSITIONS OF STRAIGHT NITROGLYCERIN DYNAMITES OF VARIOUS STRENGTHS

Ingredients	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%
Nitroglycerin	15	20	25	30	35	40	45	50	55	60
Combustible material*	20	19	18	17	16	15	14	14	15	16
Sodium nitrate...	64	60	56	52	48	44	40	35	29	23
Calcium or magnesium carbonate	1	1	1	1	1	1	1	1	1	1
	100	100	100	100	100	100	100	100	100	100

*Consisting of wood pulp, flour and sulphur for grades below 40%; wood pulp only for other grades.

In other than straight dynamites the trade rating is not a measure of the nitroglycerin content, as the following tables of ammonia and low-freezing dynamites will show, and other brands of dynamite of the same commercial rating have not been found to be equivalent in every respect to straight dynamite. The rating, 40% for instance, for more than one kind of powder of very different blasting properties, is an unfortunate and misleading one.

Straight Nitroglycerin Dynamite

An analysis of 40% straight nitroglycerin dynamite, quoted from Bureau of Mines Technical Paper 17, is as follows: Moisture, 1.45%; nitroglycerin, 39.46%; sodium nitrate, 42.62%; calcium carbonate, 1.11%; wood pulp, 15.36%; total, 100%.

Some form of oxidizer is necessary in an explosive. Saltpeter is the common ingredient of black powder for this purpose; five-sixths of its oxygen is available for oxidization and the nitrogen is given off in a free state. Sodium nitrate contains more available oxygen than the potassium salt and is more commonly used in dynamite, although at very high temperatures it exercises a less powerful action upon the other combustible ingredients. It cannot be used for ordinary gunpowder, because it is hygroscopic. Because this is so largely used in ordinary dynamite is one reason why the latter will deteriorate so rapidly if stored in a damp place, as for instance a wet drift underground. Calcium carbonate, magnesium carbonate or sodium carbonate are inert bases, which are added to the dynamite to neutralize any free acid present.

This explains the function of each of the ingredients of the ordinary straight dynamites shown in the analysis: Nitroglycerin is the explosive; wood pulp is the combustible absorbent; sodium nitrate (Chile saltpeter) the oxidizing agent; and calcium carbonate is the neutralizing agent.

Straight dynamite can be had in 75 and 80% strengths on special order but its use is almost always ill-advised. It is too sensitive both to shock and to friction to be transported safely and it gives off extreme amounts of obnoxious gases.

Nitroglycerin dynamites freeze at temperatures between 45 and 50 deg. F.

The ammonia dynamites are practically straight dynamites with part of the nitroglycerin replaced by ammonium nitrate. Sulphur is usually one of the constituents of this type of dynamite, and the wood pulp may be largely replaced with flour. The substitution of ammonium nitrate for the nitroglycerin has one slight advantage over the use of sodium nitrate, namely, that on explosion it goes completely into gas. Other than this, it has no advantage except to lower the cost of manufacture of the dynamite. It gives a weaker and less powerful explosive. Ammonium nitrate does have an advantage, however, in the manufacture of explosives for use in coal mines because on explosion a considerable amount of water is formed which lowers the temperature of all of the products of the explosion.

Ammonium nitrate is hygroscopic to such an extent that its use in military explosives has been entirely discontinued.

When ammonium nitrate is dissolved in some solutions a considerable amount of heat is absorbed and this property is utilized in many so-called freezing mixtures. Ammonia dynamite freezes at temperatures lower than straight dynamite and when some of the nitroglycerin is replaced with nitro-substitution compounds a low-freezing ammonia dynamite is obtained with still lower freezing point. The following tables from Bulletin 80, p. 23, Bureau of Mines, give the ingredients of these types:

COMPOSITIONS OF TYPICAL AMMONIA DYNAMITES

Ingredients	30%	35%	40%	50%	60%
Nitroglycerin	15	20	22	27	35
Ammonium nitrate.....	15	15	20	25	30
Sodium nitrate.....	51	48	42	36	24
Combustible material*.....	18	16	15	11	10
Calcium carbonate or zinc oxide.	1	1	1	1	1
	100	100	100	100	100

COMPOSITIONS OF LOW-FREEZING DYNAMITES

Ingredients	30%	35%	40%	50%	60%
Nitroglycerin	13	17	17	21	27
Nitro-substitution compounds....	3	4	4	5	6
Ammonium nitrate.....	15	15	20	25	30
Sodium nitrate.....	53	49	45	36	27
Combustible material*.....	15	14	13	12	9
Calcium carbonate or zinc oxide.	1	1	1	1	1
	100	100	100	100	100

*Composition similar to that of the combustible material in straight dynamite of grades below 40%.

Low-Freezing Dynamites

Nitro-substitution compounds have been used as components of dynamite, particularly because they lower the freezing point of the nitroglycerin therein. The nitro-substitution compounds are substances derived from coal tar, after having been acted upon by nitrating solutions. These mixtures reduce the temperature of the freezing points to 35 deg. F., which gives the dynamite its type named. This low-freezing quality is the only advantage of this type of powder, which, like ammonia dynamite has a lower rate of detonation and hence less disruptive effect than straight dynamite. It also has the disadvantage of the deliquescence of the ammonium nitrate and cannot be stored in damp places. A typical analysis of the composition of low-freezing dynamite is quoted from Bulletin 80, p. 22 of the Bureau of Mines.

COMPOSITIONS OF LOW-FREEZING DYNAMITES

Ingredients	30%	35%	40%	45%	50%	55%	60%
Nitroglycerin	23	26	30	34	38	41	45
Nitro-substitution compounds	7	9	10	11	12	14	15
Combustible material*.....	17	16	15	14	14	15	16
Sodium nitrate.....	52	48	44	40	35	29	23
Calcium or magnesium carbonate	1	1	1	1	1	1	1
	100	100	100	100	100	100	100

*Composition similar to that of the combustible material in straight dynamite.

Nitroglycerin acts as a solvent under certain conditions to dissolve soluble nitrocellulose, and the mixture that

[2]Bulletin 48, p. 7.

forms will set to a jellylike mass. In this way, or by the use of other solvents, the explosive known as blasting gelatin is formed. This is rated at 100% nitroglycerin, meaning that the dope has absorbed an amount of nitroglycerin equal to 100% of its own weight. This is the most powerful explosive that transportation companies will accept for carriage, and while perfectly safe to handle, in fact much safer than straight dynamite above 40%, is altogether too violent for ordinary mining operations, although having a field all its own for special applications. This composition is diluted by mixing it with a dope such as nitrate of soda and wood pulp used in straight dynamite, and the mixture so formed is known as gelatin dynamite. This gelatin dynamite is made in various grades rated by per cent. strength, as are the straight dynamites. The reason blasting gelatin gives so much greater force is because it gets more complete combustion on explosion than any of the other dynamites, and this additional chemical action greatly increases the heat, hence the volume of the gases and the force of the explosion. The initial shock necessary to detonate blasting gelatin is six times greater than is required for dynamite. This applies in only a slightly less degree to the gelatin dynamites, which is the reason a stronger cap is necessary when using this type of explosive. Unlike straight dynamite, gelatin dynamite is very sensitive to shock when frozen. In its ordinary condition its sensitiveness is increased by heat, but under usual circumstances it is much less sensitive to shock and friction than straight dynamite is. Aside from the strength of this explosive the greatest advantage of this type is its almost complete combustion and hence the freedom from noxious gases after the explosion. The next great advantage is the fact that it can be used in the wettest kind of work. A cartridge placed in water will turn white on the surface, on account of the nitroglycerin in the outer layer being displaced. The nitrocellulose remaining forms a protective coating for the rest of the mass, and makes it practically waterproof. However, those gelatin dynamites of low grades which contain a large proportion of hygroscopic nitrate have this water-resisting quality to a less degree than those higher up the scale.

Gases from Explosion of Dynamite

Both the amount and the quality of the gases produced by the explosion of dynamite are of important consideration, because the effect of the explosives is directly due to the quantity of gas generated. Referring to the last column in the following table, it will be seen that 60% straight dynamite generates about 50% more gas than does 40% straight dynamite. The tendency to use 60% dynamite underground should be discouraged, because while it is true that it does have much greater disruptive force than 40% dynamite, it gives such a large volume of obnoxious gases that smoke troubles are likely to overbalance any advantage due to using this stronger explosive. The figures in this table are taken from a more elaborate one in Bulletin 48 by the Bureau of Mines, and the results are concisely stated in its Bulletin 80, p. 25, as follows: "The low-freezing dynamite produced on detonation larger volumes of poisonous gases than any other explosive tested, one sample of the gaseous products of combustion of a low-freezing dynamite containing 47.47% by volume of carbon monoxide. The straight nitroglycerin dynamite produced 26.9 to 34.6% of carbon monoxide; blasting powder produced 10.8% carbon monoxide, and 8.7% hydrogen sulphide; granulated powder produced 2.7% carbon monoxide, and 15.7% hydrogen sulphide; and ammonia dynamite produced 3.8% monoxide, and 5.4% hydrogen sulphide. The gelatin dynamite on detonation gave the least amount of poisonous gases, namely, 3.0% carbon monoxide and 4.1% hydrogen sulphide."

GASEOUS PRODUCTS RESULTING FROM TEST OF EXPLOSIVES*

Class and Grade of Explosive	Gaseous Products (% by Volume)							
	Carbon Dioxide	Carbon Monoxide	Oxygen	Hydrogen	Methane	Nitrogen	Hydrogen Sulphide	Volume of Gas (Liters)
30% straight nitroglycerin dynamite	22.9	28.4	0.0	20.6	0.7	27.4	...	85.8
40% straight nitroglycerin dynamite	27.3	26.9	0.0	18.0	0.4	27.4	...	88.5
50% straight nitroglycerin dynamite	24.4	31.2	0.0	20.7	0.7	23.0	...	105.5
60% straight nitroglycerin dynamite	22.2	34.6	0.0	23.2	0.8	19.2	...	128.9
60% low-freezing dynamite	8.9	47.4	0.0	31.0	0.6	12.1	...	169.5
40% ammonia dynamite	41.4	3.8	0.0	3.1	0.8	45.5	5.4	65.6
40% gelatin dynamite	50.8	3.0	0.0	1.8	0.8	39.5	4.1	60.3
5% granulated nitroglycerin powder	51.3	2.7	0.0	0.9	0.7	28.7	15.7	61.6
Black blasting powder	49.7	10.8	0.0	1.8	0.6	28.4	8.7	67.8

*These explosives are not the same as given in the previous tables.

Summary of Characteristics

The straight nitroglycerin dynamite develops greater disruptive force than any of the other types of explosives, class for class, and where shattering effects are required should be used in preference to any other kind. Straight dynamite freezes at temperatures between 45 and 50 deg. F. The chief disadvantage in the use of straight dynamite is the considerable volume of obnoxious gases which are given off on detonation. These dynamites also are not suitable for use in very wet work.

Ammonia dynamite freezes at a lower temperature than the straight dynamite, and gives off less obnoxious and poisonous gases. It does not have the same strength as straight dynamite, grade for grade, is hygroscopic to an extreme degree and must be kept in perfectly dry storage or the deterioration is very rapid. Also it cannot be used in wet work. It is cheaper than straight nitroglycerin dynamite and is advisable for work where straight dynamite gives too violent an explosion. Ammonia low-freezing dynamite differs only from the above in that the freezing point is about 30 to 35 deg. F.

Low-freezing dynamite has practically the same advantages and disadvantages of the ammonia dynamite except that on detonation it produces the largest volume of obnoxious gases, and should not be used underground where the ventilation is poor.

Gelatin dynamite is the safest dynamite to handle and generates the least amount of obnoxious gases when detonated. It is the only dynamite to use in connection with wet work. It costs more than straight dynamite and does not give, grade for grade, the same disruptive effect, otherwise it would completely replace straight dynamite in mining work.

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Gold-Bearing Quartz Veins in Dutch Guiana

By J. B. Percival*

The gold-bearing quartz veins in Dutch Guiana, South America, have not yet been exploited to any great extent, although there are indications that with the necessary capital to open and develop them thoroughly, the veins will prove as rich as any in South America.

Three Distinct Gold Zones

The best-known quartz veins in the colony are in the first gold zone. There are three distinct zones—the first, about 50 mi. from the coast, the second, 100 mi. and the third, between 160 and 180 mi. These gold zones have an easterly and westerly direction and run practically through the whole country. The first zone, which embodies the Mindrinettie Creek district, has proved the richest so far, although on both the others rich ore has been discovered.

Up to the present in Dutch Guiana only the alluvial deposits have been extensively worked, but within the last year or two the quartz veins have been receiving attention. The large quantities of sharp-cornered quartz, lying about the hillsides, would show that it is in close proximity to its source. Lately, veins have been discovered showing visible gold on several properties. Portions, broken from the vein, are very rich. A large amount of the alluvial gold of the country comes from these quartz veins which have been broken down and eventually deposited in the creeks.

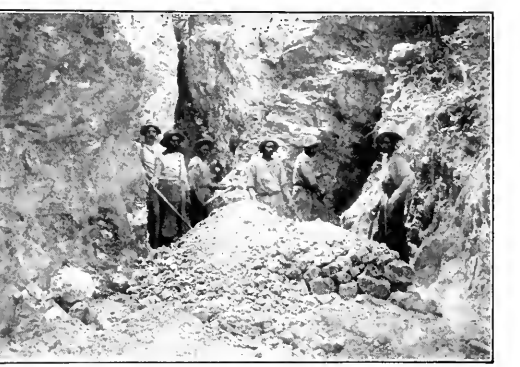
The best-known veins in the first gold zone are to be found on the Dejonge and Guyana Gould Placer concessions, where some of the veins have a thickness of 5 m. A geologist, who explored this part of the country and on his return to Europe published a paper entitled "A Brief Outline of the Surinam Gold Industry" said: "The most important part of the first gold zone examined by me is to be found between the Guyana Gould Placer Concession and Dejonge's property. The reefs continue their course along many hundreds of meters in an easterly and westerly direction. In the vicinity of the Guyana Gould property, the quartz veins are thickest and found at about a distance of 60 m. above the creeks and thus easily accessible. The gold percentage so far is remarkably high."

On the geological map of the colony the situation of these concessions is clearly shown to be slightly north of the fifth degree of latitude and west of a range of hills running from the Tempatie River across Bergendaal in an east-west direction. Most of the gneiss strata lie east and west and incline steeply toward the north.

The minimum level of this part of the colony is only 10 m. above Paramaribo, the capital; and, although the concessions mentioned are about 55 mi. from the coast, the altitude of the highest hill in the middle of these properties is but 500 m.

On the north, east and south of these concessions many good-looking veins are exposed for miles, and all that is required is capital to develop them. The railroad traverses the country and guarantees good communication with Paramaribo.

PROSPECTING PARTY BREAKING CAMP



MINING RICH QUARTZ IN DUTCH GUIANA

Quartz veins of different thicknesses are met with almost everywhere in the interior of Dutch Guiana. They do not, as a rule, take the same course as the steep gneiss formation, but notwithstanding carry more or less gold. A striking feature is the utter absence of basic and acidic eruptive rocks in some parts of the colony, which is not encouraging to those who maintain that the presence of similar rock formations is the cause of Dutch Guiana's gold wealth.

Farther south, that is to say, in the second and third gold zones, the country is very mountainous. Dutch Guiana is undoubtedly a rich country, and capital judiciously spent would make it a large producer.

Laboring men from temperate climes are not adapted to local conditions in Dutch Guiana. They could not exist on food of the kind supplied to the natives of the country, who are black and colored and earn only 50c. per 8-hr. day, with rations free. Black labor is good, comparatively speaking. When you can get a man to shift 300 cu.ft. of overburden, on the placers, in a day, it is good work, and of this the natives of Dutch Guiana are

*Box 139, Paramaribo, Dutch Guiana, South America.

quite capable; but they must in every case be supervised by white men.

In regard to climate it may be safely said that, if white men from northern countries take proper and known precautions, no fears need be entertained. There are tropical inconveniences but the resident soon becomes habituated to them. It is probable that at no distant date Dutch Guiana will become an important gold center. What is now required is a better knowledge of local conditions by strangers abroad.

Manganese-Ore Supplies

One of the products that is essential in our steel industry, though its actual quantity is not so great as is generally supposed by those unfamiliar with the case, has been materially affected by the war conditions abroad. This is the manganese alloy which is used—generally in the form of ferromanganese—in both the converter and the openhearth furnace in making steel. The quantity of this alloy consumed for several years has been only about 1% of the total steel produced in the United States, but its use cannot be dispensed with, as no substitute has yet been found.

Difference Between Ferromanganese and Spiegeleisen

Two alloys of this kind are known familiarly in the trade, the difference being mainly in degree. The more important is ferromanganese, which has from 60% manganese up, the standard being 80%. This requires, of course, high-grade ore for its making. Spiegeleisen is lower in grade, the standard being 20 to 25% manganese, and can be smelted from ores which are more nearly manganiferous-iron than manganese ores. The use of ferromanganese is preferred and has been increasing for several years, while that of spiegeleisen has been declining.

The consumption of ferromanganese and spiegeleisen in the United States for three years past has been, in long tons:

Ferro:	1912	1913	1914
Domestic	125,378	119,495	100,731
Imported	99,137	128,070	82,997
Total	224,515	247,565	183,728
Spiegel:			
Domestic	102,561	106,980	76,625
Imported	1,015	77	2,870
Total	103,576	107,057	79,495

For the eight months ended Aug. 31, 1915, the total ferromanganese and spiegeleisen made in this country was 132,514 tons, which would indicate a total production of more than 200,000 tons for the year, notwithstanding the supposed scarcity of ore.

The sources of the raw material for our domestic product have been as follows, for three years:

Imports:	1912	1913	1914
Russia	83,334	124,337	52,680
India	128,645	141,587	103,583
Brazil	81,580	70,200	113,924
Other countries	7,102	8,966	13,107
Total	300,661	345,090	283,294
Domestic production	1,663	4,048	2,635

The ore from other countries was chiefly from Cuba. The total imports of ore in the half-year ended June 30, 1915, were 58,148 tons, being 76,133 tons less than in the corresponding period of 1914. The domestic production for several years past has been rather less than 1% of the ore used in our furnaces. The excess of foreign ore used has not been altogether because of the scarcity of domestic ore. The necessity of crushing and concentrating most of our ores and the cost of transportation have discouraged attempts to compete with foreign ores which had the advantage of cheaper mining, of little or no cost of preparation and of cheap water freights. No one anticipated the time when supplies might be cut off, and the consideration was only for present pront, not for provision for the future.

War and Manganese Shipments

The war in Europe introduced new and unexpected elements into the question. The exports of manganese ore from the Caucasus were cut off altogether, while those from British India were prohibited for a time, and when the strict embargo was raised, they were seriously restricted in quantity. The only free source of ore left was in Brazil, and to increase shipments from that country it was necessary to enlarge mining facilities, which required time and money. The ore resources in that country are large, but have never been properly developed.

Of course the immediate result of these conditions has been a strong advance in the prices of ore and of manganese alloys. Ferromanganese, the alloy most used in steel making, was quoted in the first half of 1914 at $36 to $38 per ton at Baltimore, where most of the foreign metal is imported. The current quotation is up to $105, Baltimore, for early delivery, while there have been sales of domestic ferro as high as $112.50 per ton, or three times the price a year ago. Ore has advanced in like measure. The Carnegie Co. bought in 1914 domestic ores on a schedule which made 26c. per unit of manganese for 49% ore the highest price, and this was understood to be a higher figure than was paid for imported ore, the company desiring to promote domestic production.

At the present time 45c. per unit is being named for 48% ore, while limitations as to silica and phosphorus are not as strict as they were. It is understood that the Brazilian ore that the Steel Corporation is now importing costs from 11 to 12c. per unit at seaboard, the ore running from 45 to 48% manganese, and being low in phosphorus.

Naturally there is a good deal of talk about prospecting for manganese ores and about reopening and developing old mines. The time is favorable, but so far there has been no large source of these ores brought to the point of commercial production.

New German Copper Refinery

A new German electrolytic copper-refining plant is to be installed, according to the London *Electric Review*. It is announced that the Hüttenwerke Niederschonweide proposes to erect a plant in the vicinity of Bitterfeld for the production of electrolytic copper. The energy required is estimated at 2,000,000 kw.-hr. per annum, which would be obtained from the Electro Works Co., of Golpa Jessenitz. The carrying out of the scheme would increase to three the number of works turning out electrolytic copper, the two existing being those of the North German Refinery Co. and the Kayser Metal Co.

Tin-Ore Dressing at Llallagua, Bolivia—II

By Durward Copeland* and Scovill E. Hollister†

SYNOPSIS—To separate the pyrite from the valuable cassiterite in the sulphide ore at Llallagua, Bolivia, roasting and magnetic separation were applied, following jig-and-table concentration. Kauffman 5-hearth mechanical furnaces and Stern wet-type magnetic separators have replaced hand furnaces and buddles.

As can readily be appreciated the production of *barrilla* from the pyrite-cassiterite middlings by means of hand furnaces and buddles was expensive at Llallagua, Bolivia, both because of the high-priced fuel and the large number of laborers—even though the labor is cheap—that were required. Because of this high cost, and because the hand furnaces were inadequate to handle the larger amount of fine pyrite-cassiterite middlings resulting from the treatment of a constantly increasing percentage of pyrite ore from the mine, automatic roasters and magnetic separators were installed. This installation is handling all of the fine middlings produced and the hand furnaces and buddles are now but interesting relics of the past.

Roaster-Magnetic-Separator Installation

The only problem the roaster-magnetic-separator plant must solve at Llallagua has to do with the treatment of pyrite-cassiterite middlings consisting of grains of small diameter. In these middlings the minerals have been broken free from one another, but a separation was not made by the water-concentrating machine of the mill. This does not mean that a reasonably good separation on classified material cannot be made between cassiterite and pyrite. On a table, for example, even with reasonably good classification it is difficult to make a high tin recovery without including in the concentrates so much pyrite that the sulphur becomes high enough to cause smelter penalties. The roasting furnaces employed to prepare the ore for the separators use no fuel except the sulphide in the ore, therefore, on the tables it is the practice to attempt no direct *barrilla* but to cut in with the band of tin enough of the band of pyrite to give concentrates with at least 25% sulphur as pyrite. The roasters require about 25% sulphur in order that the charge shall be self-burning (the furnaces are 13,000 ft. above sea level). The material, therefore, which the magnetic-separator plant has to treat is pyrite-cassiterite middlings with 25% or more of sulphur, usually containing at least 15% of tin, and nearly all of the middlings are finer than 1 mm.

The middlings are first taken to a drying floor of concrete, where the material is spread and raked over by hand until a greater part of the moisture has evaporated. There is still in the ore as it goes to the furnace feeder about 5% moisture. Five Kauffman furnaces, made by the Erzröst Gesellschaft of Frankfort-am-Main, Germany, prepare the ore for the magnetic separators. The Kauffman furnace used is of the five-compartment type, similar in general design to the McDougal furnace so common in American roaster practice. To cool the center shaft, air is supplied by a small fan. The air for burning the sulphide is regulated by an exhaust fan and adjustable air inlets in the furnace. Each of the furnaces has an iron pipe connection to a dust chamber, situated between the furnaces and the exhauster. From each of the furnaces the ore is delivered into a short conical trommel of unperforated sheet iron. The trommel serves two purposes: (1) To make constant the feed to the separators, and (2) to cool the ore somewhat. The ore leaving the trommel is hit by a stream of water which carries it through wooden launders to the magnetic separators. The separating machines are of the Stern wet type and were made by the Electro Magnetische Gesellschaft, Frankfort-am-Main. The nonmagnetic material is, if the feed is right, *barrilla* of sufficiently high tin percentage for exportation. In case there is an excessive amount of nonmagnetic material that is not tin, in the product the concentrates are re-treated on tables before shipping. The magnetic material is sent to the Hardinge mill for regrinding and from there to classifiers and tables.

No Carbonaceous Fuel Required

This plant is unusual in a number of ways. The ore is prepared for the separators by a furnace using no carbonaceous fuel. Therefore, since the magnetic oxide cannot easily be obtained, the problem is to roast to the magnetic sulphide. The "flash roast"—where the ore is passed through the furnace rapidly, and the bulk of the heat comes from the burning of carbon fuel, and where this heat drives off a part of the sulphur of the pyrite—is not applicable here. When the carbon fuel is used it makes no difference whether the sulphide burns or not, since the heat itself will drive off enough of the sulphur of the pyrite to make the resulting iron sulphide magnetic.

At Llallagua the heat to keep the furnace above the ignition temperature of the pyrite must come from the burning of a part of the sulphide itself. We have carried on extensive experiments to find which is the best degree of roast to make an iron mineral of the greatest possible magnetic permeability. The simplest method of regulating this is to control the percentage of sulphur in the furnace product. Our ores average about 27% sulphur and the best results are obtained when the furnace product still contains 10 to 12% sulphur. It would undoubtedly be more satisfactory, in case the furnace feed varied greatly in the amount of pyrite contained, to regulate the operation by the amount of sulphur in the magnetic part of the separator discharge. When working best the magnetic material from the separators contains about 22% sulphur and 50% iron, while the nonmagnetic part has about 1.5 to 2% sulphur and 2.5% iron. The roasted ore should be black and of metallic luster. In case the roast

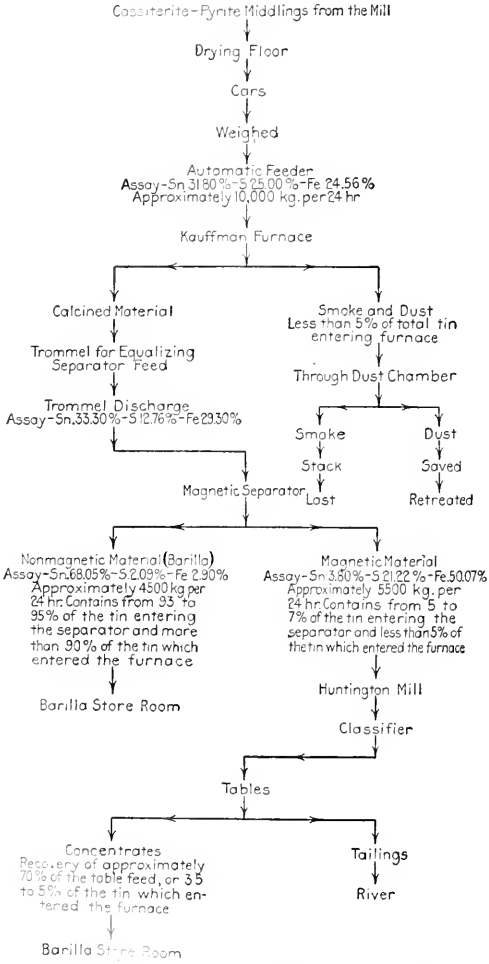
*Metallurgist, Cia. Estañifera de Llallagua, and professor of metallurgy, Missouri School of Mines, Rolla, Mo.

†Mill superintendent, Cia. Estañifera de Llallagua, Llallagua, Bolivia.

has proceeded far enough to give to the product a reddish color the separators do poor work and the *barrilla* runs up in iron.

Magnetic-Separator Work Dependent on Satisfactory Roast

It is, of course, true that the entire success of the magnetic separation depends on the work done by the furnaces. If the roast is properly made the magnetic machines must work well, while if the iron mineral is not made sufficiently permeable during the roast the separators cannot make clean *barrilla*. It is undoubtedly true, also, that the highest temperature prevailing in the furnace is of great importance because of its effect on the reactions that can take place. With a regular feed and air supply, the sulphur percentage is the most convenient means of regulation. Our furnaces will roast about 10 tons each per 24 hr. when preparing the ore for the separators, that is, roasting from about 25% sulphur down to 10%. This is about 400 kg. per sq.m. of hearth area. It should be remembered that the furnaces are 13,000 ft. above the sea, that the greater part of the feed passes 1 mm. and that when entering the furnace the feed contains 5% moisture. If a quantity greater than that mentioned is fed, the furnace soon gets cold, more air simply aiding in the cooling. It is possible that with more rapid stirring and more air the furnace capacity could be increased. Our furnaces have two rabbles per compartment and the center shaft makes 3 r.p.m.



FLOW SHEET OF MAGNETIC-SEPARATING PLANT

The amount of flue-dust made by the furnaces is surprisingly small when the fineness of the material treated is considered. Ordinarily the flue-dust produced is less than 5% of the weight of the furnace feed. The percentage of tin is always much less in the dust than in the feed. When the ore has 20% tin the material caught in the dust chambers never contains more than 5% tin, so the loss in dust is small; such loss never amounts to more than 2% of the tin charged to the furnace. The draft through the furnace is not particularly strong. The cassiterite does not decrepitate. All of the material which enters the furnaces is sufficiently heavy to be caught in water-concentrating machines. Under the conditions mentioned one would not expect to find in the flue dust much of a mineral which does not change either chemically or physically during its passage through the furnaces.

Trouble from Arsenic Condensation

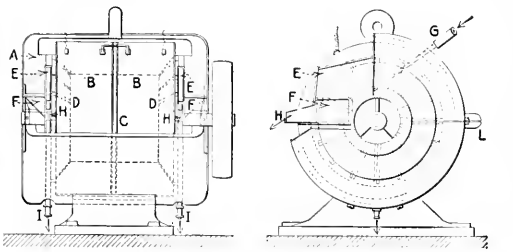
With the furnace installation as made at Llallagua there are some difficulties due to the fact that the design seems to have been made without a good knowledge of ores and conditions. Each of the furnaces is connected with the dust chamber by a sheet-iron pipe 80 cm. in diameter and 8 m. long. In the sulphide middlings treated there is always some arsenopyrite. During the roast a large part of the arsenic volatilizes as arsenious oxide. The sheet-iron pipe mentioned is of sufficiently low temperature to allow some of this arsenious oxide to condense, and every month there must be a cleaning of the pipe. Much of the arsenic fume passes the dust chamber and condenses in the exhaust fan. At present this fan has to be cleaned of the rock-hard oxide of arsenic once in every six weeks. We have installed two exhaust fans, one of which is always in operation. To drive the fan requires from 7 to 10 hp., depending upon the amount of arsenic that has been condensed, and this power costs at least 15 bolivianos per day (1 boliviano = approximately $0.39). With a stack of sufficient height, enough air could easily be obtained without the fan. The fan may be necessary for the regulation of air in sulphuric-acid making but is not needed in our roast and should not be installed at a place where power is so expensive. The cost of a proper chimney would be small as compared to the operating cost of the fan, and such a chimney will soon be constructed at Llallagua.

Stern Wet Magnetic Separators

The Stern type of separator is particularly adapted to the problem at Llallagua where the only material on which the magnetic machines are needed is the fine jig middlings and table concentrates. At the mines of Señor Patiño, in Uncia, there has recently been installed a large magnetic-separator plant using Humbolt-Wetherill machines; preceding these machines with screens such as might be found in a pyrite-blende separator in the United States.

The reason for the magnetic separators on the tin ores of Llallagua and Uncia is to do work which the mill could not easily perform. The mill did not complete the separation because classification was difficult on account of the fineness of the material. We can, therefore, see no reason for following the water end of the mills at Llallagua or at Uncia with another plant requiring classification and working poorly on fine ore. The gravity difference of two is sufficient to enable the mill to make a first-class separation of the cassiterite from the pyrite in the coarse ore. The wet separators used at Llallagua treat the whole product and work well on unclassified and fine-diameter feed.

A sketch of the Stern separator is shown herewith. The magnetic field is obtained by passing the electric current through the stationary coils *B* inside of which the iron core *C* revolves. Attached to the revolving iron core *C* are the flanges *D* which are beveled at the ends to concentrate the magnetic lines. The chambers *E*, in which the separation takes place, are between the revolving flanges *D* and the cast-iron body *A* of the machine. The roasted ore mixed with water, after passing a small sta-



STERN WET-TYPE MAGNETIC SEPARATOR

tionary screen to remove occasional large pieces which might clog spigot *I*, enters the separating chamber at *F* and is immediately subjected to the magnetic field. The nonmagnetic material, in this case the cassiterite, falls to the bottom of the separating chamber and passes out through the spigot *I*. That material of the feed which has sufficient permeability is raised above the water level of the separating chambers until finally it is hit by a stream of water from the jet *G* and is washed out of the machine through the spout *H*. To enable the stream of water from *G* easily to wash out the magnetic material, the field strength is lessened by having a segment cut out of the cast-iron body *A*. During the time the magnetic material is being raised out of the water the action of the lines of force, due to the revolving flanges, causes the material to turn over and over and gives good opportunity for entangled nonmagnetic particles to escape. The separating chambers are kept so full of water as to cause a constant overflow at *L* in order that the water may retard a rapid fall of the feed through the magnetic field.

Separators Require Little Power

The strength of the field may be easily varied by changing the strength of the current through the coils. Ordinarily at Llallagua about 6 amp. per machine is employed, the voltage being 110, which means about 1 hp. per machine. The revolutions of the flanges *D* may be increased or decreased, the effect being opposite to the same changes of the belt speed of an ordinary belt type of separator. The speed found best at Llallagua is about 11 r.p.m., but this can be varied according to the amount and class of the ore being treated.

The Stern separator occupies a floor space of 3½x3 ft. and the height from the entrance of the feed to the spigot *I* discharging the nonmagnetic material is 26 in. The capacity of the Stern separator on the fine-grained material treated is about 18 tons per 24 hr. Three separators can be used to handle the product from the five roasting furnaces, which leaves one separator always in reserve. The quantity of water needed for the separator varies with the amount and nature of the feed, it being necessary to have the water in the separating chambers always at the level *L*. Ordinarily about 2 cu.m. of water per hour are used with the feed to one machine and as much more for each separator to wash out the magnetic material.

The separators have given little trouble. About the only difficulty has been with the separating chambers. The side of the separating chamber next to the revolving flanges was, as supplied by the makers, made of steel containing enough nickel to be nonmagnetic, the idea being to have this necessarily nonmagnetic material sufficiently hard to resist the mechanical wear. In our ores there is always a little chalcopyrite and during the relatively low temperature roast some of the copper forms sulphate. The nickel-steel plates rapidly precipitated this soluble copper and the side of the separating chamber was soon destroyed, the wear being more chemical than mechanical. The nickel-steel has been replaced by copper plates and this trouble overcome. A separating chamber now lasts at least six months and can frequently be soldered to go a few months more.

Relation of Tin and Nonmagnetic Gangue

The most important point to take care of, if a *barrilla* rich in tin is to be obtained, is the relation between the tin and the nonmagnetic gangue in the furnace feed. If the percentage of nonmagnetic gangue is more than about one-fourth of the percentage of tin it is impossible to obtain 65% *barrilla* even if all of the iron mineral be removed.

The commercial results of the separator installation are good as compared with those obtained by the use of the old hand furnaces and buddles. With the hand furnaces the *barrilla* cost was about 1.90 bolivianos per quintal while the Kauffman-furnace magnetic-separator installation on the same material, produces a quintal of *barrilla* for 1.18 bolivianos.

The first cost of the Kauffman-furnace installation including the furnaces, freights, building, transmission, motor, fans, erection and all accessories was 160,000 bolivianos ($55,000) of which the total first cost of the furnaces in Europe was 24,000 bolivianos. The separator installation complete cost about 60,000 bolivianos ($21,000).

Three men per shift are required in the roasting department and three during the day to dry the ore and bring it to the furnaces. The separators use two men per 12-hr. shift although one man could do the work.

(*To be concluded*)

Superphosphate Is to Be Produced in the district of Slobodsk, Perm Province, Russia. The Department of Agriculture is aiding the local zemstvo in the enterprise.

Details of Practical Mining

Skip with Cable Guides

By Jesse Simmons*

A self-dumping skip operating on cable guides has been installed by E. R. Graham, superintendent of the Mogul Mining Co., Terry, S. D. The illustrations show the skip in dumping position at the top and a closer view with the skip hanging from the crosshead.

Dumping is accomplished by two hooks attached to the bottom of the skip, engaging a piece of 2-in. steel shafting that lies on the horizontal timber extending out to the left about half way up the headframe. Two bars

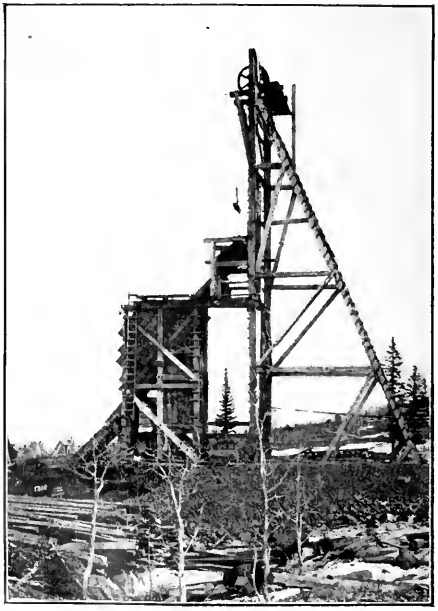


FIG. 1. SKIP IN DUMPING POSITION

are fastened to this shafting at right angles to it and are provided with hinge connections so that the shafting is pushed up and out of the way by the skip coming upward. The shafting immediately drops into position when the skip bottom has passed; the engineer then drops the skip on the shafting, which is a few inches to the side of the center of the skip and causes it to tip. The hooks then engage the shafting and prevent its falling. The lip of the skip drops over until it rests on a timber. After the skip has dumped the engineer pulls it up quickly; the hooks in disengaging cause the skip to swing, and while it is swinging it is quickly dropped past the shafting. It is then stopped for a second or so, until it ceases swinging and is then lowered to the station at the bottom to be loaded. The cable guides are ¾-in. steel ropes.

Channel iron, ½x6 in., was used for the crosshead, two pieces being bolted together, with wood between. At each end 1-in. holes were bored to permit the guides to pass through. From the crosshead the skip is suspended by two short pieces of cable. The guides are fastened at the top to the headframe and at the bottom pass through I-bolts in heavy sills. The skip has a capacity of 1,800 lb. of rock—the load of a single mine car. The engineer finds it comparatively easy to hoist 50 to 75 skips per 8-hr. shift, besides having time to

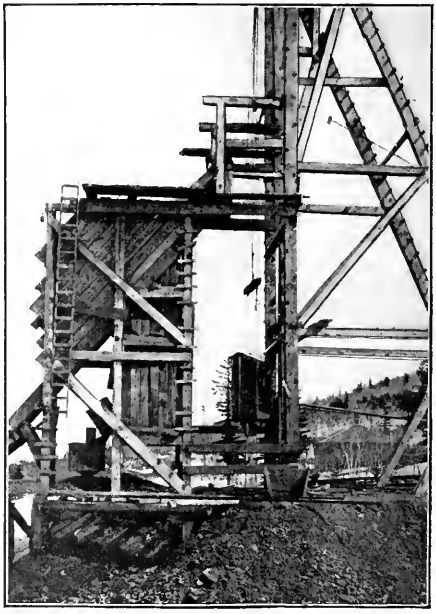


FIG. 2. SKIP READY TO LOWER

assist the blacksmith, repair the five or six stoping drills used underground and do other odd jobs.

The shaft is 135 ft. deep to the present loading station, and for the first 30 ft. only, is timbered with square sets; the remainder of the shaft is plank-lined. The rock is mostly a hard, firm shale, with some sandstone, lying nearly horizontal and having but a slight tendency to slough or cave. The shaft was sunk at a moderate expense, requiring considerably less excavation than if it had been planned to be timbered fully. It is one of the principal sources of ore supply for the company's mill. At the left in Fig. 1 may be seen a C., B. & Q. R.R. car being loaded for shipment to the mill. Waste is handled through the bin under which the mine car is seen standing. At present waste is used for stope filling.

*Deadwood, S. D.

The Bonus System Applied to Tunnel Driving*

The rapid advance made on some of the recent "record" tunnels, notably the Mount Royal, Arizona Copper, St. Louis Water-Works, Laramie Poudre, and Los Angeles Aqueduct, seems to have been due very largely to the bonus system of wages. This system was used at all the tunnels mentioned, and is the only practice of note that was common to those five contracts. Different types of drills, some with and some without carriage mountings, both long and short rounds, and different methods of handling the muck were used.

The cost of tunnel driving varies with the rate of progress. The saving realized by the bonus system in the labor cost is shown in the tabulation:

LABOR SAVING BY BONUS SYSTEM

	Per Cent.
Mount Royal Tunnel	15
Arizona Copper Tunnel	20
St. Louis Water-Works Tunnel	50
Laramie Poudre Tunnel	31

The cost of driving the tunnels during the record months under the bonus system has been compared with the cost of driving before the bonus system was adopted. Before considering the several projects separately the accompanying tables should be examined. Table 1 gives some general data as to character of rock, size of heading, etc., while Table 2 shows the approximate number of men at work.

TABLE 1. DATA OF TUNNELS WHOSE RECORDS ARE COMPARED

	Mount Royal Tunnel	Arizona Copper Tunnel	St. Louis Water-Works Tunnel	Laramie Poudre Tunnel
Rock	Trenton limestone with igneous dikes	Granite porphyry; good drilling	Both hard and soft limestone	Moderately hard, gray or red granite
Size of tunnel heading	8x12 ft.	8x8 ft.	8 ft. diameter (circular)	7½x9½ ft. (elliptical)
Average cross-section	3.56 cu.yd. per ft. advance	70.04 sq.ft.	95 sq.ft.	62 sq.ft.
Record advance in 31 days	810 ft.	790 ft.	745 ft.	653 ft.

TABLE 2. TOTAL LABOR ON TUNNEL CONSTRUCTION

	Mount Royal Tunnel	Arizona Copper Tunnel	St. Louis Water-Works Tunnel	Laramie Poudre Tunnel
Superintendents	2		1	1
Foremen or bosses	3	1	3	3
Drillers and helpers	24	12	24	15
Muckers	24	15	22	18
Miscellaneous labor of all classes	59	12	51	22

The bonus paid to the men at the Mount Royal tunnel was 7% of their daily pay for every foot over 14 ft. per day. The influence of the bonus system on the work at this tunnel is shown by Table 3.

TABLE 3. MOUNT ROYAL TUNNEL

Costs	A Typical Month Without Bonus	Record Month With Bonus
Labor	$9,980 00	$15,883 00
Equipment and supplies	2,927 00	4,750 00
Total, including overhead	13,916 00	21,633.00
Advance	434 00	810 29
Per foot (labor)	$23.00	$19 61
Per foot (labor, equipment and supplies)	29.76	25 47
Per foot (total)	32.06	26 70
Per cubic yard (labor)	6.48	5 51
Per cubic yard (total)	9.00	7 51
Saving (in labor) in cost per foot, by bonus system		3 39
Saving (in labor, equipment and supplies) per foot		4 29
Saving (total) per foot		5 39
Saving in total cost per cubic yard		1 50

At the Arizona Copper tunnel the men received regular wages, and for every foot of advance over 350 ft. per month a bonus of $7 was divided. This was only a trial, but although it was found that the bonus was excessive it was not reduced, as the duration of the test was short. The tunnel was driven the first month without a bonus and the three succeeding months with a bonus. A comparison of the advances and the costs per foot of tunnel in each case is shown by the figures in Table 4.

TABLE 4. ARIZONA COPPER TUNNEL

Costs	Without Bonus	With Bonus		
	First Month	Second Month	Third Month	Fourth Month
Labor	$3,773 00	$5,314 24	$5,802 69	$6,374 77
Equipment and supplies	2,013 33	2,013.33	2,013 33	2,013 33
Labor, equipment and supplies	5,786 33	7,327 57	7,816 02	8,588 10
Advance in feet	350	582	664	762
Per foot (labor)	$10 78	$9 13	$8 74	$8 63
Per foot (labor, equipment and supplies)	16 53	12 59	11 77	11 27
Cubic yards of rock removed, labor, equipment and supplies	6 33	4 82	4 51	4 32
Saving on labor, per foot, by bonus system		$1 65	$2 04	$2 15
Saving on labor, equipment and supplies, per foot		3 94	4 76	5 26
Saving on labor, equipment and supplies, per cubic yard		1 51	1 82	2 01

Three shifts per day were employed at the St. Louis Water-Works tunnel. A minimum advance of 72 ft. per week was set, and for all over that amount the following bonus rates were paid: Superintendent, 50c. per ft.; heading foreman, 50c.; muck foreman, 30c.; drill runners, 30c.; drill helpers, 20c.; nipper, 20c.; muckers and cage men, 10c. Each shift was credited with one-third of the extra progress and received one-third of the bonus.

TABLE 5. ST. LOUIS WATER-WORKS TUNNEL

Costs	Estimated Without Bonus	Cost per Day With Bonus
Labor	$381 75	$381 75
Total bonus per day		66 80
Advance, feet per week	72	745
Labor per foot	$37 09	$18 66
Labor per cubic yard rock removed	10 54	5.30
Saving in labor, per foot, by bonus		18 43
Saving in labor, per cubic yard, by bonus		5 24

Three shifts per day were employed on the Laramie Poudre tunnel. For the first part of the work each underground workman was paid a bonus of 25c. per day for each 25 ft. in excess of 400 ft. per month. This system was soon discontinued, as it was found to be not only cumbersome but excessively high, and the following system was adopted: When the rate of driving for any calendar month exceeded 400 ft. and was less than 500 ft., each underground employee was paid $10 extra; between 500 and 600 ft. the bonus was $15, and between 600 and 700 ft. it was $20. In order to distinguish the bonus money from the regular wages the bonus was paid by check. The itemized account is given in Table 6.

TABLE 6. LARAMIE POUDRE TUNNEL

Costs	Estimated Without Bonus	Cost per Day With Bonus
Straight wages	$242 65	$242 65
Total bonus per day		29 68
Advance per month in feet	400	653
Labor, per foot	$18 76	$22 94
Labor per cubic yard removed	8.16	5 60
Saving per foot due to bonus		5 82
Saving per cubic yard due to bonus		2 56

The bonus system at the Los Angeles Aqueduct tunnels proved to be a great success, and all tunnels here were driven under this system. The bonus was shared by the tunnel foreman, shiftboss, miners and muckers. All back-trimming was done by the crew, which shared the bonus. Overbreakage was about 30%.

The bonus varied from 20c. to 40c. per ft. over the base rate, depending on the class of material encountered. At the start it was estimated that a reasonable progress

*J. R. McFarland, 5710 Kimbark Ave., Chicago, Ill., in "Engineering News," Aug. 26, 1915.

would be 8 ft. per day with three 8-hr. shifts. A bonus system based on this advance gave 40c. per ft. in excess of the 8 ft. Thus it was expected that the monthly advance would not fall below 248 ft.; as a matter of fact, 10.8 ft. per day was averaged, giving a monthly progress of 330 ft. The standard tunnel crew consisted of 16

TABLE 7 DAILY COSTS, LOS ANGELES AQUEDUCT TUNNELS

Average daily progress	10.8 ft.
Average cost, direct charge	$51 10
Equipment	6 50
Pipe lines and operation	46
Roads, trails and maintenance	1 40
Buildings	1 49
Surveys	24
Division administration	2 12
Executive administration	1 92
Miscellaneous losses, test, phone, operation, etc	53
Grand total cost per foot of tunnel	$65 76

men in untimbered tunnels and 23 men in timbered tunnels. In dry tunnels miners received $3 per day and muckers and timbermen $2.50 per day; in wet tunnels each man received 50c. more per day. The itemized account is given in Table 7.

Track Ropes for Tramways*

There are two main types of rope which are used as track cables in aërial tramways—the spiral and the locked-coil construction. The main advantage of the spiral type is its cheapness, and in lines transporting a small tonnage per hour it will generally answer the purpose. When, however, a larger tonnage and the consequent heavier carriers enter into the question, its disadvantages begin to be apparent. The runner wheels passing over this type of rope come in contact with it only at one point of each of the top wires, whereby the wheels have grooves rapidly cut into them and the wires themselves begin to wear and commence to break. In order to overcome this difficulty, spiral ropes are generally made of a material having a higher breaking stress than that of the material used for locked-coil rope. A further disadvantage of spiral rope is that moisture penetrates between the individual wires and rusting occurs, thus shortening the life of the rope. Rope composed of several strands surrounding a hemp core is sometimes employed, but is not to be recommended as the individual wires are apt to break because of their small diameter. Spiral rope of the usual type should consist of 19 wires in ropes of 1 in. diameter and of 37 wires in ropes up to 1½ in. diameter.

Above 1½ in. diameter, locked-coil rope should invariably be used. To obtain the required diameter of the carrying rope, various makers employ different formulas. It may be obtained from the usual formula for the tension in ropes, but it has been proved by experience that much trouble is caused by breaking in consequence of the bending near the saddles, and for this reason many firms employ formulæ based upon stresses resulting from bending. The formula used by Pohlig, of Cologne, is:

$$\textit{Weight per meter of rope} = \frac{0.85}{100}[\textit{weight of carrier} + (\textit{distance between carriers in meters} \times \textit{weight of traction rope per meter})]$$

This is for spiral-construction rope. It works well for the small lines up to about 50 tons hourly capacity. For each additional five tons, 0.05 should be added to the factor 0.85. With locked-coil rope the factor 0.85 becomes 1.05.

The correct laying out of the profile for a ropeway can only be done after much experience; but a few points of importance may be mentioned. Although the rope really hangs in a catenary, it is the usual practice to assume the parabolic formula to obtain the dip of a rope; that is:

$$Dip = \frac{L^2 W}{8 T}$$

where

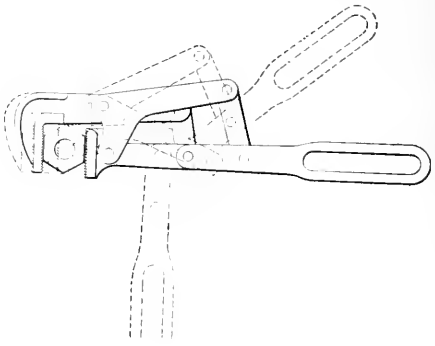
L = Span;
W = Weight per unit length;
8 = The constant;
T = The tension.

When the line is laid out on paper the curve of the rope obtained from this formula is set out and the supporting trestles placed accordingly. It sometimes happens in practice, however, that when the rope is fully tensioned, it floats or rises up from the supporting tower, perhaps because of a small error in the drawn profile. To avoid this, some makers employ a so-called factor of safety for the dip; that is, the denominator $8T$ is multiplied by a constant, the formula giving as a result a dip more than the actual. This factor may be taken at 1.5 for spiral rope and 1.1 for locked-coil rope.

* Abstract from "The Engineer" of July 23, 1915.

Hayward Pipe and Nut Wrench

The Hayward Wrench Co., of St. Louis, Mo., is manufacturing a new pipe and nut wrench, called the "Hayward," in which the wrench opens and closes by a link motion operated entirely by the pull on the wrench



LINK MOTION MONKEY WRENCH

in tightening or loosening the nut. By an ingenious application of this motion the face of the movable jaw remains continually parallel to the face of the fixed jaw. In the illustration the upper dotted line shows the position of the handle when the wrench is fully open, the full lines when it is gripping the nut shown, and the lowest dotted lines, the position when the jaws have met.

Peruvian Mines Employ Nearly 20,000 Men, according to the "Boletin" del Cuerpo de Ingenieros de Minas. Of these, over one-half are employed in the Department of Junin, in which are situated the important operations of the Cerro de Pasco Mining Co. and those of the Backus & Johnson Co.

Details of Milling and Smelting

Recent Progress in Pyrometry

A general review of progress in pyrometry is given by C. R. Darling (*Journ. Royal Soc. Arts*, p. 63, 1915; abstr. *Journ. Soc. Chem. Ind.*, June 15, 1915).

Since 1910 no pyrometers based upon new principles have been introduced, and the advances made have been confined to improvements in methods previously in use. The values now generally recognized for purposes of standardization are—Water, boiling point, 100° C.; aniline, boiling point, 184°; naphthalene, boiling point, 218°; tin, melting point, 232°; cadmium, melting point, 321°; lead, melting point, 327°; zinc, melting point, 419°; sulphur, boiling point, 445°; antimony, melting point, 631°; sodium chloride, melting point, 800°; silver, melting point in reducing atmosphere, 961°; gold, melting point, 1,063°; copper, melting point, graphite covered, 1,083°; lithium metasilicate, melting point, 1,202°; nickel, melting point, 1,450°; palladium, melting point, 1,550°; platinum, melting point, 1,755°; tungsten, melting point, about 3,000°; carbon arc, about 3,500° C.

Thermo-electric Pyrometers—Base metals have been used to a considerable extent for the construction of thermocouples. This has been so not only because of the comparative cheapness of such materials, but the fact that properly chosen base-metal couples develop a relatively high e.m.f. Kowalke has shown that base-metal couples are liable to alter if subjected to continued heating, and suggests that such couples should be "aged" by continued heating before calibration. Carbon and graphite couples have been used for temperatures exceeding 1,200° C. (Bidwell, *Phys. Rev.*, June, 1911). The potentiometer principle has been largely adopted for commercial instruments.

Few changes have been introduced in resistance pyrometers. Sir William Crookes has shown recently that platinum is measurably volatile above 1,000° C., and this explains why pyrometers give erroneous readings when continuously used for higher temperatures.

Charge Car at Midvale, Utah

In connection with the new mechanical-charging system for handling materials from stock bins to furnaces at the plant of the United States Smelting Co., Midvale, Utah, there are used three Brownhoist electric

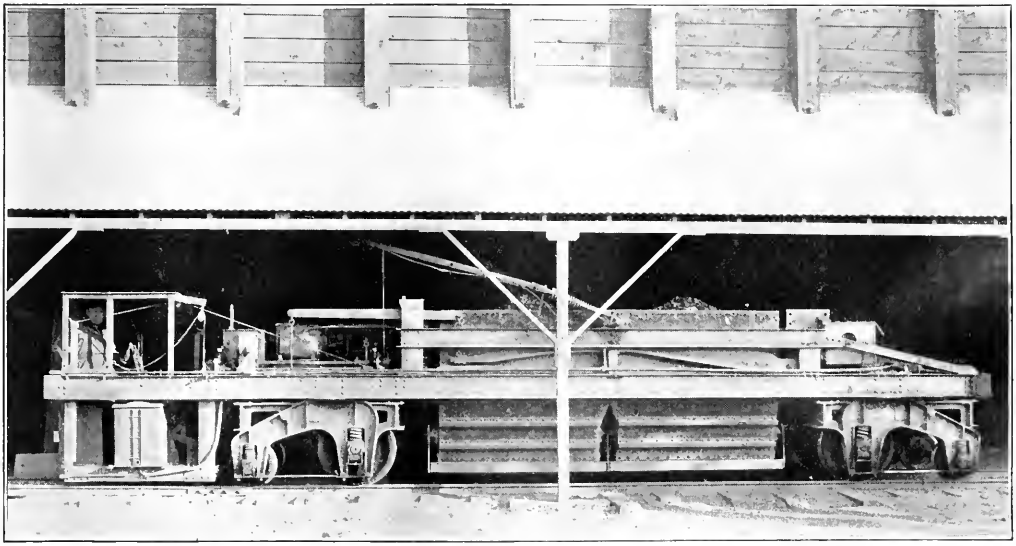


FIG. 1. BROWNHOIST LARRY COLLECTING CHARGE FOR LEAD BLAST FURNACES AT MIDVALE, UTAH

larries of the type shown in Fig. 1. The charge car is mounted on two four-wheel swivel trucks, each having one large pair of wheels and one pair of guide wheels, which permit the larry to be operated on sharp curves. A 19-hp. 500-volt direct-current motor drives the car at full load at a speed of from 600 to 700 ft. per min.

As will be noted in Fig. 2, the operator's platform contains, in addition to the scale beams for weighing the charges, the traveling and bin-gate-operating controllers and the foot brake. The car has a capacity of 120 cu.ft., and the charge is dumped into the furnace through drop-bottom gates. The hopper frame is suspended on scales, so that the weight of each class of material is shown on the scale beam on the operator's platform. The scales have multiple beams, such as are commonly used in mak-

ing up lead-furnace charges. Each beam is set for the exact amount of the certain kind of material wanted, and the operator allows this material to flow into the hopper until the beam balances.

The bins storing bulk materials, such as coke, lime rock, iron ore, roast, etc., are provided with belt gates, shown in Fig. 2. The bedded ores are drawn from the bins by means of the reciprocating arc gates shown in Fig. 3. The bin gates are operated by a 7½-hp. motor on the larry, the connection being made by means of gearing. When the larry, which was built by the Brown Hoisting Machinery Co., of Cleveland, Ohio, is stopped in the proper position beneath the gate, the operator by throwing a lever connects the gate mechanism with a motor on the larry. This operation simultaneously breaks the current through the travel motor, thereby making it impossible to move the car while it is connected to the bin-gate gear. A careful operator, with this traveling charge car, is able to make up the charge with the accuracy necessitated by the extreme sensitiveness of the lead blast furnace.

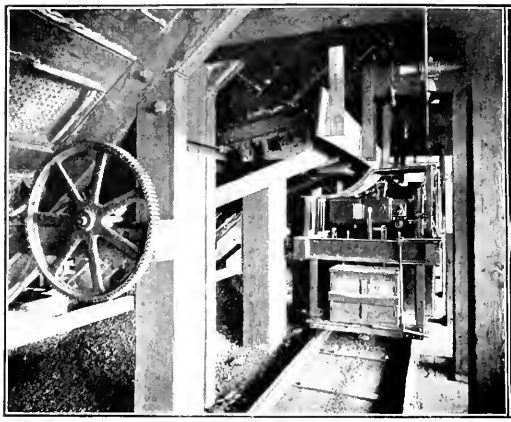


FIG. 2. BELTED BIN GATE OPERATED BY GEARING AND MOTOR ON CHARGING LARRY

FIG. 3. BEDDED-ORE BINS WITH ARC GATES ALSO OPERATED BY THE CHARGING LARRY

Ore Weighing at the Bunker Hill Mill

At the large concentrating mill of the Bunker Hill & Sullivan Mining and Concentrating Co., at Kellogg, Idaho, a total of about 1,250 tons of ore per day is handled. In consequence of the extreme care which is taken in this mill to secure the highest possible extraction, it is believed that accurate tonnage estimations of the material entering the mill are essential. In order to insure accuracy, a rather elaborate system of weight estimation and checking has been established.

The actual weights are obtained from a Blake-Dennison automatic weigher, which estimates the quantity of material passing over the inclined conveyor belt that delivers ore from the rockhouse into the mill bins. Ore is deposited upon this belt through four Challenge feeders driven by belts, so that the rate of feeding may be made to correspond with conditions.

In order that the weight obtained by the Blake-Dennison machine can be checked from time to time, a fifth Challenge feeder is installed, delivering at a rate equal to the combined rate of the other four. This machine is used only to check weights, and when it is put into use the others are thrown out. A box that holds about 800 lb. of ore is placed on a Fairbanks scale and its contents weighed accurately and then dumped into the Challenge feeder. While this is being fed onto the conveyor belt, the box is filled and weighed again, the contents then being thrown into the feeder. In this way the actual weight of the ore being fed to the belt can be obtained for a measured period and compared with the weight shown by the Blake-Dennison automatic weighing machine during the same time. So long as the automatic weigher checks within 50 lb. in 8,000, in comparison with the hand-weighed parcel of ore, no change is made, but if the error is greater the weighing machine is adjusted to read correctly. This checking is performed at intervals so that no risks will be run of errors in the weight of mill feed. The system is easily managed and insures correct estimation of the amount of ore handled daily by the mill. It is said that the weighing machine does not require frequent adjustment, but maintains its accuracy over long periods of time. The tests are made often to insure safety.

Prevention of Action of Ferric Iron on Copper Cathodes

The re-solution of cathode copper in a cell containing ferric salts is said by Lawrence Addicks to be greatly inhibited by aluminum salts (U. S. pat. 1,138,921). The conditions under which he operates are described as follows: Cu, 3%; ferrous iron, 3%; alumina, 3%; a little free sulphuric acid to prevent the formation of basic salts; current density, 13.5 amp. per sq.ft.; a temperature of 115° F.; and a circulation sufficient to hold the ferric iron at about 0.25%. Under such conditions a 70 to 90% current efficiency can be obtained.

The Assayer and Chemist

Electro-analysis of the Second Group Metals

In a paper read at the New Orleans meeting of the American Chemical Society, E. P. Schoch and Denton J. Brown elaborated on their earlier work on the electro-analysis of the sulphureted-hydrogen group of metals. Their earlier work showed that copper, tin, lead, bismuth and antimony can be determined accurately by electro-deposition out of acidified chloride electrolytes which contain suitable reducing agents such as hydroxylamine or formalin. The present paper asserts that copper, bismuth and antimony can be deposited simultaneously and can be separated from tin and lead; that tin and lead can be deposited simultaneously and separated from cadmium; that copper or bismuth can be separated from antimony by dissolving alloys of these metals in nitric acid plus tartaric acid and electrolyzing the solutions with a limited cathode potential; that bismuth phosphate can be precipitated quantitatively out of the same solution; that tin may be separated completely from lead by dissolving an alloy of these two metals in nitric acid plus potassium nitrate; and that silver in silver chloride may be determined by dissolving the latter in ammonia, adding ammonium nitrate and electrolyzing.

These facts are all combined in the following systematic procedure for the rapid electro-analytical determination of all the common metals the potentials of which are more noble than that of cadmium.

(A) Dissolve sample in hydrochloric acid or in *aqua regia;* an insoluble residue—silver chloride—is dissolved in ammonia plus ammonium nitrate, and the silver determined electrolytically.

(B) Treat solution *A* with hydroxylamine—mercury, gold and platinum will be precipitated.

(C) Out of filtrate *B* remove arsenic by distillation with hydrochloric acid, and determine arsenic iodometrically.

(D) Electrolyze retort residue *C*—copper, antimony and bismuth will be deposited with a cathode potential limited to 0.45 volts (against the normal calomel electrode).

(E) Dissolve metal deposit *D* in nitric acid plus tartaric acid, and precipitate bismuth as bismuth phosphate.

(F) Electrolyze filtrate *E* with a limited cathode potential—copper alone will be deposited. Antimony is obtained by difference.

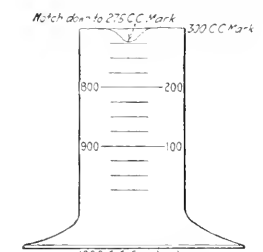
(G) Electrolyze residue *D* with a cathode potential limited to 0.7 volt against the normal calomel electrode: tin and lead will be deposited. Treat the deposit with nitric acid plus potassium nitrate: the solution contains all the lead and this metal may be deposited as lead peroxide, or the residue of tin oxide may be dissolved in hydrochloric acid plus hydroxylamine and the tin determined by electrolysis.

(H) Electrolyze residue *G* to obtain cadmium or other metals.

Assay of Cyanide Solutions, Lead Acetate Method

Many variations of the lead-acetate method for assaying cyanide solutions have been devised and published, most of them differing only in details. While all these methods will give good results, the majority of them require so many steps and so much time that it is apparent that they have never been tried out under practical working conditions in a busy laboratory, or that the writers intended them to be used only in experimental work where the chemist could devote his entire attention to a few solution assays.

The method described here was devised to meet the requirements of a laboratory where the assayer is called upon to run 10 to 20 solution assays daily in addition to 50 to 70 fire assays and perhaps a few leads, coppers, zincs, etc., and has no time to manufacture lead cones, wash the sponges numerous times, filter, scorify and what not, yet must obtain accurate results. No claim is made for any improvement in the chemistry of the assay. The advantage of the method lies in the speed with which a number of determinations can be made, due to the mechanical manipulations that will be described in detail. Briefly the assay consists of the following steps: Measuring out 10 a.t. solution, adding 30 c.c. lead acetate solution and 1½ to 2 grams zinc dust, heating, adding 50 c.c. hydrochloric acid, boiling, removing and squeezing the sponge, drying the sponge and cupelling.



APPARATUS FOR SOLUTION ASSAYING

The 10-a.t. charge is measured in the graduate shown in Fig. 1. A 1000-c.c. graduate is cut off at the 300 c.c. mark and a notch broken out of the rim down to the 275-c.c. mark, or thereabouts. The exact size of this opening can only be determined by trial and should be such that when the graduate is rapidly filled to the top the excess solution will flow out through the notch down to the 292-c.c. mark, surface tension holding the liquid above the bottom of the notch. The advantage of this graduate in saving time is apparent, no careful filling and pouring out to a certain mark being necessary. The solution is added rapidly and the excess drains off immediately, leaving exactly the right amount.

Solutions are usually brought to the assay office in beer bottles or the like. Time can be saved in pouring by

grasping the bottle with the hand inverted, turning the bottle over and at the same time giving it a quick rotating motion. The solution will then run out whirling, as water does down a drain, rapidly and with no gurgling.

The beakers are now placed on a hot plate. A beaker of 600-c.c. capacity, tall shape, is most convenient for a 10-a.t. charge, as it takes up less room on the hot plate, and the extra volume prevents the charge from boiling over when the acid is added. Lead-acetate solution 30 c.c. and 1½ to 2 grams of zinc dust are now added. A 250-c.c. graduate cut off at the 100-c.c. mark from the bottom is most convenient for measuring the acetate solution and hydrochloric acid. A quantity of the zinc dust may be kept in a pan or dish and dipped out with a spatula. After a trial or two the exact amount can be estimated. The addition of these two reagents takes but a minute for a number of assays. The acetate solution must be saturated. In order that a sufficient quantity of the solution be always on hand, two or more bottles should be prepared, the supernatant liquid from the oldest bottle being decanted when needed, and after the determinations are made all the bottles should be violently shaken to insure further solution of lead acetate. The bottles will then clear by the next day. When one bottle is empty it should be refilled and the next bottle in order used. As soon as the solutions on the hot plate come nearly to the boiling point, 50 c.c. HCl is added to each, and the solutions boiled until perfectly clear. The hotter the plate the quicker the solutions will clear, within reasonable limits of course. The sponge formed will cling together if the lead-acetate solution used was clear, and will usually float. This can be easily removed from the liquid by means of a 6-in. wood paddle, shown in Fig. 2, placed on an inverted spot plate and by a few squeezes between two paddles shaped into a cube, with nearly all moisture removed. If the spot plate is tipped up at a slight angle by means of a block of wood, as shown in Fig. 2, the liquid will flow off as it is squeezed out of the sponge.

The cubes of lead sponge are next placed upon the hot plate and thoroughly dried; the plate, however, must not be so hot as to cause lead globules to melt out of the sponges. After drying, which takes but a few minutes, each sponge is wrapped in a piece of lead foil about 1½ in. square and is then ready for cupelling.

It will be observed that the time required for measuring the solutions, adding reagents and preparing sponges for cupelling is reduced to a minimum. While the solutions are boiling the assayer can be busy with other duties, getting the sponges ready for cupelling when all the other cupelling is done. Hence a number of solution assays can be run with little expenditure of time and with little attention. The results too are all that can be desired of the average solution assay. Even traces of metals are easily saved, and the duplicates check remarkably well.

*

Cupellation Losses

According to a recent investigation by W. J. Sharwood (*Trans.* A. I. M. E., August, 1915), cupellation losses on silver or gold buttons of different weights, run under identical conditions, closely follow this rule:

$$y_1 \text{ (weight lost)} = cx^{\frac{5}{6}}$$

$$y_2 \text{ (percentage lost)} = cx^{-\frac{1}{6}}$$

where c is a constant to be determined by running a proof and x is the weight of the button. The bearing of this is: If c be determined by a proof, in a muffle where there are buttons of varying weights, then a correction can be calculated for all the various-sized buttons from the one known case.

*

Making Up Standard Permanganate Solution*

It is well known that a $KMnO_4$ solution freshly made with the usual distilled water of an industrial laboratory precipitates MnO_2, thus changing its strength. Instead of endeavoring to prevent this I help it along as nearly to completion as possible and find our finished solution does not change more than the contraction and the expansion due to changes of temperature alter it.

The procedure is as follows: Weigh out the amount of $KMnO_4$ necessary to make the solution somewhat weaker than the desired strength (enough weaker more than to compensate for some incidental evaporation later on). Put the solution into a number of large flasks and place them on the steam plate. Make another solution in the same way, but much stronger and much less in volume; place this also on the steam plate and keep both near the boiling point for some time—two days if possible.

The reactions that precipitate MnO_2 will be practically completed, and no water may thereafter be added to either solution. Filter both solutions separately through filters made of prepared asbestos spread over broken glass in a large funnel or percolator. Then determine their strength precisely and measure the weaker solution carefully.

Add to the weaker solution a sufficient amount of the stronger to bring the strength up to the desired factor. This amount is determined by the following formula:

$$n = \frac{m\,(a - c)}{c - b}$$

in which

m = Number of cubic centimeters of the weaker solution;
a = Factor of the weaker solution;
n = Number of cubic centimeters of the stronger solution required;
b = Factor of the stronger solution;
c = Factor of the desired solution.

By substitution n is obtained. Add this amount of the stronger solution to the weaker and mix thoroughly. Determine the strength of the resulting solution. A correction is seldom necessary. Its factor is exactly what is wanted and its variation practically negligible.

I have always kept my $KMnO_4$ solution in a carboy painted black. I do this by tradition, but as to whether it is really necessary I have some doubt. A carboy of $KMnO_4$ solution lasts about a year, and one carboy showed the following variation in its iron factor as shown by testing with sodium oxalate furnished by the United States Bureau of Standards: 9-17-13 = 0.002807; 10-27-13 = 0.002808; 1-4-14 = 0.002800; 4-22-14 = 0.002790.

The method is widely applicable. It can be used to advantage in making standard alkali solutions for phosphorus determinations in iron and steel. In this the carbonic acid may be precipitated with excess Ba $(OH)_2$ and the supernatant solutions used.

*From an article by H. E. Moyer in the "Chemist-Analyst."

Refining Cyanide Precipitates

By H. T. Durant*

SYNOPSIS—Ordinary methods of acid treatment of cyanide precipitates fall short of the desired results because all the impurities are not removed. The methods pointed out in this article enable the practically complete removal of foreign substances and the production of high-grade bullion.

The mixed product that results from the usual clean-up in cyanide plants consists, before any acid treatment and apart from gold and silver contents, of two classes of constituents. The first class includes those substances which are, or could be, rendered soluble with the aid of sulphuric acid, though not necessarily under the conditions which are possible at cyanide plants; and the second class includes those substances which could not be rendered soluble by these same means.

Separation of Impurities

The group of substances that are soluble in sulphuric acid consists principally of zinc metal and compounds, copper metal and compounds, and iron and its compounds. There are, besides, various complex cyanides, ferrocyanides, and other elements which occasionally exist in various combinations and quantities, such as magnesium, aluminum, nickel and tellurium.

The group of substances insoluble in sulphuric acid consists principally of sand, calcium carbonate, calcium sulphate, lead and its compounds, and carbonaceous matter. Of these substances sand is usually present as a result of defective filters or of atmospheric dust. Both of these causes can be guarded against and therefore the amount of sand present can be kept down. Calcium compounds cannot always be so easily kept low. Lead, apart from being a more or less regular constituent of zinc, has often to be used to aid the precipitation work. Carbonaceous matter is also present in zinc to a slight extent. It is evident that if everything which is theoretically soluble in sulphuric acid were actually so, there would remain for smelting very small quantities of impurities after acid treatment. The general analysis of the slimes before and after acid treatment, and also after the drying or calcining that follows the acid treatment, is pretty well known to operators.

Usual Acid Treatment Incomplete

As a rule there remains after acid treatment a large proportion of substances belonging to the first class. This is evident from the base metals in the bullion produced, also from a rough, pocket-lens examination of the slimes after acid treatment and calcination.

The fact that certain complex cyanides are not affected by the acid treatment is shown by the ammonia given off during the subsequent calcination. It is easily seen by a small-scale experiment that material which has been acid treated and calcined will usually, by further acid treatment, yield in a soluble condition more of the substances of the first class. This further acid treatment has of course been rendered effective by the calcination (oxidation) which has converted sulphides into sulphates or oxides, and insoluble cyanides into soluble compounds. Beyond this, any metallic zinc that during the first acid treatment might have been protected by lead or copper or the sulphides of these metals, will be oxidized during calcination or otherwise prepared for further acid treatment.

The ordinary acid treatment is generally carried out in a lead-lined tank fitted with a water-seal cover, gas-escape pipe, steam-heat attachment and mechanical agitator, or in some apparatus that answers the same purpose. In any case the efficient agitation is most important, as all the material that is to be acid treated should be kept well in motion.

As this acid treatment proceeds the increasing amount of fine slimy material formed will tend more and more to protect material from the action of the acid, and therefore efficient agitation, even to the point of attrition, becomes more and more important. When the ordinary acid treatment has been finished so that practically no further action takes place and the slimes are still in the acid-treatment tank, any substances of the first class which remain can be removed by the procedure that I shall outline; and any lead or lead compound that may also be present can be turned into sulphate so that it will not appear in the final bullion bar.

Removal of Residual Impurities

First of all decant or filter off as much as possible of the well-settled zinc solution, leaving all the slimes in the acid-treatment tank; then run in fresh water till the total weight of water is about five times the assumed dry weight of the slimes in the tank. While continuously and thoroughly agitating, add separately strong sulphuric acid (whatever strength is available) and then bichromate of potassium previously dissolved in as little hot water as possible. It is better while this treatment is going on to keep the contents of the tank heated. These two chemicals are always required in the proportion of 2½ lb. of actual sulphuric acid (or say 4 lb. of 66% acid) to each pound of solid bichromate of potassium. The actual total amount of acid and bichromate to be used will naturally depend on the quality of the slimes in the tank; but each addition of say 10 lb. of sulphuric acid (or 16 lb. of 66% acid) will be followed by 4 lb. of bichromate of potassium dissolved in as little hot water as possible.

Three or four minutes after adding the bichromate a small sample of filtered solution from the tank can be tested for chromic acid by well-known tests or it may be evident from the color of the filtered solution. When chromic acid is present and persists for a minute or two the acid treatment is finished, but until this persistence of chromic acid in the solution is obtained it is necessary to continue the addition of sulphuric acid and bichromate as described. When treatment is finally finished, the slimes, after very thorough water washing, are collected and dried in the usual way and are then ready for smelting.

It has been found that a small-scale trial in a glass flask will show in a few minutes the alteration, if any, when the treatment with acid and bichromate follows the ordinary acid treatment. This treatment with acid and

*Mining engineer, 3 London Wall Buildings, London, England.

bichromate should not be carried out until the ordinary acid treatment has been worked to a finish, as previously described. Salt or hydrochloric acid should not be used either in the ordinary acid treatment or in the subsequent acid and bichromate treatment. After treatment with acid and bichromate the slimes will settle well without any of the usual aids, such as glue and alum.

Some Alternative Practices

Instead of bichromate of potassium there could be used the same weight of bichromate of sodium. Similarly, permanganate of potassium or sodium in calculated equivalent quantity could be used, but it is not so satisfactory for several reasons. If the treatment with acid and bichromate is carried too far the only trouble is that silver will begin to be dissolved, although this can be recovered from the solutions if necessary. The finished slimes are heavy and after slight heating, in order to dry them thoroughly, will generally appear as annealed gold, and sometimes will show the gold color even before heating.

Unless much sand is present no flux other than borax glass is required; it is well, however, always to add a little niter to oxidize any small amounts of carbonaceous matter that may be present. The finished slimes must be smelted in a clay crucible. They must not be put in a plumbago crucible and should not be in contact by stirring or otherwise with plumbago or any reducing agent during or before smelting; otherwise a mixed lead matte may be formed. The final bullion should be practically free from zinc, lead and copper. The extra cost for acid, bichromate and labor in this work will be more than compensated for by the decreased cost of fluxes in the smelting; by the fact that no light, dusty slimes will be handled; by the saving of time, labor, and fuel in the smelting; and by decrease in the amount of slag produced. Practically all the bullion will be obtained at once in the bars.

Nevada-Douglas Mill Running

The furnace for the manufacture of nitric acid at the leaching plant of the Nevada-Douglas mill at Ludwig, Nev., started Aug. 30 and the crushing of ore in the new mill at Ludwig commenced Sept. 2, according to the Yerington *Times*. The mill is about completed, though the furnaces and driers are not yet fully installed and some additional tanks will be built. A force of 10 masons is rushing to completion the Wedge furnace, which will treat 250 tons of ore per day. The oxidized-ore yard, which will accommodate 2,500 tons, is also built and ready for receiving the ores now passing through the crushers.

The repair work at the mines is all done, and as soon as the mill and furnaces are completed a force of probably 100 men will be put to work in the mine, largely increasing the number now employed. There are about 100 men on the leaching plant finishing the mill, tanks and furnaces and installing the remaining machinery. At first it is expected to treat from 200 to 300 tons per day, and then as soon as the present plant is finished to increase the tonnage to 500 tons per day. As the mill capacity can be run up to 750 tons per day the leaching capacity will be increased by adding another unit to meet the requirements of the mill.

Australian Zinc Contracts

During the week of Sept. 4, the Zinc Corporation made a further attempt in the High Court to obtain a decision on the effect of the war upon its contract with Aron Hirsch & Sohn, of Halberstadt, Germany, says the *Mining Journal* of London.

It will be remembered that on a previous occasion the plaintiffs were nonsuited, but since that date legislation has been passed providing for the representation of enemy parties in a suit. The facts of the case are, shortly, that the Zinc Corporation, by an agreement dated Sept. 14, 1908, agreed to deliver 355,000 to 385,000 tons of zinc concentrates in certain quantities from their works at Broken Hill to the defendants. At the time the contract was entered into the company was registered in Victoria, but in July, 1911, it was incorporated in England. The Australian Government has, since the war, by the Enemy Contracts Annulment Bill, terminated these contracts. The English Government, however, has up to the present taken no such step, and on the result of the action now proceeding, in which a decision will no doubt be sought in the House of Lords, eventual action by the British Government will probably depend.

The most material clause in the contract, numbered 17, provided as follows: "In the event of any strike, lockout, combination of workmen, interference of trade unions, suspension of labor, whether partial, local, or general, and from whatsoever cause arising, floods, storms, fire, stoppage of water supply, washaways of railways, accidents, acts of God, force majeure or perils of the sea, breakdown of machinery, or inability of the Silverton Tramway Co. to provide the necessary trucks for taking away the concentrates, or in the event of any cause beyond the control of either the sellers or the buyers preventing or delaying the carrying out of this agreement, then this agreement shall be suspended during the continuance of any and every such disability."

Mr. Gore-Browne, K. C., on behalf of the company, argued that the agreements had not been merely suspended in the terms of this clause, but had been entirely abrogated as involving commercial intercourse with the enemy. Such intercourse, where one of the parties was an alien enemy, was prohibited as illegal. Therefore the contract under which those transactions took place was itself rendered illegal and void. It would be an utterly unreasonable view for the court to take that the plaintiffs must sit down and wait for the end of the war for the rights under the contract to revive. Suppose Germany carried on the war for 20 years, and history repeated the Napoleonic wars, were all these transactions to be open to enforcement then? A contract which tended to the advantage of the enemy country or was prejudicial to the interests of this country was prohibited. The contract here was detrimental to the interests of this country, because it altogether prevented the plaintiffs from selling zinc concentrates during the period of the war. It was important that this country should have a large supply of spelter for the manufacture of munitions of war. If the contract was merely suspended during the war it would be impossible for the plaintiffs to sell their zinc concentrates to persons other than the defendants, because no one would expend large sums in the erection of refining works unless it was certain that the supply of zinc concentrates would be continued after the war.

It was clear, on looking at the details of the agreement, that it was not intended that the whole of the agreement should be suspended under clause 17, but only the making and taking of deliveries should be suspended, and therefore as something had to be done under the contract during the war which involved commercial intercourse with the enemy the contract was dissolved. Further, war was not one of the causes within clause 17 which gave the right to suspend the contract. Force majeure meant something of a physical nature which prevented the contract from being carried out, and it did not include war. The words "any cause beyond the control of either the seller or the buyer preventing or delaying the carrying out of this agreement" must be construed as ejusdem generis with the causes previously mentioned, and did not include war, which was a totally different cause. He submitted that the contract came to an end, vested rights under the contract alone being enforceable after that date.

On behalf of the defendants, Mr. Compston, K. C., submitted that the outbreak of war was an event which was not so different from the events mentioned in the clause as suspending the fulfillment by either side of contractural obligations that it could not apply to this case. During the war there was necessarily a suspension of some of these obligations, but it was not contrary to public policy for a contract made before the war to provide that after the war trading

should be resumed with persons who in the interval had become alien enemies. The defendants denied that the zinc concentrates purchased in Australia were imported into Germany to be there smelted. They were imported to and smelted in England, France, and Belgium, and only a small proportion went to Germany. All past consignments were not freed from the conditions of the contract, and although payment could not be demanded until there had been an adjustment of the invoices such an adjustment did not involve prohibited commercial intercourse between the seller and the purchaser.

On Sept. 7 decision was delivered against Aron Hirsch & Sohn by Mr. Justice Bray, according to the London *Financial News*, which says:

Giving judgment, his Lordship said that when war broke out the defendants, to whom the whole of the plaintiffs' output of spelter was to be sold, according to the agreement, became alien enemies, and they at once told the plaintiffs that they would discontinue the acceptance of any more spelter until the end of the war. The Zinc Corporation now contended that the outbreak of hostilities rendered the performance of the contract by them illegal, and the defendants, on the other hand, submitted that the delivery of the spelter was merely suspended until the war was over.

His Lordship said the questions were: Was war to be one of the causes of the suspension of the contract, and what was the meaning of the words "shall be suspended"? The court could not substitute for an agreement made between the parties another agreement minus one of its terms. The difficulty was that an event had arisen which was not contemplated when the agreement was entered into, and, after having given careful consideration to the clauses and all the circumstances of the case, he had come to the conclusion that the contract should be declared to be dissolved as from Aug. 4, 1914, when war broke out. Plaintiffs would be absolved from the obligation to supply the goods to defendants without prejudice to the defendants' rights to take proceedings for alleged breach of contract by the plaintiffs before that date.

Judgment was entered accordingly for the plaintiffs with costs. The defendants intimated that they would appeal.

Shortage of Metals in Austria

According to a Reuter dispatch from Zurich, dated Sept. 5, a highly significant admission of the growing shortage of war metals in Austria is contained in a semi-official communiqué from the Central Metals Organization, which was established jointly by the Government and the Ministry of War for the purpose of obtaining metals for the manufacture of munitions. The communiqué frankly states that hitherto the Organization has never appealed to the public because it has been obtaining all necessary supplies from wholesale quarters, but that since the latter are now exhausted it is forced to invite the public to sell voluntarily their metal goods rather than force the authorities to requisition them. All owners of articles composed of pure nickel, copper, brass, and bronze are directed to sell them forthwith to the Metals Organization. This applies to merchants and dealers as well as private persons.

This seems to lend color to the Italian charge that the great bronze statue of Dante at Trent has been broken up and remelted.

Asphalt in Honduras

Asphalt has been found in Honduras, according to a report from Special Agent G. Harris to the Department of Commerce. The discovery is on the west coast, in the vicinity of Juticalpa. Prospects uncovered for over 450 ft. show the bed to be of great purity, and there are outcroppings for several miles. The discovery was made by an American citizen resident in Honduras, who has the control of the property. It is considerably distant from the Pacific port of Amapala, which will have to the port of shipment, but is on the line of a new mode road the Government of Honduras is preparing to construct, so that motor transportation will soon be available, and it is not greatly distant from the logical line of the contemplated railroad from Amapala to the interior.

Clifton-Morenci Strike

More than 8,000 miners, about one-half of them Mexicans, are on a strike in the Clifton-Morenci district for higher wages. The strike, which became general Sept. 12, has tied up the mines of the district, and serious trouble is threatened by the Mexican element involved in the strike.

The Mexican miners were receiving from $3 to $3.50 a day, and the more skilled American miners received wages running to $5 a day. The companies refuse to grant the demand for more pay.

Agitators of the Western Federation of Miners have been in the district for weeks stirring up the men, and it is said Mexican agitators have also been appealing to the prejudices of the Mexican miners.

The *Boston News Bureau* prints the following under date of Sept. 21:

"Entire plants of the Arizona, Detroit and Shannon copper companies in Clifton, Morenci and Metcalf have been formally turned over to Sheriff Cash of Greenlee County for protection.

"Sixty-five to seventy deputies are posted to guard the mines and smelteries, which are also heavily picketed by strikers. No attempt will be made to operate. At mass meeting strikers ratified committee of nine named to treat with companies. Two representatives of the companies were present at meeting. Companies posted notices they were willing to treat with the men, but could not recognize Western Federation miners. Situation quiet and no trouble is anticipated. Strikers are confident of victory and companies are equally determined."

Ontario Mineral Production in First Half of 1915

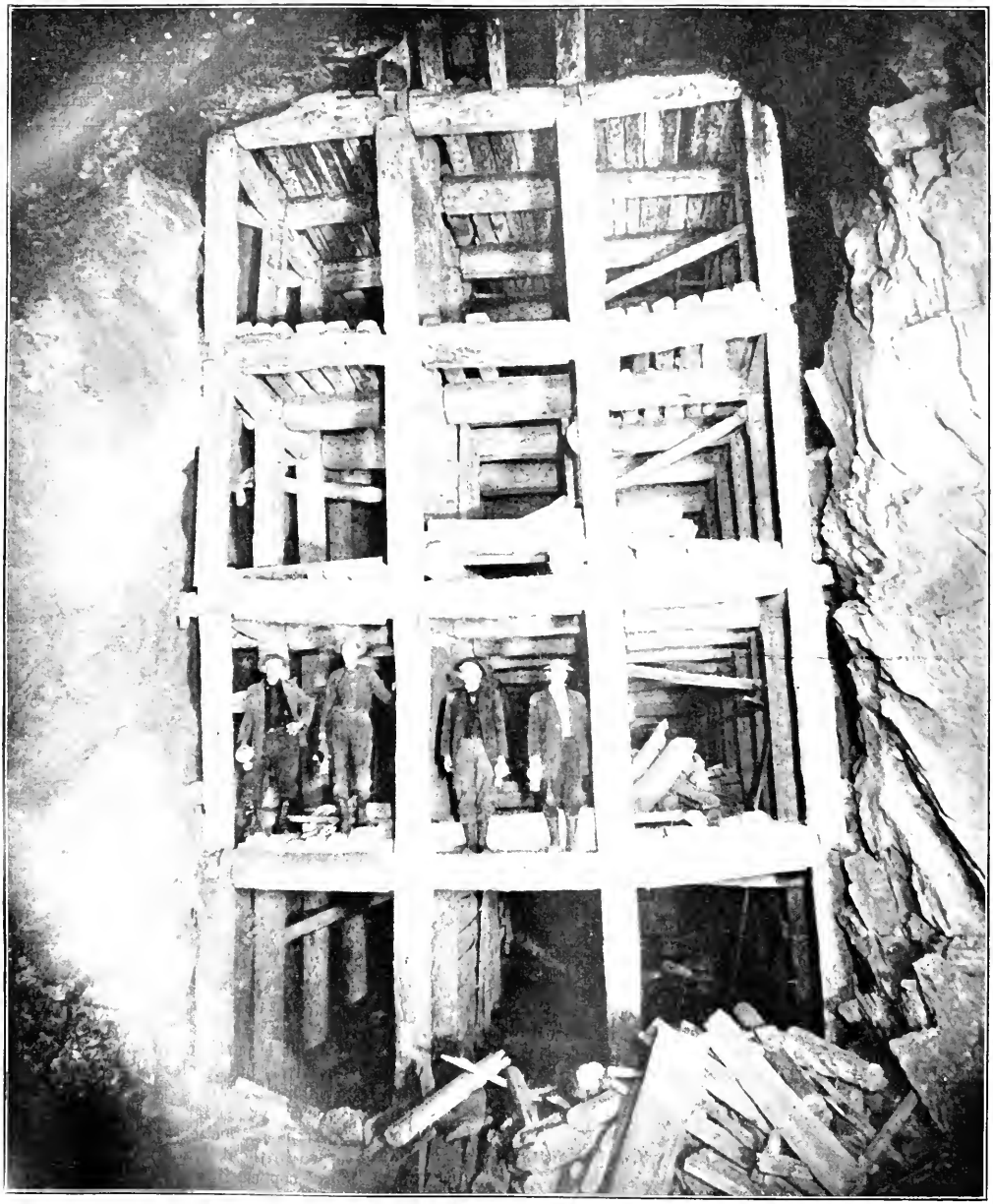
The Bureau of Mines report for the first six months of 1915 states that the output of gold for Ontario during that period was $3,530,072, as compared with $2,011,069 for the corresponding period of the previous year. Of the total yield for the period under review $2,267,620 came from Porcupine. Promising developments are in progress in other fields, particularly in the Kirkland Lake district. The Goodfish Lake section is also being developed, and ore of remarkable richness is being taken from the Dobie mine in Monroe township.

The diminution in the output of silver continues, the value of the output for the period being $5,188,763, as compared with $7,053,418 for the same period in 1914. The falling off in value is partly due to the lower prices being obtained for silver, but is also largely due to the exhaustion of the high-grade ore from the mines.

The output of nickel is the highest ever recorded, but on the basis of present production the amount will be considerably exceeded in the second six months of 1915.

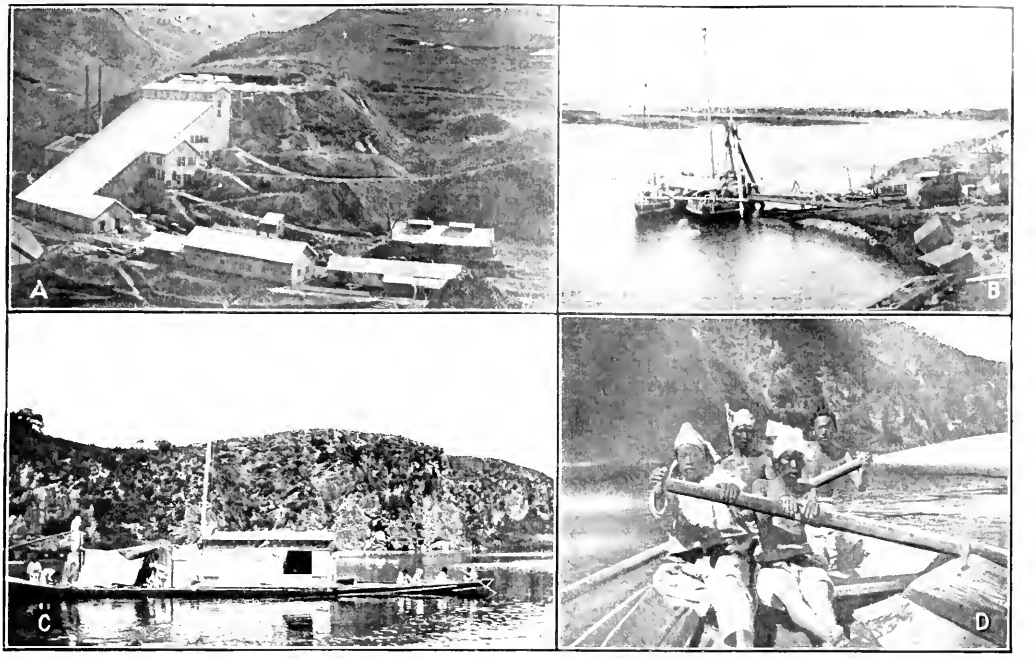
The production of copper, iron ore and coal showed slight increases, while pig iron and cobalt-nickel oxides showed a decline.

Photographs from the Field



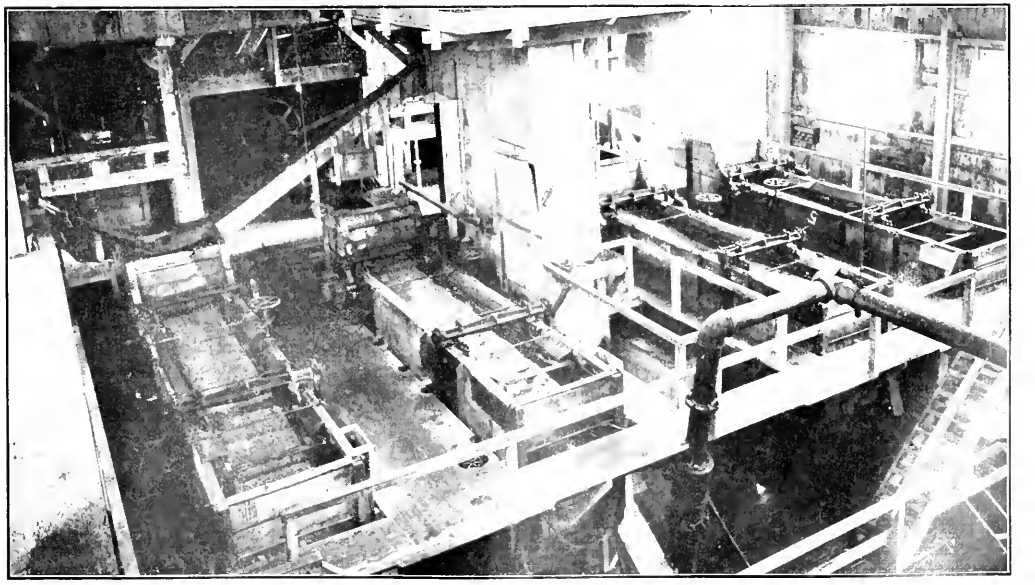
STOPE IN THE HOMESTAKE MINE, LEAD, S. D.

This photograph shows the [illegible] of the stope, together with the system of timbering used in such cases



OPERATIONS OF THE SEOUL MINING CO., HOLKOL, CHOSEN

A—Suan 200-ton mill. B—Unloading heavy machinery at main electric station. C—Houseboat used in traveling on Tai Dong River. D—Motive power of the native freight boats.



JIGS AT THE WASHOE CONCENTRATOR

Hancock jigs in the remodeled section, No. 1, of the Washoe concentrator at Anaconda, Mont., of the Anaconda Copper Mining Co.

Precious-Metal Production in the United States

A memorandum of the revised statement of gold and silver production in the United States in 1914 was given in the *Journal* of Sept. 4. The full statement of production by states as apportioned by the Director of the Mint and the Geological Survey is shown in the table herewith. The figures for gold are the value; for silver the quantity in fine ounces.

	Gold: Value		Silver: Fine Oz.	
	1913	1914	1913	1914
Alabama	89,200	$12,300	100	300
Alaska	15,201,300	16,547,200	366,700	865,900
Arizona	4,104,400	4,568,900	3,912,000	4,439,500
California	20,241,300	21,251,900	1,421,500	2,020,800
Colorado	18,109,700	19,962,400	8,989,700	8,804,400
Georgia	13,300	16,800	100	100
Idaho	1,244,300	1,187,200	9,477,100	12,573,800
Illinois			2,300	1,900
Maryland	700	200		100
Michigan			333,700	415,500
Missouri			38,900	60,400
Montana	3,320,900	4,143,600	12,540,300	12,536,700
Nevada	11,977,100	11,536,200	15,657,400	15,877,200
New Mexico	892,000	1,219,100	1,666,900	1,771,300
North Carolina	115,200	130,300	1,700	1,500
Oklahoma			800	6,200
Oregon	1,477,900	1,589,400	172,200	147,400
South Carolina	4,100	3,200		
South Dakota	7,211,200	7,334,000	172,600	179,800
Tennessee	7,700	6,400	109,000	102,800
Texas	200	8,800	429,800	574,700
Utah	3,570,300	3,377,000	11,282,300	11,722,000
Virginia		300	200	1,500
Washington	657,500	587,800	218,700	341,300
Wyoming	17,500	6,700	1,200	100
Continental United States	$88,176,100	$93,429,700	$66,796,200	$72,444,800
Porto Rico	1,100	2,800		
Philippines	707,200	1,099,300	5,300	10,300
Totals	$88,884,400	$94,531,800	$66,801,500	$72,455,100

California was the leading gold producer in 1914, Colorado second, Alaska third and Nevada fourth. A second group of large producers included South Dakota, Arizona, Montana and Utah. The eight states named produced 93.8% of all the gold won in the United States.

In 1914 Nevada was the chief silver producer, Idaho being second, Montana third and Utah fourth. A second group included Colorado, Arizona, California and New Mexico. None of the other states produced as much as a million ounces of silver.

Michigan Iron Lands at Auction

SPECIAL CORRESPONDENCE

The holdings of the Pittsburgh & Lake Angeline Iron Co. were sold at public auction at Ishpeming, Mich., on Sept. 15. The Cleveland-Cliffs Iron Co. bid in the Lake Angeline mine for $27,000. Only other bidder was the Jones & Laughlin Ore Co., which bid $26,500. This is believed to be a remarkably low price for the mine, building, machinery and 60 dwelling-houses. The tract comprises 700 acres. The Mitchell property, three miles south of Ishpeming, sold for $2,000. Other small tracts, none of which contain mineral, were sold for low prices. The entire holdings did not bring $35,000. The Cleveland-Cliffs Iron Co. has not decided what will be done with Lake Angeline, but it is believed that the little ore in sight will be mined, and exploratory work carried on. The property lies between the Lake and Salisbury mines of Cleveland-Cliffs, and it is believed that chances of locating other high-grade leases are good. The land contains about 2,000,000 tons of low-grade ore, which is not in demand at this time. The Mitchell also has considerable low-grade ore, with some better grades at depth. The Mitchell stopped working several years ago when the Oliver Iron Mining Co. closed its Sect. 21 mine. The Oliver company was pumping the Mitchell water at that time, and the Lake Angeline company did not care to go ahead and install pumps and take care of the heavy flow.

American Institute of Mining Engineers, San Francisco

EDITORIAL CORRESPONDENCE

The American Institute of Mining Engineers began the 111th meeting in San Francisco on Sept. 16 at the Bellevue Hotel. The meeting was opened by C. W. Merrill presiding, and an address of welcome on behalf of California was delivered by Gov. Hiram Johnson. President Saunders replied to the Governor's welcome on behalf of the Institute, and the technical work of the sessions was begun by the presentation of a paper on "Underground Mining Systems of Ray Consolidated Copper Co.," by Lester A. Blackner. This was followed by a paper on "Some Problems in Copper Leaching," by L. D. Ricketts; "Notes on Homestake Metallurgy," by Allan J. Clark; and the "Metallurgy of Gold in the Witwatersrand District, South Africa," By F. L. Bosqui.

The afternoon was occupied by two sessions in separate apartments. The Gold and Silver session was presided over by F. Lynwood Garrison. The following papers were presented: "Mill and Cyanide Plant of Chiksan Mines, Korea," Charles W. DeWitt; "Electric Furnace for Gold Refining at the Alaska-Treadwell Cyanide Plant," W. P. Lass; "Cyaniding Practice of Churchill Mining Co., Wonder, Nev.," E. E. Carpenter; "Zinc-Dust Precipitation Tests," Nathaniel Herz; "Recovery of Mercury from Amalgamation Tailings, Buffalo Mines, Cobalt," E. B. Thornhill; "Slime Agitation and Solution Replacement Methods, West End Mill, Tonopah, Nev.," Jay A. Carpenter; "Amalgamation Tests," W. J. Sharwood; "A Rule Governing Cupellation Losses," W. J. Sharwood; "Tonopah Plant of the Belmont Milling Co.," A. H. Jones. The session on Geology and Mineralogy was presided over by James F. Kemp. The following papers were presented: "Geology of the Iron-Ore Deposits In and Near Daiquiri, Cuba," James F. Kemp; "Formation and Distribution of Residual Iron Ores," C. L. Dake; "Occurrence of Covellite at Butte, Mont.," A. Perry Thompson; "Formation and Distribution of Bog Iron Ores," C. L. Dake; "Geology of the Burro Mountains Copper District, New Mexico," R. E. Somers; "Additional Data on Origin of Lateritic Iron Ores of Eastern Cuba," C. K. Leith and W. J. Mead; "Method of Making Mineralogical Analysis of Sand," C. W. Tomlinson; "Formation of the Oxidized Ores of Zinc from the Sulphides," Y. T. Wang; "Copper Deposits of San Cristobal, Santo Domingo," Thomas E. Donnelly.

For the remaining period of the convention the technical program provides for a session on electro-metallurgy, in conjunction with the American Electro-Chemical Society, to be presided over by Lawrence W. Addicks, president of the latter society; a session on Petroleum and Gas, Arthur F. L. Bell presiding; a session on Mining, Milling and Non-ferrous Metallurgy, Karl Eilers presiding; a session on Iron and Steel, Joseph W. Richards presiding.

The Panama-Pacific Exposition management provides for an American Institute of Mining Engineers Day at the Court of Abundance. Other social entertainments and technical excursions are provided for by the International Engineering Congress. The technical excursions include visits to fire systems, gasworks, water-works, delta lines and power plants in and around San Francisco. The distant technical excursions include the deep gold mines at Nevada City and Grass Valley, the hydro-electric development at Blue Lakes, the gold-dredging fields at Oroville, the hydro-electric development at Las Plumas and the oil fields at Coalinga. The pleasure trips began with an automobile ride for the ladies attending the Institute on Thursday, which included a visit to the Cliff House and the exposition. Other visits will include a trip to Mt. Tamalpais, a lawn party at the University of California, another automobile trip for the ladies, a banquet at the Palace Hotel and a cruise and inspection trip of the harbor of San Francisco. Besides the program by the International Engineering Congress, D. C. Jackling has placed at the disposal of members of the Institute and ladies his private yacht "Cyprus." The cruise will extend to points of interest on San Francisco Bay and possibly through the Golden Gate.

California Metal Output, 1914

The total yield of mine gold in California in 1914, as reported by the United States Geological Survey, was $20,653,496, an increase of $246,338 over that of 1913. With the exception of one year (1883) the mine-gold output of the state in 1914 was higher than at any other time since 1864, fifty years ago.

In 1914 there were 658 properties reporting production, of which 318 were deep mines and 340, placers. The producing deep mines may be classified by metal product as follows: Gold, 211; copper, 19; silver, 7; silver-lead, 6; and lead, 9. Of the placer mines 105 were hydraulic, 60 dredges, 70 drift, and 105 sluicing or surface-placer mines.

The 318 deep mines made an output of 2,465,485 tons of ore, of which 2,050,317 tons were siliceous precious-metal ore, 397,868 tons copper ore, 640 tons lead, 460 tons silver, and 16,180 tons silver-lead ore.

In 1914 there were treated in gold and silver mills in California 1,993,821 tons of ore, containing altogether $10,743,207 in gold, an average value of $5.39 per ton, and $91,327 in silver, an average value of $0.05 per ton. This gives a total value of $10,834,534 in gold and silver, or an average per ton of $5.44 in both metals. In milling the 1,993,821 tons of ore there was recovered as bullion $8,637,329 in gold and silver, or $4.33 per ton; and from this ore was derived 16,072 tons of concentrates, which yielded in gold and silver $2,197,205, or an average of $47.69 per ton.

The 449,132 tons of smelting ore treated yielded altogether metals valued at $5,633,856, or an average of $12.54 per ton, including all metals. There were treated also 22,532 tons of old tailings, which yielded $83,624 in gold and silver, or an average of $3.71 per ton.

The 340 productive placers in California yielded $9,080,849 in gold and $19,287 in silver, a total of $9,100,136, which is an increase of $242,590 from this source over the yield of 1913. The dredge yield fell off $306,900 in gold, but there was an increase in total output from the hydraulic, drift, and surface placers of $551,572 gold or $244,672 more than the decrease in the dredge yield. Of the total placer gold the 60 dredges yielded $7,783,394, or 86%; the 105 hydraulic mines, $702,884, or 8%; the 70 drift mines, $329,948, or 3%; and the 105 surface or sluicing mines, $264,623, or 3%. There are now 60 gold dredges operating in the state, and since the commencement of dredging in California in 1898, the total gold yield from this source to the end of 1914 has been $71,307,766.

Of the total ore milled in California from deep mines, 1,243,529 tons, or 62%, came from the mines in the five Mother Lode counties of Amador, Calaveras, El Dorado, Mariposa, and Tuolumne. This ore yielded, on an average, in gold and silver, $5,075,552, or $4.08 per ton.

The mine production of silver in California in 1914 was 1,471,859 fine oz. Of this, 1,436,982 oz. was won by deep mining. The larger part of the output, 1,267,752 oz., was derived from crude smelting ore. The greatest output was made, as usual, by Shasta County, where the yield from the smelting of copper ores was 592,727 oz.; from siliceous ore, 33,220 oz.; and from placers, 1,007 oz.; a total for the county of 626,954 oz., valued at $346,706.

The copper produced from California ores in California in 1914 was 30,507,692 lb., a decrease of 4,067,315 lb. Copper was produced in Amador, Calaveras, Imperial, Inyo, Mariposa, Mono, Placer, Plumas, Riverside, San Bernardino, and Shasta Counties.

The yield of lead in 1914 was 4,251,923 lb., an increase in quantity of 737,581 lb., and in value of $11,194. Most of the lead was derived from Inyo County, though some came from Shasta, Kern, and Placer Counties. The zinc production in 1914 was 389,471 lb. In 1914 only three mines produced zinc, all in Inyo County.

Missouri's Investigation of the Alleged Zinc-Smelting Trust

JOPLIN CORRESPONDENCE

The state investigation of the alleged zinc-smelting trust in Missouri was started in Joplin, Sept. 14. The opening session was conducted by John B. Ewing, assistant attorney general. Senator Frank W. McAllister is sitting as a special commissioner named by the supreme court. The hearing is being conducted to determine if there exists sufficient evidence of the violation of the trust laws of Missouri to warrant the state legal department in entering and prosecuting complaints against the several zinc-smelting companies engaged in business in the state. The real cause of the present investigation was the agitation started last February in the zinc-ore producing districts by some dissatisfied producers. This resulted in demands for an investigation being placed before Attorney-General Barker. The dissatisfaction arose from the fact that, when the ore market reached abnormally high levels and normal prices were more than doubled, the generally used basis of buying ore, based on the current market price of spelter which is usually figured a ratio of 8 to 1, began to decline and developed as low as 5 to 1, causing much dissatisfaction among the producers, who became convinced that the buyers of zinc ore were in a combination to hold down the price and stifle competition.

Representatives of the Illinois Zinc Co., American Zinc Lead and Smelting Co., Edgar Zinc Co., Mineral Point Zinc Co., Prime Western Spelter Co., Grasselli Chemical Co., Hegeler Zinc Co., Joplin Separating Co. and the Matthiessen & Hegeler Zinc Co. were present at the hearing. These present were only a small portion of the smelting companies engaged in business in Missouri.

Many witnesses were summoned, but only a few of them could be found in time for the hearing. Charles T. Orr declared that no important difference was ordinarily observable between bids of competing ore buyers on the highest grades of ore. On lower grades, he said, the variation in bids was sometimes considerable.

Very little testimony, beyond that tending to show there is no great variance between the prices offered for standard zinc ores in the southwest Missouri district by buyers for smelting companies, has been so far offered. That this condition was brought about by caution on the part of the buyers and a long-established custom of not interfering with one another's customers was the only explanation offered by witnesses.

Several buyers, who have represented smelters here during many years, testified that they act very largely on their individual judgment, without instructions from headquarters as to prices. The variation between bids on low grades of ore was generally admitted to be greater. Every buyer examined denied that the buyers, of whom about 14 are stationed in the district, ever held meetings. No testimony to show that meetings were held has been introduced.

Several of the largest ore producers and buyers were examined, but no evidence was secured showing any violations of the Missouri anti-trust laws. There was a decided lack of coöperation and interest on the part of the operators toward the investigation. In fact, the absence of mine operators from the sessions of the hearing has been its one conspicuous feature.

Attorney-General Ewing examined such witnesses as could be secured. The examination of mine operators and ore buyers was brought to a close Sept. 15, with the inspection of a batch of the buyers' correspondence requisitioned by Attorney-General Ewing, who hoped to determine the method employed by the buyers in fixing the weekly ore prices. This part of the investigation was conducted privately. Further investigation of the alleged zinc-smelting trust will be conducted in St. Louis on Sept. 21, at the Planters Hotel.

Nevada Metal Production, 1914

The production of gold, silver, copper, lead and zinc from Nevada ores sold or treated in 1914, according to the United States Geological Survey, was valued at $29,300,812.

The output of recoverable gold from Nevada mines in 1914 was 555,[illegible] oz., valued at $11,181,188, and of this amount 87.29% was derived from dry or siliceous ore. The placer-gold output was 18,250.05 oz., of which 10,345.04 oz. came from placer mines in Nye County. The dry or siliceous ores contained 484,296.46 oz. of gold; copper ores, 49,476.61 oz.; and lead, zinc, and copper-lead ores contained 2,879.35 oz. Bullion from gold and silver mills contained 439,919.37 oz.; concentrates, 11,686.38 oz., and crude ore shipped to smelters, 55,375.09 oz. The mines of Esmeralda County produced nearly one-half of the total gold, or $5,226,367, and the Goldfield district yielded $4,705,240 of this total. Nye County produced $3,377,262 in gold; the Tonopah district yielded $2,648,833; the mines of the Comstock lode produced $434,387 in gold, and Humboldt, Mineral, White Pine, and Churchill Counties, in the order named, each produced more than 15,000 oz. of gold.

For three years prior to 1914 the silver output of Nevada had been steadily increasing, but on account of the low prices of the metal in the last half of the year 1914 there was a slight decrease in silver. The total output was 15,455,491 oz. valued at $8,546,887. Of this total yield 14,721,094 oz., or 95.3%, was credited to siliceous ores; 286,935 oz., to lead ores; 181,733 oz., to copper ores; and 115,138 oz., to lead-zinc ores. Ores treated at gold and silver mills were credited with 12,100,494 oz.; concentrates, with 1,721,318 oz.; and crude ore, with 1,600,315 oz. Nye County produced 11,424,769 oz.; the Tonopah district produced 11,388,452 oz., or 73.7% of the entire silver production of Nevada; the Comstock lode, or Storey County, yielded only 278,599 oz.; Churchill County's output was 1,545,926 oz.

In 1914 Nevada produced 60,986,450 lb. of copper. The greater part of the copper, 50,366,650 lb., came from concentrates, while 10,551,000 lb. was from crude ore shipped to smelters. The mines at Ely were operated at a reduced rate, and the Mason Valley smeltery was idle during a good part of the year.

The lead output of the States was 12,809,655 lb. Clark and Lincoln Counties continued to outrank all others in the production of lead, the combined output of these two counties being 10,193,098 lb. White Pine County yielded 915,602 lb. and Elko County 860,826 lb. The yield of lead from concentrates was 3,937,126 lb., and that from crude ore 8,791,246 lb.

The zinc ores of Nevada produced 12,980,232 lb. of recoverable zinc figured as spelter. Clark County produced 11,862,149 lb. of the entire zinc output, the remainder coming mostly from Lincoln County although small shipments were made from Eureka County during the year. The greater part of the zinc material is oxidized. From crude zinc ore shipped, 6,116,898 lb. were recovered, and from concentrates 6,863,334 lb. were recovered.

There were 131 producers of gold, silver, copper, lead, and zinc in Nevada in 1914. Of the total of 4,522,022 short tons of ore sold or treated, 1,461,577 tons was treated in gold and silver mills, principally cyanide mills; 2,768,193 tons was concentrated, and 261,018 tons shipped to several smelters. The largest part of the total tonnage, 2,882,121 tons, represented copper ore; 1,594,486 tons was siliceous ore; 16,088 tons, lead ore; 9,490 tons, zinc ore; 3,762 tons, copper-lead ore; and 16,075 tons, lead-zinc ore.

Japanese Mineral Output, First Five Months of 1915

According to the Department of Agriculture and Commerce, the Japanese production of minerals for the five months, January to May, 1915, was as follows:

Item	Amount	Change from 1914
Gold	3,079 kg.	I. 2.2%
Silver	59,979 kg.	I. 1.3%
Copper	26,895,887 kg.	I. 4.0%
Iron	19,917,887 kg.	D. 30.5%
Coal	7,681,407 tonnes	D. 9.0%
Crude oil	178,878,780 liters	I. 23.7%
Sulphur	22,331,817 kg.	D. 6.2%

Editorials

The Definition of "Smelting"

Careless use of words sometimes breeds trouble, an interesting example of which recently happened. In the vernacular almost every kind of an ore-reduction works is either a "mill" or a "smelter." The idea of the mill is a plant wherein the ore is crushed for the mechanical separation of its mineral constituents, or a stamp amalgamation mill, or a plant for the extraction of the precious metals by chlorination or cyanide lixiviation. Almost everything else is a "smelter," and especially is the idea of a smelter associated with the buying of ores in lots on samples. Thus we read of ore going to smelters who in reality are merely magnetic-separators, etc.

Recently an item was published in the news pages of the *Journal,* as well as in several daily papers, to the effect that the Weedon Mining Co., Ltd., of Quebec, was going to build a "zinc smelter" at Welland, Ont. The company has written to us that it has suffered much annoyance owing to this item. Among other things the farmers of the vicinity of Welland rose in protest against the project. In fact the company was going to erect a plant for the hydrometallurgical-electrometallurgical extraction of zinc. In the eyes of the news reporters this was a smelter, and hence the trouble.

Just what is a definition of smelting? On this subject lexicographers are vague. The process of reducing lead, copper and iron ores in the blast furnace is unquestionably smelting. Here are conveyed two ideas—namely, (1) the reduction and fusion of a metal and (2) the scorification and fusion of the gangue or the impurities. The production and discarding of a slag seems to be an essential part of the conception. In the treatment of metallic products the proportion of slag may be very small and the process is commonly described as "refining." A man who treats the black precipitate from the cyanide process is never called a "gold smelter." He is a gold refiner. In the reduction of zinc ore in the ordinary way there is necessarily only one of the two main ideas of smelting. The metal is reduced and drawn in molten state, but the gangue of the ore is not scorified and fused if the metallurgist can help it, and in many cases he can. The British call the zinc smelter a zinc distiller, which is precise.

In the reduction of zinc ore for the manufacture of zinc oxide by the Wetherill process, and similarly in the reduction of antimony ore by the Herrenschmidt process, there is neither fusion of the metal nor of the gangue. However, the processes are commonly called smelting and the operators thereof are smelters, although the only connection with the main idea is that they treat the ore in furnaces. If zinc is to be extracted hydrometallurgically and precipitated by electrolysis, there is not even that connection; for although the ore may have to pass through a roasting furnace that would not be necessary if it were an oxidized ore. The only furnace in the plant might be that for melting cathodes, which particular part of the process would be melting, not smelting, as everybody would agree.

Proposed Patent Reform

If there ever be any reform in the Patent Office procedure of the United States, there ought to be introduced a new form of letters patent. At present this document consists of two parts—the specifications and the claims. There ought to be a third—a synopsis of both. There might, moreover, be advantageously introduced some subdivisioning of the specifications. It would not be worth while to make these suggestions, or to give any attention to the subject, were it not that patent specifications are an important part of technical literature. The Patent Office authorities claim that they are the most important part—that every new discovery, new process, new idea is sooner or later recorded authoritatively in their office in the form of an application for a patent, and that in making any investigation it is scarcely necessary to search outside of their files. This is not absolutely sound, but there is no doubt a good deal of meat in it. But, admitting that, we submit that the patent files are forbidding and are cluttered with so much rubbish that it is very difficult for anybody—even for a skilled patent-examiner, we imagine—to find in them what he wants.

Let us illustrate. Our attention recently fell upon a newly granted patent for "Method of Smelting Sulphide Ores." This title in itself drags a red herring across the scent of the investigation. The patentee in fact describes a process for zinc smelting, but in order to have his patent as broad as possible he gives it the less definite title. We do not urge any encroachment upon the rights of an applicant. Let him take all that the law allows him. But why should not the Patent Office give to every patent an index title, with the understanding that it does not commit or limit the patentee?

This particular patent in specifications of 291 lines and claims of 160 lines (four pages of text) describes and protects a process that we summarize as follows:

Blende is crushed to minus-100-mesh size and is burned in suspension in the combustion chamber of a distillation furnace, its heat performing the distillation of a charge of ore in the retorts thereof. The products of combustion are conducted through a bag house (bags of asbestos fabric) and the zinc oxide collected therefrom is mixed with coal and charged into the retorts of the distillation furnace. The retort gases are conducted into the combustion chamber of the distillation furnace to assist in the distillation of the zinc.

The claim might be: "The combination of the above steps, and specifically the burning of blende in suspension and the utilization of the heat thereof for zinc distillation."

We shall not discuss the practicability of this ingenious conception of making zinc-sulphide ore do its own smelting or suggest a study of the respective exothermic and endothermic reactions involved; but we submit that all that anybody skilled in the art of zinc smelting needs to know is comprised in our summary,

which might be even more brief. Such a summary ought to be printed as the introduction of every patent specification.

The patent upon which we have commented is manifestly the protection of an idea. There are other patents which are based upon observations of things that happened. A process patent should be subdivided in some such way as the following:

Review of State of the Art: The inventor and his solicitor usually consider it to be necessary to go into this at length. Thus is the reader told repeatedly in zinc-smelting patents that blende is finely crushed, roasted, mixed with coal, and distilled in small cylindrical retorts, with certain drawbacks such as excessive use of fuel and labor, imperfect extraction of zinc, production of blue powder, etc. The Patent Office might usefully adopt a set of standard summaries of the state of each art and in prefacing each new specification with the appropriate one the labor of the drawer of the patent would be lightened and if properly subheaded, as it should be, the reader could skip it if he wanted to, as generally he would.

Next there should be a subhead, "Observations," under which the applicant should tell what he had learned in the laboratory, in the works, or elsewhere. This would be the star feature of many patents. At present it is not given sufficient prominence. Take the famous Everson flotation patent, for example. How much more impressive would it have been if the experiments that the applicant had really made had been brought out in a striking way. In later years they were dug out, to be sure, but there are thousands of dusty, pigeonholed patents which contain scraps of useful information that nobody knows about. The proper exposition of such in the patent office papers would be a real contribution to technical literature.

Finally there should be the subhead of the "Proposal," the way the applicant aimed to do something new and useful, based upon his observations and ideas. In the cases of many process patents there would of course be no subhead "Observations." In such patents a subhead, "Ideas," might well be introduced.

Technical men are generally wishful that there be not so many patents as at present, so many of them being upon mere combinations of steps that would be obvious to anybody who had to take them; but temperateness in the dissipation of paying money for patent fees is probably too much to hope for, although progress in this, as in the prohibition of alcoholic drinking, may gain unexpected headway. In the meanwhile, however, conditions will be somewhat ameliorated if patent specifications and claims be reformed in the ways herein suggested.

Notes About Copper Selling

So long as the war continues, deranging the ordinary machinery of commerce, nobody need be surprised by erratic conditions in the commodity markets, especially those of international character, like the copper market. It is interesting to review some recent features and comment on some current factors.

A little while ago we boasted that we were going to emancipate ourselves from the London standard market. Moreover, that we were going to sell copper in dollars and cents, nevermore in pounds sterling. We are obliged to admit that the wish was father to the thought—that we cannot do what we hoped.

The rise and fall of standard copper in London still sways sentiment here—partly through the medium of Wall Street, partly otherwise—no matter whether it ought not to.

We ought to be able to say that Europe must come to us for copper and must pay us in dollars and cents if we demand it; but when we try to put such a policy into effect, we find that we are simply playing into the hands of the London dealers who will sell European consumers in the way they are used to, and we run the risk of losing our own customers.

The violent fluctuations in the rate of exchange have greatly increased the element of gambling in selling copper for delivery abroad. Thus a pound of copper sold on the basis of £86 realizes nearly 18.05c. if exchange be 4.70 and only about 17.85c. when exchange is 4.65. There were recently sales of copper to domestic consumers at 17¾c. per lb., netting the seller about 17.55c. after deducting discount and freight charges. At the same time the same sellers were willing to sell for export at £86, and did so, which with exchange at 4.65, as it was then, corresponded to 17.85c.; and after deducting c.i.f. charges netted 17.25c. to 17.35c. here.

This difference in price was a feature right along in the recent dull market. Producers were stiff in their attitude toward domestic buyers, but were willing to take less from foreign buyers. Let anybody figure this out as he wants to. Of course about half of the domestic production of copper has got to be sold abroad anyhow. The British pundits who have seen malevolence in the attitude of the American sellers of spelter may like to explain the generosity of the sellers of copper.

There have indeed been three prices for copper of late, on an ascending scale—namely, the price to European buyers, the price to domestic consumers, and the Wall Street price. The last has been pretty steady at 18c. per lb., although there have been threats that it might go to 20c.

The strike of copper miners in the Clifton-Morenci district has turned out to be serious, the several mines and smelteries having been formally put in the hands of the sheriff, who thus has the responsibility of preserving them. Elsewhere among the copper mines there has been remarkable peace and contentment. The bitter strike at Lake Superior and the amusing affair at Butte cleared the atmosphere. The policy of paying the men on a sliding scale corresponding to the price for copper, introduced in many districts, has proved a good one. It is a simple and satisfactory system of profit-sharing, which makes the men feel that they are partners in the business.

The investigation of the alleged zinc-smelting trust opened at Joplin, Mo., last week has already resulted in a fiasco, as everybody of good information knew it would. Only two or three mine operators took the trouble to attend the hearing, and none of them had any evidence of importance of offer. Several ore buyers for smelters testified that the there had never been collusion among themselves, but that they had simply bought ore for their

principals as cheaply as they could. Perhaps the most remarkable thing is the way the smelters turn these men loose in the district, telling them only to buy a certain tonnage of ore and not to exceed a certain price, and leaving the rest to their judgment, skill and honesty. There have rarely been cases of misplaced confidence. The ore buyers of the Joplin district are a good lot of men.

BY THE WAY

The ill-fated Quebec bridge is now being melted down by the Canadian Car and Foundry Co. for use in making shrapnel. The mistake of the civil engineers is furnishing additional employment for the metallurgist.

⁂

The mining and metallurgical gentlemen who are interned in the Douglas Aliens Camp, Isle of Man, Great Britain, find time heavy on their hands and have appealed for American books and journals about minerals and metals that can be spared by generous members of the fraternity in this country. Dr. W. A. Dyes (address Douglas Aliens Camp, Isle of Man, Great Britain) will attend thankfully to the distribution of any literature of this kind that may be sent him.

⁂

The word "terrain" is frequently being used in the war news of today, and although a foreign military word it is becoming common in civilian use, as it has long been in army parlance. Terrain means, according to the "Century Dictionary," a part of the earth's surface, limited in extent considered with reference to its fitness or use for some special purpose, as for a battlefield. The word, although little used, heretofore, is so expressive that it will often be employed to designate territory under consideration and will soon become familiar in the English vocabulary.

⁂

"On a raft 100 ft. underground two bandits at Webb City, Mo., who held up street-car conductors on Sept. 19, paddled to safety through abandoned mine shafts. The mines had been flooded a few days before when a big levee along the river near by collapsed. The bandits floated for six miles underground, climbed to the surface and fled," says the New York *Tribune*. "The men, both masked, held up three conductors near the car barns and got $200 in money and watches. Bloodhounds were put on the trail, which led to the mouth of an abandoned mine. Officers found traces of the men having hastily constructed a raft. The hounds picked up the trail again at the mouth of another shaft, but too late to overtake the men." Thus do the dime novels of our boyhood come to pass in real life.

⁂

About Oct. 1 the headquarters of the statistical bureau of the American Iron and Steel Institute will be removed from 261 South Fourth St., Philadelphia, to 61 Broadway, New York, where the general offices of the institute are. The building in Philadelphia was first occupied by the American Iron and Steel Association under the direction of James M. Swank as secretary about Jan. 1, 1874; when the association was merged in the institute at the beginning of 1913, the statistical department was continued at the Philadelphia office. The building, which was originally a dwelling house, is plain and simple in its exterior and in all its fittings and furnishings, but it served its purpose well for 42 years and many of the older members of the association will learn of its abandonment with regret. The new offices are in the 36-story skyscraper of the Adams Express Co. in New York.

⁂

To the students of union-labor activities the following will doubtless prove of interest: It is very probable that before very long all union workmen dying in Hudson County, N. J., will have to have union funerals. They will be laid out by union embalmers in union caskets, carried by union pallbearers to a hearse driven by a union driver, and buried in a grave dug by union gravediggers or else cremated by union cremators. William F. Kavanagh of the Central Labor Union of Hudson County declared that such will be the rule if the resolution he proposes to introduce at the next meeting of the union on Thursday evening, Sept. 17, is passed. "It is entirely consistent with trade unionism that the bodies of men who were loyal to the cause of union labor should be handled by none but union men," according to Kavanagh.

⁂

The naming of Virginia City, Nev., is related in the *Saturday Evening Post* of July 31, 1915, in Charles E. Van Loan's interesting distillations of his conversations with the "Oldest Inhabitant." In the autumn of 1859 the town acquired a name. "And there was something queer about that," says the Oldest Inhabitant. "There used to be an old prospector round here named Fennimore. They called him Finney for short, and sometimes Ole Virginny on account of his always talking about his native state. Finney liked his liquor pretty well, and one night he fell and broke his bottle. He poured out the drop or two that was left—poured it on the ground. The boys asked him what he was doing. 'I'm christening this camp,' says he. 'It's time she had a real name and from now on she's Virginia Town.' When the postal authorities sent out the cancellation stamps, 'Town' was changed to read 'City.' Old Finney made an awful row about that, but the Government outheld him and Virginia City she was."

⁂

Reuter's agent at Zurich states that agents are conducting a diligent and systematic hunt for copper throughout Switzerland, according to the London *Financial Times*. They are penetrating the mountains to the remotest valleys and persuading the peasants to part with this precious metal. Taking advantage of the ignorance of these country people they tell housewives that their copper utensils are burned out and offer to give them new pots and kettles in exchange, which of course prove to be of greatly inferior metal. The business is enormously profitable, since the agents pay only 2d. to 4d. a lb. for copper which they sell to Germany for ten times as much. The Germans are constantly finding new ways of getting copper from the Swiss. There are no brass smelters in Switzerland and taking the advantage of this the Germans insist upon receiving an equal amount of copper for every delivery of brass. And as the copper in brass weighs only one-half to two-thirds as much as the brass, a surplus is thus obtained.

PERSONALS

Leo Von Rosenberg, of New York, is in eastern Oregon.

Kirby Thomas, New York, has been in the Tintic district, Utah.

Prof. F. W. Sperr of the Michigan College of Mines has gone to California.

Henry Krumb and F. S. Schmidt, of Salt Lake City, Utah, are in Alaska reporting on several properties.

A. I. D'Arcy, general manager of the Atlanta Mine has returned to Goldfield, Nev., after having visited different places in California.

Charles W. Newton, superintendent of the Consolidated Interstate Callahan Mining Co., Wallace, Idaho, spent several days in Spokane this week.

W. Ray Cox, who for several years has been a mineral inspector of the General Land Office at Portland, Ore., has been appointed professor of Mining and Metallurgy in the School of Mines at the Oregon Agricultural College, Corvallis, Oregon.

W. R. Coleridge Beadon, who has been engaged in mine management and engineering for the past 18 years in Montana, India and Burma, chiefly for John Taylor & Sons, London, is now investigating the possibilities of old gold workings in the highlands of the Dekkan in India.

The New York Section of the Mining and Metallurgical Society of America held its annual election of officers at the Machinery Club on Sept. 16. J. E. Johnson, Jr., was elected chairman; A. H. Rogers was reëlected vice-chairman and D. M. Liddell, reëlected secretary-treasurer.

F. C. Cheney, mining engineer of Cleveland, Ohio, aged 21, formerly assayer and surveyor at the Hudson Bay Mine, Cobalt, but recently with the Dome Lake, Porcupine, Ont., disappeared on Aug. 23. On that date he left Timmins to go to the Dome Lake, and called at the Schumacher and Dome mines, but has not been seen since, though an extended search has been made for him.

J. M. Turnbull, of Trail, B. C., has been appointed professor of mining in the University of British Columbia. Mr. Turnbull for years has been a mining engineer with the Consolidated Mining and Smelting Co. of Canada, Ltd., graduated from McGill University, Montreal, in 1897. During the long period he has been associated with the Consolidated he has had a close and extensive experience with the productive mining industry of British Columbia, besides which in his capacity of examining engineer he has travelled throughout the various districts of the Province, so that he has acquired much valuable information relative to its mineral resources.

OBITUARY

John Cameron died at Virginia City, Nev., Sept. 4, aged 75 years. He was for many years connected with the Yellow Jacket Mine on the Comstock.

William H. Woodward died recently at Park City, Utah, aged 74 years. He had been for over 30 years a prospector and operator in that district and had located several important mines.

James Hendrickson was killed in the Albion tunnel at Alta, Utah, Sept. 16. The miners struck a heavy flow of water on that day, which was followed by a large volume of carbon dioxide. Mr. Hendrickson, with another man, both armed with oxygen helmets, went into the tunnel to open up the air line, but was overcome, notwithstanding the helmet. He was a mining engineer, a graduate of Columbia University and had been in Colorado and Utah about 12 years past.

SOCIETIES

American Institute of Metals—The ninth annual meeting will be held at Atlantic City, N. J., Sept. 28-Oct. 1, and will be a joint meeting with the American Foundrymen's Association. Many interesting papers are promised.

American Electrochemical Society—A meeting of the New York section was held at the New Grand Central Palace, Sept. 25. The speakers of the evening were: John Barrett—"The Great Pan American Opportunity." Thos. H. Norton—"The Possibilities of Niagara for American Electrochemistry."

Franklin Institute, Philadelphia—The program of lectures to be delivered at the 1915-1916 meetings has been published. Among them are the following relating to metallurgical subjects: Oct. 20, 1915—"Recent Progress in the Metallurgy of Copper," by H. O. Hofman. Dec. 2, 1915—"Magnetic Investigations of Iron and Steel," by John D. Ball. Dec. 9, 1915—"Smoke as a Source of Atmospheric Pollution," by W. F. M. Goss. Mar. 30, 1916—"Some Problems in Physical Metallurgy at the Bureau of Standards," by George K. Burgess. Apr. 6, 1916—"Use of Powdered Coal in Metallurgical Processes," by C. J. Gadd. Apr. 13, 1916—"Heat Measurement as Related to the Industries," by Charles W. Waidner.

Yale Engineering Association—There has been recently formed an organization among graduates of Yale University known as the "Yale Engineering Association," the purposes and objects of which are clearly set forth in a circular letter which has been widely distributed to Yale graduates. The officers of the Association consist of: President, Edwin M. Herr, Westinghouse Electric and Manufacturing Co.; vice-president, Harry N. Covell, Lidgerwood Manufacturing Co.; secretary-treasurer, Richard T. Dana, consulting engineer. While any Yale graduate is eligible for membership, yet the association naturally appeals more strongly to those who are engaged in engineering pursuits, transportation or manufacturing. It is proposed to hold the first meeting of the association in New Haven the early part of November.

American Mining Congress—The meeting of this body was held in San Francisco, Sept. 20-22. The provisional program provided for the opening session on Monday morning, Sept. 20, and for the afternoon address on "What the United States Bureau of Mines is Doing and Hopes to Do for the Metalliferous Mining Industry," Van H. Manning; "Plain Writing," Dr. George Otis Smith; "Federal Influence in the Settlement of Industrial Disputes," Dr. Martin D. Foster.

Tuesday's sessions were devoted to reports of Committees on Prevention of Mine Accidents, on Uniform Mine Reports, on Alaskan Affairs, and on Revision of Mineral Land Laws. Papers were: "Rights of Way Over the Public Domain," Hon. Charles S. Thomas; "The Right of Appeal from Decisions of the Interior Department in Cases Where the Government is Charged with an Interest," H. H. Schwartz; State versus Federal Leasing of Natural Resources Where Government Control is Essential to Public Welfare" (general discussion); "California's Water Infiltration Law," Fletcher McN. Hamilton.

At noon memorial exercises in honor of the late Dr. Joseph A. Holmes, Chief of the Bureau of Mines, were held.

In the evening the business meeting and election of officers were held.

The sessions on Wednesday, Sept. 22, were devoted to reports of the Committee on Resolutions, on Mine Taxation, on Mining Investments, on Freight and Ore Treatment Rates. Papers and addresses on "The Development of Mine Taxation in Arizona," G. H. Dowell; "Mining on Government Indian Reservations," F. Lynwood Garrison; "Workmen's Compensation Insurance and the Coal Mining Industry," Herbert M. Wilson; "The New Plan of Mining Insurance," David Ross; "Mining Hazards on the Pacific Coast," Dr. F. L. Hoffman; "The Iron Resources of Utah," Prof. Fred J. Pack; "The Future of the American Zinc Industry," Otto Ruhl; "Interesting Phases of the Anthracite-Mining Industry," Dr. E. W. Parker; "Federal Control of the Coal Mining Industry," including a discussion of the Sherman Law, the Clayton Bill, and the Federal Trade Commission, Rush C. Butler.

On Wednesday evening a complimentary banquet tendered to Van. H. Manning, the new Director of the United States Bureau of Mines.

TRADE CATALOGS

The James Quartz Mill & Crusher Co., Denver, Colo. Catalog No. 12. Quartz Mills and Crushers. 20 pp., illus., 6x9½ inches.

The Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog U. Brownhoist Transfer Cars and Larries. 32 pp., illus., 6x9 inches.

Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Ill. Bulletin No. 72. Sullivan Drill Sharpener. 24 pp., illus., 6x9 inches.

The Electric Storage Battery Co., Philadelphia, Penn. Handbook H L. Low Voltage Isolated Electric Light and Power Plants with the Chloride Accumulator. 52 pp., illus., 6x9 inches.

Editorial Correspondence

SAN FRANCISCO—Sept. 15

Patrick Creek Copper Mines, owned by W. Duley and O. B. Lauff, of Crescent City, have been taken on a purchase option by George P. Reuter and Arthur A. Slobbling, of Portland, Ore. The mining districts in Del Norte County have the great disadvantage of lack of adequate transportation. The only travel or connection is by steamer to San Francisco or Portland and Seattle. The proposed railroad now under construction from Grants Pass, Ore., to Crescent City will put the Del Norte districts in direct transportation connection with the Southern Pacific and will aid very largely in the development of the copper ores in Del Norte and Siskiyou Counties. The Queen of Bronze mine in Josephine County, Ore., and the Britten mine in California are shipping copper ore to Kennett, by way of the new railroad. The possibilities of northwestern California and southeastern Oregon will soon be made evident, and if the proper methods of development are applied to that region, they will add very largely to the future gold and copper production of the Pacific Coast.

Semi-Monthly Pay Day provided for by law passed by the last legislature does not appeal to miners generally. At the Argonaut in Amador County, the company has proposed to make the semi-monthly pay day optional with the men. Those who wish their money twice a month instead of once will be accomodated. It is probable that the majority at this and other Mother Lode mines will express their preference for the monthly pay day. Miners can see very little merit or advantage in the law, especially when working for reliable operators, and they are not much disposed to changing their habits in the matter of paying their bills which formerly have been settled once a month. So far as the mine owners are concerned, the law necessitates more labor in the clerical departments and some inconvenience probably, but this is of no great importance so far as it affects the industry generally. Mine owners and employees are not the only persons to be considered under this law. In fact they furnish rather a small proportion. There are other industries whose employees will be very largely benefited by semi-monthly pay days, and the law was meant for their benefit, without particular consideration of the mining industry. At any rate the industry will not suffer by reason of the law and it is not going to disturb mining men enough to make a fuss about. By the active work of the California Metal Producers Association, and its friends in the lobby of the last legislature, some very bad bills were killed and while some bills got by which are not particularly to the advantage of the industry, mining men have nothing particular to grieve about and should be very well satisfied with present conditions. The mine-safety rules are being got into good shape, the mine-insurance rates have been reduced, and altogether the mining industry has fared better than it has in a good many years past so far as legislation affects it.

DENVER—Sept. 16

A New and Standard-Gage Route into the San Juan mining region is being sought by the Denver & Rio Grande Ry. Engineers believe they have found a practicable route starting from the station of South Fork, between Del Norte and Creede, following up a water grade, crossing the San Juan Mountains in Mineral County and then traversing the rough prairie to Durango. President B. F. Bush and party of railroad officials have been touring the proposed route by wagons.

Charges of Fraud that had been preferred by Rufus C. Elder and Frank E. Mann against Samuel D. Nicholson, Julius Rodman and John A. Ewing, all prominent in Leadville mining, were dismissed by Judge John A. Rimer of the U. S. District Court, Denver. This suit was brought a year ago by executors of the estate of George W. Elder, a stockholder in various Leadville mining companies controlled by the above defendants and allied with the Guggenheim interests.

The Denver Branch of the United States Mint, according to Thomas Annear, superintendent, is the storehouse of upward of $465,000,000 worth of coin and bullion. He believes that Colorado will during 1915 produce from $8,000,000 to $10,000,000 more in gold and silver than it did last year. For the past four months, the mint receipts from Colorado mines have been nearly 25% above normal. More bullion is stored in the mint at Denver than in any other building in the world, it is believed. The coinage department is at present making only silver quarters.

Entire Holdings of the Tin Cup Gold Dredging Co, were sold, Sept. 2, by the United States court of bankruptcy, Denver. The property comprises a fine hydro-electric power-generating plant at St. Elmo, in Chaffee County; a transmission line thence over the continental range to Tin Cup, in Gunnison County, about 16 miles; a complete gold dredge with 3½-cu.ft. buckets, 2,300 acres of dredgeable ground; and a complete equipment of buildings, churn drill and tools. This valuable outfit was sold for $5,000 to Colorado Springs parties. One more recorded instance of failure in a promising mining enterprise resulting from management by inexperienced men and a heavy promotion overload. The complete outfit was never given a reasonable chance to operate.

BUTTE—Sept. 14

Although the Butte Mining Companies Paid in wages in August about $350,000 less than they did in July, nevertheless the payrolls last month aggregated $1,700,000. July was the biggest month in the history of the Butte mines, so far as the payment of wages is concerned, although the output of copper and the net earnings were not nearly so large as during some previous months. There are fully 13,000 men employed in the Butte mines and the rate of wages fell from $4 to $3.75 per day because copper sold under 17c. in August, the rate of wages being based on the price of copper. The Anaconda company alone paid out $1,180,000 for wages in August. The Butte & Superior paid out $170,000, which was about $5,000 less than in July, and the North Butte paid $93,000, the East Butte $90,000, the Butte-Ballaklava $15,000 and the Clark properties $60,000. It is estimated that the mining companies and other employers of labor in Butte pay out a total of $2,600,000 in wages each month.

The Output of Copper is being gradually increased by the mining companies but the total is still far from what it was a few years ago. The Anaconda company official report of August production shows the output to have been 22,800,000 lb., the largest production of any month this year, and that includes the output of the North Butte company, nearly 1,800,000 lb., and some other custom product. During the other months of the present year the Anaconda company reported production as follows: January, 13,700,000 lb.; February, 15,100,000 lb.; March, 19,000,000 lb.; April, 21,800,000 lb.; May, 20,500,000; June, 22,100,000 lb.; July, 22,100,000 lb. In August of last year the output was but 14,750,000 lb., and in 1913 it was 22,500,000; in 1912, 25,250,000 lb. The copper-producing companies now are the Anaconda, North Butte, East Butte, Butte-Alex Scott, Elm Orlu, Davis-Daly, Butte-Ballaklava, Pilot-Butte and Tuolumne. About the only development company operating in Butte at the present time is the Rainbow, a Cole company, which is engaged in developing the Rainbow and Butte & London properties. Sinking was resumed in the Rainbow shaft a few weeks ago and in the Butte & London last week.

SALT LAKE CITY—Sept. 16

The Salt Lake Stock and Mining Exchange appointed delegates to the National Brokers Convention in San Francisco, Sept. 21 and 22, as follows: George H. Dern, W. D. Nebeker, J. C. Dick, Fred C. Dern, and J. A. Hogle. Messrs. G. H. Dern, Dick and Nebeker have also been appointed delegates to the American Mining Congress, which meets at San Francisco during the same week.

SEATTLE—Sept. 15

Lower River Claims are Showing Up Well under development, an average of 50c. a yard being obtained from the claims in the open cuts. Considerable activity is also in evidence in the camp. About 36 operators now are busy doing development work.

The Strike Among Miners at Long, near Rico, has closed down many placer claims, and only two small concerns are operating on Long and Bear Pup Creeks. A good many of the men affected by the strike are scattering to other creeks and some are leaving the district entirely. The operators offer to pay $4 a day for muck, but the men

want $5 and have struck to enforce their demands. At present there is no indication of a compromise, as the mine owners say the ground will not stand the wage scale.

WALLACE—Sept. 17

The Controversy Between the Hercules Mining Co. and the American Smelting & Refining Co., which has been occupying the attention of this district for the last three months, still affords material for much interesting speculation. Having failed to secure a satisfactory contract for the treatment of its ores, the Day interests, which control the Hercules, opened negotiations for the old Northport smeltery, near the British line in the State of Washington, owned by an English company. These negotiations resulted in the purchase of the plant by the Days for $80,000. The plant has long been idle and is said to have originally cost over $1,000,000. The Days evidently intend to embark in the smelting business, not only handling the ore of the Hercules and other mines they control, but will do a custom business also. The smeltery was built to handle copper ores and is now being remodeled to treat lead ores also. There are a number of interesting features in connection with this move on the part of the Days, and the belief still prevails in some quarters that the purchase of the Northport plant was merely a bluff to force the A. S. & R. to make concessions to the Hercules. The owners of the Hercules are not a unit on the smelting proposition. The company is not incorporated and it is known that at least two of the large owners, August Paulson and L. W. Hutton, of Spokane, have declined to go into the smelting enterprise. It was therefore up to the Days, Harry L., Eugene R., and Jerome J., to furnish the sinews. It is now learned that the funds for the extensive work that is going on in rebuilding the Northport plant are being provided by the Tamarack & Custer Consolidated Mining Co., which is controlled by the Days. This company is incorporated under the laws of the State of Nevada, which it appears give practically unlimited powers to the three members of the executive board. This company has a large ore reserve and for several years has been operating steadily, but has never paid a dividend. Its surplus is estimated as high as $600,000 and it appears that this money is to be used to overhaul and restore the old smeltery to a condition of activity. Another interesting feature of the situation is that Harry L. Day, one of the brothers who dominate the Hercules and Tamarack & Custer, is still president and general manager of the Federal Mining & Smelting Co., a subsidiary of the American Smelting & Refining Co., with which the Days are now at loggerheads and with which they are preparing to compete in the smelting of Coeur d'Alene ores and the ores of other districts.

CHISHOLM, MINN.—Sept. 18

With the "safety-First" Idea in mind, the Oliver Iron Mining Co. is experimenting with a small attachment on the shoes of its surface timber crew, to permit of greater ease and safety in getting over the logs. The device is a small piece of sole leather with a spiked plate, and is detachable. It has been found a good safeguard against loss of footing because of loose bark, rolling logs, snow, ice, etc.

DULUTH—Sept. 18

Bathtubs in Miners' Cottages are to be tried on the Mesabi range. At Chisholm, a local plumber has been given a contract to install bathrooms in 11 company houses of the Oliver Iron Mining Co. in Monroe Location. This is in line with the welfare work being done by the company.

Taxes and Penalties aggregating $67,794.84 have been paid by the Oliver Iron Mining Co. and Pickands-Mather Co. on mining property in Hibbing, Minn. Such taxes were paid only on mining property held under state leases, indicating that the operators propose to take no chances on the possible forfeiture of their state leasehold interests, as all state leases contain the usual clause requiring prompt payment of taxes. Officials of the above two companies, as well as the remaining nine operators, state that this small payment does not mean the abandonment of the fight against the alleged municipal extravagance of the Hibbing officials. No other part of the $1,500,000 tax levy has been paid by the mining companies.

HOUGHTON—Sept. 20

The Proposal to Consolidate Centennial with Osceola has not been heard from further, although the proposal is by no means dead. There have been two meetings of large shareholders, entirely independent of the Calumet & Hecla interests and at these it was determined not to go ahead with matter in hand until the results of the Tamarack proposal to sell out all individual holdings to the Calumet & Hecla should materialize or should be dropped. The belief is general that the average miner or shareholder in Calumet has a pretty fair knowledge of the conditions underground in both of these properties and Centennial shareholders are waiting to see what sort of a proposal the Calumet & Hecla is willing to accept from the Tamarack and then they will go ahead and make their proposal to the Osceola. W. E. Parnall, who was here making an examination of the Tamarack, in connection with the proposal to sell out, has completed his underground investigation and returned east.

The New Arcadian is now operating a small crew of men at a point 1,400 ft. south of present shaft. It is hoped to pick up the same rich amygdaloid that is now making such a continued good showing in each opening in the main shaft. The point where this preliminary work on a possible second shaft is going forward is the pit where work was undertaken 5 years ago. At that time the overburden was found to be 30 ft. deep and it was expensive work to get to the solid rock. This pit has been unwatered and the first blasts uncovered some good-looking amygdaloid, much like that taken from the first shaft. The conglomerate, presumably the Calumet, was shown in three points in the shaft and in two diamond-drill cores in previous records. Assuming that the amygdaloid is about the same distance east of the conglomerate in this mineral formation, present locality ought to disclose the formation in quantity and quality.

NEGAUNEE, MICH.—Sept. 19

There Will Be Very Little Ore Left in stock when the shipping season comes to a close this year. The piles at the Negaunee, Maas, Hartford, Rolling Mill, Mary Charlotte, Breitung Hematite and Queen Group will all be forwarded. These are the only operating mines at present, with the exception of the South Jackson, which is operated only during the summer months and which will ship about 60,000 tons this year. Negaunee is now in as good a condition as any city in the Michigan iron district, with a number of large mines, and all ore to be loaded and sent out. There should be no worry about the winter there. If it is true that the price of ore is to be advanced 50c. before next spring, the operators will want to get out all that they can and have it ready to ship. Higher prices also mean that some mines that are now idle are apt to be started up again. Some of the high-cost producers always have a difficult time breaking even when the market prices are low, but they are able to derive a profit when bessemer ore is selling above $4 and nonbessemer is above $3. The present prices are $3.75 for bessemer and $3 for nonbessemer.

GRAND RAPIDS, MINN.—Sept. 19

Operations in Itasca County are epitomized in the report of the mine inspector covering the period from Feb. 1, 1915, to July 1, 1915, just published. It shows that there are 21 mines in the territory and that 10 were operated during the period covered by the report. Six of them shipped ore during that time. Stripping operations were carried on by five companies. The Hill-Annex removed the largest amount of dirt during the five months, stripping 746,000 cu.yd. The Canisteo came second, with 214,000 cu.yd. Other mines stripping were the Bennett, Quinn-Harrison and the Hawkins. The greatest shipment of ore was from the Canisteo pit, at Coleraine, with 442,000 tons. Other shipments were as follows: Hill mine, 266,000 tons; Holman, 240,000 tons; Judd, 95,000 tons; Mississippi, 153,000 tons; Hawkins, 61,000 tons; Quinn-Harrison, 136,000 tons. During the period 1,285 men were employed. Of these 1,113 worked on surface. Only 172 were employed underground. There were but two fatal accidents during the five months, a far better record than for any previous period since the district was opened. Otherwise no one suffered serious injuries, fractures or amputations. The minor accidents were few in number. It can be clearly seen that the "safety-first" campaign is having good results. Since the period covered by the report, activities have been greatly increased. More mines are working and more men are employed. The outlook is very bright on that part of the Mesabi.

TORONTO—Sept. 18

From the New Kowkash Gold Field many prospectors have returned discouraged with the impression that there are few favorable indications outside of the original discovery. The expectations of claimholders have since been revived by another important find, distant 15 miles from the King Dodds discovery, from which rich samples are shown, which is regarded as indicating the extent of the field. While the geological formation is considered as favorable, there are few rock outcrops, and much stripping away of the overburden must be done before the value of the field can be determined. Under these conditions it is not likely that superficial prospecting will result in further sensational finds, and though prospecting parties are still going in, there is little disposition on the part of capitalists to make investments before the value of the field is established. The report of Percy Hopkins, assistant geologist of Ontario, which will probably be made public in a few days, is awaited with much interest.

The Mining News

ALASKA

PATTERSON AND FINLEY (Fairbanks)—Have made their fourth cleanup on Livengood creek. About 223 oz. of dust were taken out, netting $3,982, which averages $17.86 per ounce.

ROSS & BYRONS CLAIMS (Nome)—A four-horse team load of ore has been brought out and shipped to the Tacoma smeltery for treatment. It was blocked out of a quartz stringer in bedrock, 40 ft. from the surface, and has a high mineral content.

THOMAS-CULROSS (Valdez)—Has started development work on larger scale than heretofore, owing to extraordinary value of ore recently uncovered. Property is located near Thomas Bay, on Culross Island, in Port Wells district, 70 miles from Valdez. Last shipment made to Tacoma smeltery showed value of $140 per ton. Vein is exposed for distance of 1,500 ft. and runs from sea level to the top of the Coast Range.

YUKON GOLD (Dawson)—Has bought 3½ miles of placer ground on Greenstone creek, in the Ruby camp, and will install a dredge there soon, according to reports. Company took ground under option year ago and only recently finished prospecting it. Dredge with 3½-ft. buckets will be installed and operated by steam, as it has been found the creek is not long enough to warrant installation of all the necessary equipment for an electrical plant.

ARIZONA

Gila County

INSPIRATION (Miami)—During August mill handled 85,000 tons of ore. Made extraction of 83 per cent. against a predicted recovery of 85 per cent. when mill reaches capacity. September tonnage expected to be 125,000 tons.

CALIFORNIA

Amador County

AN IMPROVISED MILL has been constructed by Harry Troop in Pioneer district and reported to be doing good work. Mortar block size of common die is sunk in the ground 8 or 10 ft. Two pieces of timber 6x10-in. section, 10 ft. high, are bolted to two sides of the mortar block. Sides are boarded up proper height and die placed therein. Screen is fastened above die and ordinary iron fittings are used.

CLINTON (Jackson)—Six men working at this gravel mine, using water hoist to lift boulders and heavy gravel out of pit. The bar is about 100 ft. deep and produces coarse gold.

KENNEDY (Jackson)—Rolla White, underground engineer, was caught in sheave at the hoist, Aug. 28. He was coming out of shaft riding bail of skip and hoist engineer not noticing him gave him no time to get off at collar of shaft.

PRODUCE DEVELOPMENT (Ione)—Cleaning, drying and shipping kaolin and sand is in progress. When present cleanup is finished a steam drier will be installed. Company will manufacture pottery and other products. More men will be employed.

EAST EUREKA (Sutter Creek)—This mine, originally Poundstone, is reported to have been bonded to Alexander Rennie. Property is equipped with 20-stamp mill, which was built about three years ago. Mine has been idle for year or more. Preparation is being made for unwatering old shaft.

CENTRAL EUREKA (Sutter Creek)—Directors at San Francisco levied an assessment of 5c. a share. Indications on lower levels are that little more work should disclose large orebodies. During this development mill will crush ore from three lowest levels. Company employs 100 men James A. Davis is superintendent.

Butte County

WATER FOR ELECTRIC POWER amounting to 6000 in has been applied for in Little Butte Creek by Malcolm D. W. Greene, to be applied to mining property on Magalia Ridge. It is purposed to generate 1500 hp.

Eldorado County

LARKIN (Placerville)—Suit to quiet title decided in Superior Court in favor of Charles F. Lecker, who has been in possession for past five years. Property formerly controlled by Larkin Mining Co. Company trustees did not contest Becker's rights.

Inyo County

DARWIN DISTRICT has good prospect of development. Tex Hall and Frank Paul, of Ely, Nev., have 18 men employed sampling some of the mines.

ANTIMONY ORES amounting to 25 tons daily reported being shipped from Wild Rose Cañon. Ore is hauled by motor trucks to Trona, thence shipped east by rail.

CALMICH (Deadwood)—Development shaft will be sunk to 100 ft. Installation of hoist and other machinery contemplated if development should warrant.

BONNELLY GULCH (Lewiston)—New 5-stamp mill under construction at this mine near Deadwood. Property is owned by Wallick, Davis, Johnson and Blakemore, who are practical miners and mill men.

SKIDOO (Skidoo)—Preparations being made to install 44-hp. gas engine for auxiliary purposes. The 24-mile pipe line carrying water to the mill has required some repairs during hot weather. Mine in good condition.

AMERICAN (Zabriskie)—Reported that operations will be resumed by Harris, Gilbert and Baker, of Nevada and Zabriskie, who purchased property from estate of Andrew McShane, who located mine 17 years ago. Ore is said to be high grade.

McCAUSLAND (Zabriskie)—Increase in milling capacity from 40-ton Lane mill to 150 tons is contemplated. Series of veins from 2 to 6 ft. in width carries ore running from $12 to $200 per ton. Mill is operated below sea level. Ross D. McCausland is superintendent.

BISHOP CREEK (Bishop)—Ore averaging $13 per ton is being crushed, with approximate recovery of 84%. Installation of slimes table for making closer recovery is contemplated. Ledge shows average width of 17 ft. Low-grade ore running $7 per ton is held in reserve.

IBEX (Zabriskie)—Lead and zinc ore being extracted and shipped on burros 15 miles to Tonopah & Tidewater R.R. Lead ore is said to run about 38% lead and the zinc ore 8% zinc. Veins are parallel and ore comes from depth not greater than 75 ft. Twenty men are employed.

PAMLICO PLACER (Bishop)—Placers in Hawthorne district formerly owned by Burns, Blackburn & Schumaker taken over upon payment of $2,000 cash on purchase price of $20,000. Stated that gravel contains about $4 per yard. Company organized by Senator Key Pittman and H. S. Brady, of Nevada.

CERRO GORDO MINES (Keeler)—Lease held by Louis D. Gordon expired Sept. 15. Property taken over by company without change in operation, and with Mr. Gordon as manager. Production of zinc in August was 1,620 tons. In first half of September, or to Sept. 18, estimate is 1,200 tons of zinc and 200 tons of lead. Tramway from mine to Keeler is completed and handling 100 tons of ore per day. Company employs 150 men.

Madera County

DAULTON (Madera)—Copper ore that has lain on dump for several years will be treated in old smeltery which has been out of commission for 12 years. J. P. Pennell, of Fresno, has leased property from Walter Smith, of Madera. Leaching plant has been installed to treat 2,000 tons of sulphide ore.

Nevada County

MEADOW LAKE DISTRICT is becoming active. Mrs. Tolo Wyment has given bond on her property where number of men are improving road over mine to lake. John C. Clark is rebuilding road from Meadow Lake to Three John mine. Good strike of ore was recently made at Gold Dollar mine, which has encouraged new development.

NEVADA COUNTY MINES CO. (Grass Valley)—Company has taken over Union Mine on Banner Mountain. D. W. Shanks, formerly superintendent of Union Hill Gravel Mines in Trinity County and J. Nelson Nevius, mining engineer of Los Angeles, are organizers of company. Unwatering of 225-ft. shaft will begin immediately. Gasoline engine used to operate pump. Mine was an early-day producer.

Placer County

DREDGING ON BEAR RIVER below Dog Bar Bridge will be undertaken by Thomas Donahue and associates, of Seattle. Understood that California type bucket-elevator dredge will be installed, to cost $75,000.

HERMAIN (Westville)—Operation resumed and 10-stamp mill in commission. Large amount of supplies being taken in for winter which begins early; heavy snows prevent packing during that season.

Plumas County

ROBINSON (Quincy)—Posey and Miller, representing Colorado men, have taken bond on this quartz mine in Graham basin. Installation of roller mill is contemplated. It is also intended to build 6-mile road from basin to Junction House on Oroville road.

Siskiyou County

CHROME DEPOSITS at Dunsmuir recently purchased by Clarence M. Oddie, have been sufficiently developed to supply limited quantity of ore. Property was old producer, but is so situated that it cannot be economically worked in winter months.

HEAD WATER (Yreka)—J. E. McBride, of New York, who became interested in this property on north fork of Humbug Creek 16 years ago, recently made business visit and prepared for sinking shaft on ledge, which has been developed by assessment work.

DAVIS CONSOLIDATED (Happy Camp)—Property closed down for season on August 25, having had an average quantity of water. Before resuming operations on Nov. 1, sawmill 8 miles distant from mine will be overhauled and a supply of lumber cut. Main 30-in. pipe line on 2 grade will be extended west 400 ft.; 1,100 ft. of 22-in. pipe and two 300-ft. strings of 15-in. feeder pipe will be either relaid.

Shasta County

NOBLE ELECTRIC STEEL CO. (Heroult)—Second furnace blown in working on chrome ore mined at Lowery, Tehama County. Since resumption of operation company has

manufactured 600,000 lb. of ferromanganese. Fifteen carloads have been shipped to Eastern points in Illinois, West Virginia and Pennsylvania. Eighty-five men are employed. J. J. Cogan is superintendent.

Tuolumne County

CHILANO (Jamestown)—Charles Gillis, owner, reported to have interested men in this property which will be reopened.

RAWHIDE (Jamestown)—Reported that negotiations are in progress for purchase of this property by Nevada men. Rawhide was one of important mines operated by Captain Neville during his prosperous days of Mother Lode mining.

Yuba County

MOTHER LODE MINING CO. (Marysville)—Superior Court has made restraining order prohibiting the company from working property in Indiana Ranch district claimed by Red Ravine Mining Co.

COLORADO

Boulder County

AMERICAN (Gold Hill)—Is erecting 50-ton amalgamation mill below and adjacent to outcrops of numerous closely spaced, nearly vertical veins. Extensive prospecting by trenches, cuts and adits has proved wide belt of thoroughly oxidized siliceous free-milling material, worth about $4 per ton and which, it is believed, can be mined and treated for about $1.30 per ton. James H. Caldwell, of Denver, is president and manager.

Clear Creek County

COMMONWEALTH (Georgetown)—Imperial Mining Co. shipped lot running 2.74 oz. gold, 60 oz. silver, 22% lead and 9% copper.

NORMAN (Silver Plume)—Mine dump is being sorted and shipped by Lampshire & Co. to Mendota mill, where it is converted into good lead-silver concentrates.

CAPITAL (Georgetown)—Bruce & Co. and Hummer & Son are taking out very good gold-silver-lead ore. Mill is kept busy on ores produced by company and leasers.

MENDOTA (Silver Plume)—Chappell and Lyon make monthly shipments of lead-silver-gold ore worth about $60 per ton. Stephen Bros. are mining narrow vein of lead-zinc ore.

Gilpin County

GILPIN-EUREKA (Central City)—From 30 cords of ore mined by McCallister & Co. on 600 level, mill recovered retort weighing 54 oz., worth nearly $800.

INGALLS (Central City)—Leasing company has settled for 8 tons high-grade smelting ore at 5.20 oz. gold, 27.9 oz. silver and 5.65% copper, worth net about $115 per ton.

GILPIN-ONION (Central City)—Leasers' last shipment from 2-ft. vein—11 tons—was to Globe smeltery, Denver, and gave returns of 7.46 oz. gold, 10.0 oz. silver and 2.4% copper.

FRONTENAC (Russell Gulch)—Six sets of leasers are working in levels 5, 6, 7 and 8 and, during August, shipped 94 tramway carloads to Iron City mill, in addition to 2 railroad carloads of smelting ore sent to Denver.

BATES (Black Hawk)—Leasing company shipped to Denver for smelting 18 tons of ore running 1.16 oz. gold, 10.25 oz. silver and 1.7% copper. Carload lot of concentrate shipped to same works ran 0.87 oz. gold and 3.08 oz. silver.

OLD TOWN (Russell Gulch)—Hutchens lease shipped 24 carloads via Gilpin County tramway to Iron City mill, Black Hawk, and recovered retort weighing 24 oz. and 20 tons of concentrate assaying 1.90 oz. gold and 2.0 oz. silver. Tramway cars average about 8 to 10 tons of sulphide ore, their capacity being each one cord, the county's unit of measurement for mill ore.

COEUR D'ALENE (Central City)—William F. Gray, superintendent, states that most of his work done this summer in reopening this old property has been in main shaft and in levels 6 and 7. Five raises have been made to block ore and another crosscut is being driven to catch vein. Breast of 700 level shows 4 ft. of mill ore that is shipped to and treated in Buell mill, near Black Hawk.

PEWABIC (Russell Gulch)—All property of Pewabic Consolidated Mines Co. has been sold at auction by trustee of United States court of bankruptcy. Representing Eastern capitalists, William F. Gray secured entire holdings for $30,-500, a figure below value of machinery and buildings on mine. He thus acquired 25 unpatented and 11 patented claims, all buildings and machinery. This mine, adjacent to Old Town mine, was formerly active and prosperous.

PITTSBURGH (Russell Gulch)—Manager Auger makes shipments punctually every month, always marketing products in several lots representing different working faces. The five lots for August were not so large as usual. They varied in tonnage from 8 to 16 tons each and were settled at following minimum and maximum assays: Gold, 4.18 oz.—9.49 oz.; silver, 7 oz.—12.0 oz.; copper, 6.1%—17.2%. Three cords put through 5-ft. Ft. mill, Central City, yielded retort weighing over 7 oz. and 8 tons of concentrates running 1.85 oz. gold and 5.0 oz. silver. Eight cords treated in Iron City mill returned 15-oz. retort and 2 carloads of concentrates running 1.16 oz. gold and 7.15 oz. silver.

Lake County

EVENING STAR (Leadville)—Entire surface plant at No. 5 shaft was destroyed by fire that broke out in middle of night, entailing loss estimated at $10,000. George E. Cramer, leasing miner, believes fire of incendiary origin, similar fire having destroyed plant here almost exactly year ago.

AMERICAN SMELTING & REFINING CO. (Leadville)—Legal controversy instituted by this company against the county commissioners relative to its assessment has occupied several weeks of attention of Judge Cavender. County assessor McDonald had assessed Arkansas Valley smelting plant at a valuation of $503,000. Company sought a reduction of $147,000. Court decreed that assessment must be lowered $74,510 and that county must refund to smelting company tax already paid on this amount, together with interest on same. After this decision, company, through its tax agent, A. B. Teal, submitted petition to commissioners requesting reduction in assessment on its property listed as "stocks and securities," which are represented as worth $173,600. Warm arguments followed in which county officers made new demand for examination of the company's books, demand previously denied and again denied at this time.

HILL TOP (Leadville)—This mine is almost on ridge of Mosquito range, on opposite side from its headquarters. About 50 men are employed developing and mining good tonnage of lead-zinc-silver ore that is shipped via South Park branch of the C. & S. Ry. Owing to high altitude with adverse climatic conditions and to somewhat heavy water handicap, property remained idle for two years until George B. Berger and associates of Denver resumed operations last spring, when prices for zinc became attractive.

San Miguel County

COLORADO MANGANESE (Norwood)—Has shipped five 25-ton carloads of rich manganese ore that is sold to chemical trade. It runs but 0.43% iron and sells for $65 per ton, f.o.b. cars Placerville.

Summit County

KING SOLOMON (Breckenridge)—Daniel Davidson, et al, leasers, have vein 6 to 40 in. thick from which they have shipped 11 carload lots running about $40 per ton in gold and lead.

MONTEZUMA MINES & MILLING CO. (Montezuma)—This company, with the technical guidance of James M. McClave, of Denver, has made extensive flotation tests on the complex ores of this abandoned district and has remodeled mill (erected two years ago to operate by dry concentration) into flotation plant. Silver Wave mine has been provided with an aërial tram 6,880 ft. long to this mill, and machinery is being placed on Silver Princess mine. With recent demonstration on large scale of success of oil flotation on these ores, this region has taken on real activity after almost complete idleness for nearly 30 years. Originally this district was prosperous while mining lead-carbonate ores rich in silver and gold. When sulphides of lead, iron, copper and zinc were encountered, they were accompanied by gangue of baryta that precluded clean separation by gravity methods of that time.

IDAHO

Shoshone County

CONSTITUTION (Kellogg)—This Pine Creek property has shipped two cars of first-class zinc ore and will ship third soon.

RAY-JEFFERSON (Wallace)—According to announcement of D. C. Smith, president of the Ray-Jefferson, group of larger stockholders have subscribed loan of $200,000 for further developing mine and building mill.

SUCCESS (Wallace)—This company has announced monthly dividend of 6c. per share, payable Sept. 23, and amounting to $90,000. Product mainly zinc with a little lead. Parallel oreshoot has recently been discovered which have been proved from 500 to 900 level and which may duplicate one now being mined.

CLARK COONEY (Burke)—Old Mark Cooney property near Burke, consisting of four claims and three fractions, all patented, has been sold to M. Neary, of Spokane, for $150,-000, of which $25,000 was paid in cash. There are three tunnels, each about 200 ft. long. As soon as machinery and other equipment can be landed, the new owners will start driving 500-ft crosscut to develop vein at greater depth.

IDORA (Wallace)—Option on this property held by P. J. Dwyer, of Missoula, Mont., for $150,000, expired on Sept. 15. Company plans further development under management of C. O. Mallette, of Spokane. Company owns 100-ton mill on Beaver Creek, now under lease to Tuscumbia with provision to treat Idora ore when needed.

KILL BUCK (Wallace)—This property, owned by ex-Senator Clark, of Montana, is to be developed at once by extending Vulcan tunnel, which will explore Kill Buck 600 ft. below present workings. Considerable ore shipped from Kill Buck in early days. Claims patented and property long been idle. Located mile and half west of Wallace, on Lake Gulch. Vulcan tunnel one-half mile further west and near railroad.

CHICAGO-BOSTON (Wallace)—Announced this week that parallel vein had been found on Chicago-Boston ground and crosscut at depth of 125 ft. shows 12 ft. commercial lead-silver ore, with considerable clean shipping grade. Ore in original vein is gray copper running high in silver. Property is on Lake Gulch, adjoining Kill Buck on east and second vein is supposed to be identical with Kill Buck vein. Report that properties will be consolidated and developed through Vulcan tunnel.

REX (Wallace)—M. J. Sweeny, manager of the Rex Consolidated company, which recently took bond on Rex mine, states that restoration of plant which was partially destroyed by fire recently will be completed about Sept. 20, when unwatering mine will be begun, which will probably require 30 days. Property is under bond for $200,000, payable in five years, or $150,000, payable within one year. Recent information is to effect that company is preparing to pay for it on last-named terms.

HYPOTHEEK (Kellogg)—Drifting from 1,100 level to vein, approximately 160 ft. Probably cut vein in less than a week. Encountered stringer of clean galena a foot thick, and numerous other stringers of quartz with more or less ore. Oreshoot down to 900 level almost all carbonate, and management hopes to find shoot changed to galena on 1,100. Occurrence of carbonate at that depth unknown in any other mine of district. Company shipped first car of crude ore this week. Plans being prepared for mill.

MICHIGAN

Copper

MASS (Mass City)—Production, including unusually large amount of barrel and mass stuff that goes directly to smeltery, now keeps one of furnaces at Quincy smelting plant in operation almost continuously.

ALGOMAH (Houghton)—Has resumed sinking from third level. This was not accomplished without considerable difficulty. Unwatering was troublesome and then it was necessary to lay skip road to third level, nearly 100 ft.

HANCOCK (Hancock)—Opening of No. 7 shaft, which is to be worked jointly by Quincy and Hancock companies, will be in shape to figure on actual mining of rock by Oct. 1. Repair crew going through shaft expects to reach bottom before that date. Quincy company will, of course, be able to commence hoisting rock soon after for reason that it has its old workings at depth and it will need comparatively little cleaning up to get into vein rock. On the other hand Hancock will have to do certain amount of underground exploration work to develop mineral on its property immediately adjoining.

TREMONT-DEVON (Hancock)—Diamond-drilling work on property in Ontonagon may be resumed within a month. Officials of company have such plans under consideration but as yet no definite decision has been reached. Lands comprise 680 acres. Desultory work was done on property before combination of two organizations as now in effect. Present company purposes to drill land thoroughly and in addition to open further some of pits sunk in early days when rock running more than 25 lb. refined copper was extracted. Land is in vicinity of Victoria, apparently in line of Keweenawan formation. Charles Smith is president; F. H. Begole, vice-president; and C. H. Hanchette, secretary and treasurer.

FRANKLIN (Houghton)—Conglomerate rock is making best showing of anything that ever has been taken out of this mine. In the 33rd stope, rock is averaging above 40 lb. copper. This is such unusual showing that miners are enthusiastic about it. Indicative of assurances for the future of this Allouez conglomerate on Franklin property, it might be stated that company has drills at work on 11 levels and on 10 of these are in good average commercial rock. Last week shipments of rock to mill showed substantial increase in amount of Allouez conglomerate and consequent decrease in amygdaloid. Change resulted in mill return of unrefined copper that was particularly satisfactory and better than anything in recent past. Mine is making money on its present tonnage; has sufficient reserves to maintain tonnage or increase it; and Franklin has best chance of its life to become profitable producer.

QUINCY (Hancock)—Is continuing to maintain daily rock tonnage of 4,000 tons. Average copper content is little better than average for recent years. Mesnard shaft showing is improving in most northerly openings which is further assurance relative to rock in newer Pontiac shaft, which was closed down when strike of 1913 began and has never been reopened. It has been rumored at various times that this shaft would be reopened. As matter of fact it was well opened underground, some connections with Mesnard were made and depth continued to practically capacity of temporary hoist. Foundations for permanent hoist and compressor plant were put in before strike. Some of machinery had arrived, but no construction work was attempted, presumably because it was realized that this work must necessarily be expensive and with no immediate return in copper. Quincy management desires first of all to build up its surplus to its accustomed strength and maintain its dividend at same time.

Iron

CRYSTAL FALLS—The operators in this district have granted increase in wages of 10%. This will place wage scale back where it was prior to last fall.

PEWABIC (Iron Mountain)—Hoisting and shipping now being done from four shafts. One shovel loading from stock. Walpole again in operation. More men added to the pay roll.

BATES (Iron River)—Became shipper last week for first time this season. Stock of 40,000 tons will be loaded and shipped. The work of putting down the shaft deeper is completed. Great deal of development work is being carried on underground. Mine is just getting good start and will be larger producer in 1916.

BRISTOL (Crystal Falls)—Contract let to Hicks & Barber to change course of Brier Hill Creek and clear large piece of ground. New orebody has been found underneath. Water would be hindrance to underground operations. Sinking operations will start as soon as contract is completed. Two four-compartment shafts will be sunk 300 ft. Ore deposit was located by drills.

WAKEFIELD (Wakefield)—Ore sales from here this year amount to 625,000 tons. Three shovels and five locomotives are kept busy in pit. One shovel is stripping and two loading. Stripping will be continued all winter. Mine will probably be called upon to deliver large tonnage next year. Shipments are averaging 5,000 tons daily and will continue at that rate until close of navigation.

MINNESOTA

Cuyuna Range.

ADAMS (Oreland)—Mine will be unwatered immediately upon receipt of electrical pumping equipment now ordered.

IRON MOUNTAIN (Manganese)—Company has sold 8,000 tons of manganiferous material to Pittsburgh Steel Co., and tonnage is going forward at rate of 4 or 5 cars daily.

ONAHMAN IRON CO. (Crosby)—This company, heretofore operating on Vermilion Range, has closed deal for Duluth-Brainerd mine in manganiferous belt of the Cuyuna district. Mine has been renamed "Ferro." Property is served by Northern Pacific Ry. and has complete surface equipment although but little underground work has been done.

Mesabi Range

LA RUE (Nashwauk)—Mine will start shipping after long idleness.

MAHONING (Hibbing)—Ore shipments are averaging 450 cars per day. Mine will be one of heaviest Mesabi shippers this season.

HULL-RUST (Hibbing)—This property is sending out about 700 carloads per day. Cars average 45 tons each. Missabe road is handling about 1,500 cars daily from Hibbing district.

CHISHOLM—Shovels are working off and on at Glen Allen, Chisholm and Myers properties. Most of ore in stock has been moved. All of ore that is hoisted is going forward to docks.

DUNWOODIE (Chisholm)—Winston-Bear Co. has about completed its contract here for Arthur Mining Co. Two shovels will be removed from pit next week. Arthur Mining Co. has one shovel at work now, stripping for permanent approach.

SECTION 27 (Chisholm)—First shipment of ore was made from here last week. It consisted of 11 cars. Underground work is progressing slowly. It was not thought when shaft work was started some months ago that any shipments would be made this year.

LEONARD-BERT (Chisholm)—One shovel is now working two shifts loading ore. Another is loading rock that is being used to make stocking ground at Section 27 property. It is necessary to remove rock and lean ore in order to get at better-grade ores farther on.

QUINN-HARRISON (Nashwauk)—One unit of washing plant now operating declared to be successful. At full capacity plant will handle 8,000 tons of ore per day. It is third washing plant to be erected on Mesabi range. One now under construction at Crosby mine, Nashwauk, will be working next month.

SHENANGO FURNACE (Chisholm)—Notice has been given to 40 house owners to remove their property from company's forty directly north of Monroe mine. Land is to be stripped this season. Most of structures are merely shacks but some are fairly respectable dwellings. Large deposit of ore is known to exist on this forty.

BUTLER BROS. (Nashwauk)—New type of steam shovel has arrived for this firm. It is now being assembled. It will be used in stripping Mace No. 2 mine. It weighs 315 tons. It is similar in some respects to shovels used in coal fields in Kansas. Dipper has capacity of 5 cubic yards. Dipper stick in transit occupied two flat cars. Boiler is elevated 25 ft. Shovel has circular base and swings on roller bearings; can be worked from any position.

MISSOURI, OKLAHOMA AND KANSAS

FAIRCHILD AND MATHIAS (Joplin, Mo.)—Will drain their lease on Rex land; are installing an Emerson pump, which will drain ground to 130-ft. level.

BIG SQUAW (Lincolnville, Okla.)—Will rebuild mill at old mine; most of machinery which has been removed will be replaced with new; work will be conducted at 140 level.

OWASSA (Duenweg, Mo.)—Is to build new mill of 250 tons capacity on its lease on Mercantile land south of Duenweg. Plant will be equipped with two Hodge tables, and air compressor. Will install gas engines for power.

CHAS. EARKHEART (Galena, Kan.)—Is to build large plant to handle tailings only from Squires mill; will have novel system of roughing, cleaning and finishing tables, and will be operated by gas engines. Mill will handle 400 tons every 10-hr. shift.

GALENA ROYALTY & MINING (Galena, Kan.)—Has struck another good prospect in drilling on one of leases south of Galena. Company has several hundred acres leased for mining purposes, it drills and prospects land and leases it out to mine operators to develop and mine on royalty. Have 40 acres already drilled and leased out.

MONTANA

Silver Bow County

BUTTE & LONDON (Butte)—Unwatering of the Butte & London shaft was completed Sept. 11 and sinking was started Sept. 13. New electric pump has been installed at the 1,100 station and small pump at 800 has been disconnected. It is expected to make 10 ft. per day in sinking and that 1,600-ft. point will be reached in November, when station will be put in and work on crosscutting property both north and south will be started.

BULLWHACKER (Butte)—Has again been shut down, and negotiations are on for resumption of operations with leaching plant, which was installed some years ago. Experts who have examined plant claim that with few changes plant can be made to work successfully. With completion of acid-producing plant at Washoe smeltery it will be possible to purchase acid for leaching purposes at less than half what it formerly cost Bullwhacker and Butte Duluth companies.

NORTH BUTTE (Butte)—The output is now in excess of 2,000,000 lb. of copper per month, and from present indications the output for the year will far exceed that of 1914, when the total production was 18,421,761 lb. of copper, 1,092,200 oz. of silver and 1,107 oz. of gold. While production during first 7 months of present year was only 50% of normal, it has been steadily increasing until at present time it is close to capacity of the mine. Between 750 and 800 men are employed as against less than 500 six months ago. Daily tonnage is about 1,200 tons and from this about 80,000 lb. of copper is recovered. New Granite Mountain electric hoist is working splendidly and has enabled North Butte company to make a big reduction in cost of production. Production is not yet back to the average of 1913, when ore hoisted averaged 1,342 tons per day and more than 28,000,000 lb. of copper was produced for year. At that time average number of men employed was 800.

BARNES-KING (Butte)—Is still negotiating with Kendall company for settlement of disputed orebody in North Moccasin ground, from which Barnes-King has been mining for long time, but no settlement has yet been reached. Idea of purchasing all of the Kendall company's holdings has been abandoned because of excessive price placed on its property. While controversy exists Barnes-King company has stopped operations in all disputed ground, although greater part of orebody is recognized as belonging to Barnes-King company. As consequence of dispute August output of North Moccasin mine dropped to $14,500, whereas former months yielded

about $32,000 in bullion. Only 1,464 tons of ore were mined in August from the North Moccasin mine against former average production of about 5,000 tons per month. At Piegan-Gloster property, in Marysville district, considerable improvement is noted. The receipts from the mill were $16,000 from 1,500 tons of ore. Tonnage is still far below the capacity of mill. Good progress is being made in developing the Shannon property, and showing in shaft being sunk from tunnel level is so good that company, it is understood, is seeking to acquire some more property adjoining Shannon.

BUTTE & SUPERIOR (Butte)—Blackrock mine of Butte & Superior company was closed for four days last week to permit of some needed repairs and suspension will probably result in decrease in September spelter output of company. It had been more than year since last repairs were made in shaft and some trouble was experienced recently. Mine had been run at capacity for many months and no opportunity given to make needed repairs so that it became necessary to close mine for several days, which was done when Labor Day holiday came around. With repairs just completed company will make another long run. Production of spelter last month was about 14,500,000 lb., or nearly 1,000,000 lb. in excess of any previous month. This big output was made in spite of fact that tonnage of approximately 45,000 tons of ore mined and milled was not up to July tonnage. "The improvement in the recoveries and grade of concentrates was brought about largely through the greater efficiency of the new machines," says Manager J. L. Bruce. "The adjustments are better in the flotation plant now and the results are showing what improvements have been made recently." Recoveries averaged 93%, while the grade of concentrates was 56% against 51% in former months. In regard to report that large body of copper glance has been found in Black Rock mine, Mr. Bruce said: "There is no truth in that report. Such reports have been circulated from time to time, but there is little or no foundation for them. Once in a while a body of copper glance will be run into in certain parts of the mine, but there is no evidence that our zinc ores are giving way to copper in the districts where we are mining." The same is true about reports that an unusual strike of zinc ore had been made. Nothing new has been found. By an order of district court few days ago $1,000,000 mortgage on Butte & Superior property was cancelled, mortgage having been satisfied by exchange of bonds for stock in company. Shaft sinking is going on in the Black Rock shaft, which has now reached depth of 1,750 ft. and station is being cut at 1,700 ft.

SOUTH DAKOTA

Custer County

FAIRVIEW MICA (Custer)—Property has been purchased by Salt Lake parties, who have commenced operations.

Lawrence County

TROJAN (Trojan)—Equipment for fine grinding will be installed at early date.

WASP NO. 2 (Flatiron)—Production of wolframite continues; recent shipments were sold for $15 per unit of tungstic acid. Mill is operating steadily on maximum tonnage—500 daily—of $2 gold ore.

ECHO (Maitland)—Small boiler is being installed to furnish steam for sinking pump. Shaft, 175 ft. deep, will be continued to 200 ft., station and sump cut at that point, and extensive lateral work done. Station pump will be electrically driven.

RATTLESNAKE JACK (Galena)—Milling has been suspended until arrangements can be made to dispose of tailing in some other way than running into creek. An Oliver filter has been ordered, with intention of using it as dewaterer before stacking tailing. Plant is fine grinding with cyanidation by Trent process.

Pennington County

HOME LODE (Silver City)—Company is operating plant of 25 tons daily capacity, treating ore containing free gold, jamesonite, pyrite, and some lead and copper. Fine grinding in slow-speed Lane mill is making large percentage of the gold amenable to amalgamation. Good separation of antimony mineral is made on Deister tables. Further concentrating equipment is to be installed at once.

UTAH

Beaver County

PALOMA GOLD & SILVER (Milford)—Company has made a trial shipment of copper ore that averaged 18% Cu, and 11 oz. Ag. A recent silver-lead shipment ran 22% Pb., 17 oz. Ag., and 2% Cu. Shaft will be deepened to 500 ft. Compressor and drills being installed.

Juab County

BECK TUNNEL (Silver City)—Drifting is being done south on 1,100 level, with view to prospecting ground, on which only small amount of work has been done.

TINTIC (Silver City)—Work on company's mill is progressing satisfactorily, and it is expected that operation will begin Jan. 1, with an initial capacity of 200 tons daily. Ore from Knight and Dern properties will be treated.

SCOTIA (Eureka)—About 1,000 tons of lead ore have been hoisted, and as soon as new traction engine—expected at mine soon—has been put in operation, about 23 tons of ore daily will be hauled to railroad at Jericho, 18 miles from property.

YANKEE (Eureka)—Recent strike near surface is opening up satisfactorily. Shaft has been sunk 60 ft. from surface, 40 ft. of this being in ore. Raise is being sent up from lower tunnel to connect with it. Drifting will be undertaken later.

UTAH MINERALS CONCENTRATING (Eureka)—It is stated that this company, which has been doing experimental work on low-grade ores from Chief Consolidated is preparing to start active operation. Other ores beside those of Chief will probably be treated.

Salt Lake County

MICHIGAN-UTAH (Alta)—It is announced that this company has been financed for active development work, to be started in near future. Shipments are being made from Grizzley workings by leasers, whose lease expires Oct. 7. After that date work in this section will be taken over by company. City Rocks vein above Cleaves tunnel is being worked by Triangle Mining Co., employing 30 to 40 men.

ALBION (Alta)—Large flow of water has been tapped recently in Albion drift being driven from Quincy tunnel of South Hecla. This has prevented Albion miners and leasers on Kate Hayes fissure from going to work. Flow was knee deep in Quincy and on Sept. 13 was estimated at 5,000 gal. a minute. Carbon-dioxide gas accompanied or followed the flow and two men equipped with oxygen helmets went into drift to do some work on air line. Both were overcome by gas, the helmets evidently not working properly. One was rescued but other, James Hendrickson, was found dead day following.

Tooele County

THE DRY CANON DISTRICT is active. Other properties producing are Wandering Jew, from which a car was shipped recently, and the Hidden Treasure, where a considerable force is working.

QUEEN OF THE HILLS (Stockton)—Carbonate zinc ore of good grade is being produced from this property, under lease to Big Four Exploration Co.

MONO DEVELOPMENT (Stockton)—Leasers are mining silver-lead ore, and as soon as installation of new compressor has been completed, production will be increased.

CANADA

British Columbia

FRENCH ZINC PROCESS—The provincial government has promised to aid financially in the providing of an experimental plant to further demonstrate this electro-chemical process.

BLUE GROUSE (Vancouver Island)—Six men are engaged in driving tunnel on recent discovery, which is situated near Cowichan Lake. An oreshoot 300 ft. in length has been exposed by surface stripping, varying in width from 15 to 36 ft. and averaging between 4 and 5% copper.

DELLA (Vancouver Island)—An electric hoist is being installed by Pennsylvania people who have this property under bond. Group is located 11 miles from Great Central Lake, in interior of island. Sinking is proceeding by two shifts on quartz vein 6 ft. wide that outcrops for a length of 2,000 ft. Gold occurs in ore in association with zinc blende.

Ontario

McINTYRE (Porcupine)—On 600 level has cut 6-ft. vein assaying $30 per ton.

SHAMROCK (Cobalt)—Mine has been unwatered and crosscutting started on 400 level.

HOLLINGER RESERVE (Porcupine)—Dominion Reduction Co. has dropped its option on this property.

DOBIE (Munro Township)—Vein, which was 1 ft. wide at depth of 11 ft., has widened to 3 ft. at 100-ft. level.

DOME (Porcupine)—Will add new equipment to mill that will bring capacity up to 50,000 tons per month.

BUFFALO (Cobalt)—Mill has closed down, but development work is being continued.

HOLLINGER (Porcupine)—In sinking new main five-compartment working shaft a new vein has been cut, which shows 10 ft. of $8 ore.

DOMINION REDUCTION (Cobalt)—Has taken an option on 400 acres, including 8 Bowser claims and 2 Brennan claims in Goodfish district.

CREIGHTON (Sudbury)—Made record production in August when it hoisted 73,000 tons. At Crean Hill and No. 2 mines 17,000 tons were raised, giving total production for the month of 90,000 tons. New five-compartment shaft at Creighton, 32x8 ft., was sunk 135 ft. in granite during July.

TOUGH OAKES (Kirkland Lake)—Has been temporarily closed down, owing to shortage of electric power. Winze has been completed to 400 level and is in rich ore, 5 ft. in width, averaging $70 per ton.

KING DODDS CLAIMS (Kowkash)—These three claims, on one of which original Kowkash discovery was made, have been taken over on working option by syndicate of American and Canadian capitalists, headed by John L. Orn, of Buffalo, and C. M. Forbes, of Lanark, Ont.

NIPISSING (Cobalt)—During August estimated value of ore mined was $179,048, and bullion from Nipissing and customs ore estimated value of $118,047 was shipped. Arrangement has been made with O'Brien company to coöperate in development of adjoining territory.

BEAVER (Cobalt)—Report for quarter ending Aug. 31 states that main shaft is down 1,100 ft. and that sinking will be continued until lower contact between diabase and Keewatin is reached. Promising orebody was encountered in drifting on 300-ft. level. There was $116,017 cash on hand and bullion and ore amounting to 314,511 oz.

TECK HUGHES (Kirkland Lake)—At annual meeting formally turned over property to Buffalo Mines of Cobalt, which has purchased outright two-thirds interest. Working capital for further development and for building mill, will be supplied by bond issue of $150,000, which will be taken up by Buffalo. Mine has $350,000 worth of ore developed.

Quebec

EUSTIS (Sherbrooke)—Fire has totally destroyed mill. Loss, $50,000.

The Market Report

Metal Markets

NEW YORK—Sept. 22

The copper market was fairly active and advanced slightly. The markets for lead and zinc were dull, but toward the end of our week of record exhibited a stronger tone. Tin was stationary, almost no business being done.

Copper, Tin, Lead and Zinc

Copper—At the beginning of our week of record copper was freely available from first hands at 17¾c., regular terms, corresponding with 17.55c., cash, New York. All of the American producers offered freely in Europe at £86, and made sales at that figure. What such sales would realize in cash in New York was problematical, depending on the rate of exchange and the freight rate, both of which are very uncertain factors at present. Some producers have old contracts for freight which enable them to send copper abroad for c.i.f. charges of about 40c. per 100 lb., while others have to reckon 50@60c., freight alone being 30@40c. at current rates. Probably about 17.45c., New York, was the mean equivalent of £86. On Sept. 20 the market abroad improved materially, and £86½@86¾ was realized on export sales, and on Sept. 21 and 22 business was done at £87. The price asked of domestic consumers was 18c., regular terms, right along by the principal producers. Other producers who had previously been offering at 17¾c. raised their asking price to 17⅞c. on Sept. 20. Domestic consumers were, however, conspicuous by their absence up to Sept. 22, when one of the wire drawers contracted for a round lot. For this order there was sharp competition.

A fairly large business was done during the week, the aggregate being estimated at somewhere between 20 and 35 million pounds. This was almost entirely for foreign account, France especially being a large buyer, while Great Britain and Russia took smaller quantities. The demand was chiefly for immediate delivery, out of warehouse on the other side if possible, otherwise for prompt shipment from here. Domestic consumers appear to be acting in concert in staying out of the market, a feature of their policy that is becoming increasingly prominent. The natural result is that when they make up their minds to buy they have to do it all together and produce a sharp advance on themselves. It is believed among producers that the domestic manufacturers of copper goods are bound to cover large requirements for copper during the last quarter of the year.

The matter of freight rates and freight space for shipments of metal from the United States to European ports is causing a good deal of concern among shippers.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19½c. per lb. at mill. The chief maker does not quote base price.

Copper Exports from the United States, week ended Sept 4, are reported by the Department of Commerce at 4,003,092 lb., the chief items being 1,782,452 lb. to France and 1,343,162 lb. to Great Britain. Imports for the week were 2,751,200 lb. metal and 1,433,955 lb. in ore and matte; 4,185,155 lb. in all, chiefly from Canada, Cuba and Chile.

Visible Stocks of Copper in Europe on Sept. 15 were: Great Britain, 22,350; France, 5,177; afloat from Chile, 2,675; afloat from Australia, 2,550; total, 32,152 long tons, or 72,020,480 lb. This is a decrease of 1,962 tons from the Sept. 1 report.

Tin—This market was dull and about stationary, almost no business at all being done. At the close there was a rather weaker tone, reflecting the decline in London.

Production of Banka tin in June is reported at 16,111 pikuls. Stocks of Banka tin on Aug. 31 were 905 tons. Stocks of Billiton tin at same date were 30 tons.

Lead—At the beginning of our week of record there was a little wavering of the price, some sales of domestic lead for export being made at a little below the price of the A. S. & R. Co. However, the market soon steadied itself and later became rather stronger, without any further advance in price, however. A large tonnage of domestic lead, destined for export, was sold in New York on Sept. 22 at the full price.

Spelter—At the beginning of our week of record, a rather large tonnage of spelter was sold, chiefly for export. After that the market became peculiar, as it has many times before in this remarkable year. Spelter for prompt and early delivery became almost unprocurable, while for the later months it was unsalable. In the latter half of the week some small sales of spelter for spot and prompt delivery were made at about 13½c., and the price for following months up to the end of the year was about ¼c. less per month. A considerable quantity of spelter was sold during the last week on long-range contracts, such as October-June, December-June, and January-March. This business was done at prices of 10@11 cents.

Zinc Sheets—Business has been more active, but with no change in prices. The base price for carload lots is $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Sept	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Spot, Cts. per Lb.	Lead New York, Cts. per Lb.	Lead St Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
16	4 6800	48½	17.45 @ 17.55	33	4.45 @ 4.50	4.30 @ 4.35	12.50 @ 13.00
17	4 7100	48¼	17.45 @ 17.55	3	4.45 @ 4.50	4.30 @ 4.42½	12.50 @ 13.00
18	4 6850	48¼	17.45 @ 17.55	33	4.50 @ 4.42½	4.35 @ 4.42½	12.50 @ 13.00
20	4 6850	48¼	17.50 @ 17.70	33	4.50 @ 4.42½	4.35 @ 4.42½	12.50 @ 13.00
21	4 7125	49¼	17.50 @ 17.80	33	4.50 @ 4.42½	4.35 @ 4.42½	12.75 @ 13.50
22	4 4700	49¼	17.50 @ 17.80	2¼	4.50 @ 4.42½	4.35 @ 4.42½	12.75 @ 13.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Sept	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos	Lead £ per Ton	Lead Cts per Lb.	Zinc £ per Ton	Zinc Cts per Lb.
16	23 7/16	69½	70½	86½	18.05	153¾	154	22 11/16	4.79	68½	14.20
17	23 7/16	69	70	86½	18.12	152½	153¾	22¼	4.77	66	13.91
18	23½										
20	23 7/16	69½	70½	87	18.17	152¼	153¼	23	4.81	65	13.58
21	23½	70½	71½	87	18.25	153	153¾	23¼	4.87	65	13.58
22	23½	70½	71¼	87	18.21	152	152½	23¼	4.90	63	13.16

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver, which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, prices for the latter being subject to 3 per cent discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per lb., the following approximate ratios are given, reckoning exchange at 4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Additions, £1 = 0.21c.

Other Metals

NEW YORK—Sept. 22

Aluminum—The market is still quite active, and supplies not large. Prices continue about the same, 45@50c. per lb. being asked for No. 1 ingots, New York. The American producer is reported willing to contract for 1916 business at lower rates, but will not confirm or deny the statement.

Antimony—The market has been quiet, with hardly more than a retail business doing. Chinese and other ordinary brands are quoted at 28@29c. per lb., while 43½@45c. is named for Cookson's. There are some large inquiries for export, but they depend upon the outcome of pending financial negotiations.

Nickel—Quotations for ordinary forms are 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—Business has been fair and the market has been rather more active. Prices are generally steady. New York quotations are $89@90 per flask of 75 lb. San Francisco prices are reported by telegraph at $85@90 per flask. Some dealers report large sales, but others are less active. London price is unchanged at £16 10s. per flask, second hands quoting full price.

Gold, Silver and Platinum

NEW YORK—Sept. 22

Gold—More gold is reported on the way from England, the amount not being definitely stated. How much more may come depends largely upon the negotiations now in progress over credits or note issues.

Platinum—The market is quite uncertain, owing to short supplies and the cessation of imports from France and Russia. This is about the season when supplies are looked for in the jewelry trade, but none are available. Transactions have been small. Dealers are asking $50 per oz. for refined platinum and $56@57 for hard metal. The market is very uneasy, and any considerable supply from abroad would send prices down; but no such supply is expected at present.

Iridium—Like platinum, supplies are short with no increase in sight at present. Quotations are $75@80 per oz., nominally, but each transaction stands by itself. **Palladium** is also scarce and brings about $60@65 per oz., New York.

Silver has advanced in London to 23¾d., the highest point recently reached. Purchases by the United States Government have had the effect of stimulating the Continental demand, while the supplies put on the London market have been rather limited; for this reason the undertone to the market is considered good.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Sept. 18

The base price paid this week for 60% zinc ore was $70@74 per ton, for medium grades, $65@70 per ton. The base price paid for 80% lead ore was $50 per ton.

SHIPMENTS, WEEK ENDED SEPT 18

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,741,040	80,000	440,200
Year	138,642,120	4,543,160	19,640,910

Shipped during week to separating plants, 2,838,800 lb. zinc ore.

JOPLIN, MO.—Sept. 18

Blende, high price, $82.90, base per ton, 60% zinc, premium ore, $78; medium, $73@77; lower, $70@73, with a few cars at 75 calamine base, 40% zinc, $70@73.50; average, all grades of zinc, $77.02 per ton. Lead, high price, $55; base price, $50@52 per ton of 80% metal content; average, all grades of lead, $50.[illegible] per ton.

SHIPMENTS, WEEK ENDED SEPT. 18

	Blende	Calamine	Lead	Values
Totals this week	9,562,290	675,750	2,107,600	$447,090
Totals this year	1,146,850	32,667,290	63,402,110	17,855,100

Blende value, week, $372,810; 38 weeks, $15,445,070.
Calamine value, week, $21,480; 38 weeks, $740,260.
Lead value, week, [illegible]; 38 weeks, $1,669,770.

Seven inches of rain fell in six hours, general over the entire district, Tuesday after midnight, the effect of which was slight to some, though an injury to all, and a positive blight to a number of mines, some of which were inundated. As a camp, Galena, Kansas, suffered most; Alba-Neck, Granby and Aurora seriously for several days. The result is estimated at a restriction of 15% in output. As the effect of the enormous volume of water became felt in the mines a demand increased for the ore in bin, and week-end purchases were sharply enlarged, about 6,000 tons being purchased Friday and Saturday.

Reports received in Joplin today confirm a rumor prevalent for some time that A. O. Ihlseng, of New York, would engage in the smelting of zinc ores. Mr. Ihlseng and a Mr. Johnson of California have purchased 20 acres of land at Pittsburg, have surveys under way for tracks from two railway systems, and have much of the material ordered for the four-block smelter to be erected.

Iron Trade Review

NEW YORK—Sept. 22

There has been no material change in the iron and steel markets during the week, the situation remaining about the same.

The strong demand for steel for export has kept up prices of bars and other forms. An increase in the demand for structural steel from domestic buyers has been quite in evidence. The scarcity of crude steel is also a feature of the market, and mills using purchased billets are hunting for supplies.

Pig iron has been generally strong, but without any general advance in prices. Foundries are beginning to look for first quarter iron, and basic is in demand.

PITTSBURGH—Sept. 21

With what appears to be only an ordinary flow of business, chiefly in the form of specifications on contracts, with occasional new buying, the steel mills are falling farther behind in deliveries although they are crowding for output and are shipping more steel than ever before in their history. They already have actual shipping orders entered for almost as much steel as they can make and ship the remainder of the year. It is the common statement that if there were a normally full demand for steel from domestic sources, for instance for railroad material and structural purposes, there would be an unprecedented famine in steel. Prospective railroad requirements cannot yet be estimated, but there has been an increase in railroad buying, 75,000 to 100,000 tons of rails for spring rolling having lately been put under contract, while bids are going in on at least 10,000 freight cars. Car shortages are beginning to appear in the steel industry and a general car shortage is predicted for next month as the crops come to be moved.

Steel prices continue to show an advancing tendency. Effective yesterday the American Steel & Wire Co. advanced wire products $2 a ton, the independents immediately concurring, the new prices being: Plain wire, 1.[illegible] c.; wire nails, $1.75; galvanized wire, 2.30c.; painted barb wire, 1.90c.; galvanized barb wire, 2.60c. Plain wire is now up to the maximum price since 1910. Mills have made some contracts for bars, plates and shapes for first quarter at 1.40c., but are reserved about selling even at this figure. The market for earlier delivery, at mill convenience, is strong at 1.35c. The National Tube Co. today announced the withdrawal, Sept. 30, of all special prices on oil-country goods, the demand for which is showing considerable improvement.

The Shelby Steel Tube Co. announces that it will double the finishing capacity of its seamless-tube plant at Ellwood City, Penn., adding two electrically driven piercing mills, with the necessary attendant equipment, to have an annual capacity of 60,000 tons of finished tubes, 2-in. to 8-in., at the same time building an electrically driven continuous bar mill to reduce blooms to rounds, with an annual capacity of 175,000 tons, this to replace the present mill.

Pig Iron—The market has been quiet but prices are firmly held and it is suggested that the quietness is due largely to furnaces being reserved about selling, because they expect higher prices. The stack of the Sharpsville Furnace Co. is going into blast, and Alice, Ella and Fannie, all in the Shenango Valley, are likely to blow in shortly. We quote: Bessemer, $16; basic, $15, both for early delivery; foundry and malleable, $14.50@15, gray forge, $14.25@14.75, the higher being for next year's delivery, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—A few contracts have been entered for ferromanganese by domestic producers since their recent announcement of a price of $115. English producers continue to quote $100 on contract, delivery being very uncertain. Spot lots command $100@115 according to supplies from day to day. The consumption of 50% ferrosilicon as a scavenger, to reduce the quantity of ferromanganese needed in soft-steel making, is reported to be increasing rapidly. Prices on 50% ferrosilicon are the same as before the war, $71 in 600-ton lots, $72 in 100-ton lots and $73 in carload lots, delivered east of the Mississippi.

Steel—The market for basic openhearth billets is all of $26, Youngstown, with only occasional lots to be picked up at this figure. Bessemer could probably be had at about $1

a ton less. Pittsburgh prices are Youngstown prices plus the freight of $1.05. There is no market for sheet bars as sheet and tin mills are covered and in any event could not afford to pay the prices that would be asked. With the advance in wire products rods become quotable at $30, Pittsburgh, but it is difficult to find sellers at any price.

Exports and Imports of those iron and steel products for which tonnages are given in the reports are stated by the Department of Commerce as below for July and the seven months ended July 31, in long tons:

	July		Seven Months	
	1914	1915	1914	1915
Exports	114,790	368,893	959,825	1,676,485
Imports	24,958	20,857	167,210	124,636

Exports for the seven months show an increase of 716,660 tons, or 74.7%; while imports decreased 42,574 tons, or 25.5%. The larger items of exports in 1915 were 241,348 tons wire and wire products; 263,985 tons billets, ingots and blooms; 219,371 tons steel bars; 126,394 tons steel rails.

Exports from Baltimore for the week included 2,234,540 lb. tin plates to Glasgow. Other exports included 6,171,387 lb. bars, plates, wire rods, wire, etc. to Great Britain.

FERRO-ALLOYS

Ferromanganese is quoted at $110@112.50 per ton for domestic 80% material. **Spiegeleisen** has been sold at $27 per ton for 20%, at furnace.—**Ferrosilicon,** 50%, is quoted at $75 per ton at Pittsburgh. Bessemer ferrosilicon is from $20 per ton for 10% up to $24 for 14%, all at furnace.—**Ferrotitanium** is 8@12½c. per lb., according to size of lots and delivery.—**Ferrovanadium** is $2@2.25 per lb. of contained vanadium.—**Ferrotungsten** is quoted in London at 78.@7s. 6d. per lb.—$4@90c.—for alloy 75@80% tungsten.—**Ferromolybdenum** is quoted in London at 18s.—$4.32—per lb. for 75% alloy.

FOREIGN IRON

Pig-Iron Production in Germany in July is reported at 1,064,899 metric tons, which is 75,022 tons more than in June and 197,045 tons less than in July, 1914. For the seven months ended July 31 the production was: Foundry iron, 1,382,946; forge iron, 173,727; steel pig, 913,566; bessemer pig, 98,329; Thomas (basic) pig, 4,031,068; total, 6,599,236 metric tons, which compares with 10,850,140 tons in 1914; showing a decrease of 4,250,904 tons, or 39.2%, this year.

Pig-Iron Production in Manchuria is being pushed. The Penhsihu Mining & Colliery Co. is turning out about 130 tons a day from its blast furnace. The iron is of good quality, very low in phosphorus and sulphur. The company has contracts to furnish iron to the Osaka Iron Works in Japan and to the Japanese navy.

IRON ORE

Some more sales of Lake iron ore in the East are reported, including a large lot of silicious Marquette ore at about 7c. per unit delivered. Some other blocks of Old Range ore are reported engaged for Eastern furnaces.

There is already talk of Lake ore prices for next season, and it is expected that buying will begin early in view of the great increase of activity in the iron trade. The general expectation is that prices will be at least 50c. a ton higher than this season.

British Imports of Iron Ore, eight months ended Aug. 31 were 4,002,044 long tons in 1914, and 4,239,167 tons in 1915; an increase of 237,123 tons this year.

OTHER ORES

Tungsten Ore is still in demand and supplies are not large. A recent sale reported is of a small lot of concentrates, running about 60%, which brought $35 per unit WO_3, for spot delivery. This is a considerable advance over the latest previous sales reported.—**Molybdenite,** 80% MoS_2 is reported sold at $1.25 per lb., New York.

A cargo of **Manganese Ore** from the newly opened deposit at Brigus, Conception Bay, Newfoundland, has been shipped to Pittsburgh. Others are expected to follow.

COKE

Coke production in the Connellsville region for the past week is reported by the "Courier" at 387,703 short tons; shipments, 388,862 tons. Production of Greensburg and upper Connellsville districts, 44,978 tons.

A Cincinnati dispatch says: "The Kentucky Solvay Coke Co., Ashland, Ky., has sold to the Marting Iron & Steel Co., Ironton, Ohio, furnace coke requirements of 150,000 tons annually for five years. This sale, which is one of the largest made in the history of the pig iron market in this territory, is on a sliding-scale basis."

Connellsville Furnace coke contracting for the first half of 1916 is still in abeyance, but buyers and sellers seem to be getting nearer together. Two or three sliding-scale contracts recently made are hardly representative of the market, and it is possible business will be done at that prices after all. For deliveries late in the current year $2 and $2.25 have both been paid, according to quality, etc. Spot furnace coke is $1.65@1.70, and thus slightly firmer.

British Coal Production for the first half of the year is estimated by the Board of Trade as below, in long tons:

	1913	1914	1915
Coal mined	145,923,000	140,274,000	127,826,000
Coal exported	37,279,000	36,390,000	23,595,000
Steamer coal	10,087,000	10,182,000	7,400,000
Total exports	47,366,000	46,572,000	30,995,000
Balance	98,557,000	93,702,000	96,821,000

The steamer coal is fuel furnished to steamships engaged in foreign trade. The production for the second half of 1914 was 125,369,000 tons, or 2,457 tons less than in the first half of the current year.

Fuel Exports of Great Britain, eight months ended Aug. 31, in long tons:

	1914	1915	Changes
Coal	41,257,161	29,522,179	D 11,734,982
Coke	691,061	573,218	D 117,843
Briquettes	1,324,937	864,503	D 460,434
Steamer coal	13,249,027	9,657,927	D 3,591,100
Total	59,525,186	40,620,827	D 18,904,359

The steamer coal is coal sent abroad for the use of steamships in foreign trade.

Coal Production of Austria-Hungary, years ended June 30, in metric tons:

	1913-14	1914-15	Changes
Coal	16,514,000	14,821,000	D 1,693,000
Brown coal	26,570,000	21,685,000	D 4,885,000
Coke made	2,615,000	1,788,000	D 827,000
Briquettes made	431,000	448,000	I 17,000

Of the briquettes reported last year 241,000 tons were made from brown coal, or lignite.

Chemicals

NEW YORK—Sept. 22

The general market is still rather quiet and irregular in some lines.

Arsenic—The demand is moderate and supplies are sufficient. Prices are unchanged, about $3.50 per 100 lb. for large orders, and $4 for smaller lots.

Copper Sulphate—Business has been rather quiet and sales moderate. Prices are easier, $6.75 per 100 lb. being asked for carload lots and $7 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is quite active for the season. Prices are steady at 2.42½c. per lb. for spot and 2.45c. per lb. for futures.

Pyrites—Imports at Baltimore for the week included 7,628 tons pyrites from Huelva, Spain.

Chrome Ore—The chrome-ore mines in the neighborhood of Black Lake, Quebec, are being reopened and considerable shipments are being made to the United States. These mines have been closed for some time owing to the competition of ores from Turkey, Greece and Rhodesia, which had cheap water freights. The war in Turkey and the high ocean rates from South Africa have cut off those supplies.

PETROLEUM

Shipments of crude petroleum from Tampico, Mexico, to the United States in August were 1,281,593 bbl.; in addition 70,144 bbl. were shipped to the Panama Canal Zone, making a total of 1,352,027 bbl. Shipments from Tuxpam in August were 859,054 bbl., making a total of 2,211,091 bbl. for the month.

Exports of mineral oils from the United States in July were 215,595,691 gal., being 15,673,794 gal. less than in July, 1914. For the seven months ended July 31 the total exports were 1,348,173,539 gal. in 1914, and 1,286,660,756 gal. in 1915; a decrease of 61,512,783 or 4.6%, this year.

Under an imperial decree dated Aug. 18, 1915, the Austrian Government has, as from that date, taken possession of the present and future production of crude petroleum in Galicia and of all stocks of oil belonging to business organizations owned in whole or in part by citizens of countries at war with Austria-Hungary.

Assessments

Company	Delinq	Sale	Amt
Bonanza Con., Utah	Sept. 15	Oct. 6	$0 015
Bullion, Ida	Aug. 30	Sept. 25	0 005
Cash Boy, Nev	Sept. 29	Oct. 30	0 01
Cedar Creek, Ida	Aug. 28	Sept. 29	0 005
Columbus Ext., Utah	Oct. 10	Oct. 30	0.025
Comet, Ida	Aug. 30	Sept. 30	0 0005
Con. Virginia, Nev	Sept. 28	Oct. 19	0 05
Copper Chief, Ida	Aug. 30	Sept. 25	0.005
Diam'field Black Butte, Nev.	Oct. 4	Nov. 4	0 01
Exchequer, Nev	Oct. 4	Oct. 25	0 02
Gethin Le Roy, Utah	Sept. 25	Oct. 13	0 01
Goldstrike M. & L., Utah	Oct. 1	Oct. 20	0.01
Great Bend, Nev.	Sept. 10	Oct. 10	0 01
Hancock Cons., Mich.	Sept. 1		1 00
Hancock Cons., Mich	Jan. 3		1.00
Happy Day, Ida	Aug. 26	Sept. 30	0.0025
Hector, Ida	Sept. 4	Oct. 4	0.005
Hennessy-Burns, Ida	Aug. 20	Sept. 24	0.005
Idaho Los Angeles, Ida	Sept. 3	Sept. 25	0 005
Idaho Montana, Ida	Sept. 3	Sept. 25	0 001
Idaho Nevada, Ida	Sept. 7	Oct. 1	0.002
Imperial, Ida	Aug. 31	Oct. 1	0.005
Keweenaw, Mich	Sept. 1		1 00
Laclede, Ida	Sept. 3	Sept. 27	0 003
Lake Superior & West., Ariz.			0 02
LeRoy, Ida	Sept. 25	Oct. 25	0 002
Liquidator, Ida	Aug. 28	Sept. 25	0 003
Lucky-Calumet, Ida	Aug. 27	Sept. 27	0 005
M. & P. Gold, Utah	Sept. 15	Oct. 12	0 0025
Nevada Cooperative, Nev	Sept. 15	Oct. 15	0.01
Nevada-Douglas, Nev	Sept. 27	Oct. 20	0.10
New Arcadian, Mich	Dec 1		0 50
New Baltic, Mich	Jan. 15		0 50
New Quincy, Utah	Sept. 2	Sept. 23	0.01
Northern Light, Ida	Nov. 2	Dec. 2	0 004
Old Veteran, Ida	Sept. 2	Sept. 30	0 002
Oom Paul, Ida	Aug. 28	Sept. 28	0 01
Oom Paul Con, Ida	Aug. 30	Oct. 4	0 01
Ophir, Nev	Oct. 12	Nov. 2	0 05
Phedora, Ida	Sept. 21	Oct. 21	0.0005
Phoenix, Mich	Sept. 1		1.00
Phoenix, Mich	Jan. 1		1 00
Pioche Metals, Nev	Oct. 20	Nov. 20	0 001
Revelator, Utah	Oct 4	Oct. 25	0.001
Royal, Ida	Sept 1	Oct 1	0.001
Sandstorm Kendall, Nev	Aug. 23	Sept. 27	0.01
Selma Utah	Sept. 8	Sept. 25	0 005
Snowshoe, Ida	Aug. 26	Sept. 27	0 005
Sunset Dev., Wash	Aug. 25	Sept. 18	0.002
Syndicate, Utah	Sept 11	Oct 2	0.001
Tonopah Bonanza, Nev	Sept. 13	Oct. 11	0.01

Stock Quotations

There were no sales at auction reported in either New York, Boston or Philadelphia during the week ended Sept. 22.

COLO SPRINGS	Sept. 21
Name of Comp.	Bid
Acacia	02½
Cripple Crk Con.	009
C. K & N.	02
Doctor Jack Pot	09½
Elkton Con.	25
El Paso	77
Findlay	04
Gold Dollar	‡ 02
Gold Sovereign	03½
Golden Cycle	1 80
Isabella	15½
Jack Pot	06½
Jennie Sample	‡ 02
Jerry Johnson	04
Lexington	06½
Mary McKinney	36½
Pharmacist	06½
Portland	1 50½
Raven B. H	02½
Vindicator	1 59

SALT LAKE	Sept. 21
Name of Comp.	Bid
Beck Tunnel	05½
Black Jack	07
Colorado Mining	09
Crown Point	00½
Daly-Judge	6.90
Gold Chain	15
Grand Central	54
Iron Blossom	70
Lower Mammoth	‡ 01
Mason Valley	‡1 50
May Day	16
Opohoogo	00½
Prince Con	62
Seven Troughs	01½
Silver King Coal'n	3 00
Silver King Con	2 00
Sioux Con	01½
Uncle Sam	05½
Yankee	30

TORONTO	Sept. 21
Bailey	04
Coniagas	3 75
Peterson Lake	18
Right of Way	05
Seneca Superior	1 75
Silver Queen	01
T. & Hudson Bay	21 00
Timiskaming	36
Wettlaufer-Lor	06
Dome Mines	22 75

Dome Exten	30
Foley O'Brien	30
Hollinger	25 00
Imperial	05
Jupiter	12
McIntyre	47
Pearl Lake	‡ 00½
Porcu Crown	65
Preston E. D.	05
Rea	‡ 09

SAN FRANCISCO	Sept. 21
Comstock Stocks	
Alta	05
Andes	08
Best & Belcher	05
Caledonia	50
Challenge Con.	‡ 05
Chollar	03
Confidence	16
Con. Virginia	08
Gould & Curry	03
Hale & Norcross	03
Jacket-Cr. Pt	13
Julia	‡ 03
Mexican	31
Occidental	79
Ophir	18
Overman	07
Potosi	04
Savage	03
Sierra Nevada	19
Union Con	32

Misc. Nev. & Cal	
Belmont	3 62½
Jim Butler	80
Lone Star	05
MacNamara	02
Midway	14
Mont Tonopah	32
North Star	10
Rescue Eula	08
West End Con	59
Atlanta	28
Booth	45
C O D Con	04
Comb Frac	08
D'field Daisy	03
Jumbo Extension	1 35
Pitts-Silver Peak	‡ 06
Round Mountain	11
Sandstorm Kendall	12
Silver Pick	07
Central Eureka	09

N. Y. EXCH.	Sept. 21
Name of Comp.	Clg.
Am.Sm.&Ref.,com.	84½
Am. Sm. & Ref., pf.	107½
Am. Sm. Sec., pf. B.	80
Anaconda	71½
Batopilas Min	1½
Bethlehem Steel	354½
Bethlehem Steel, pf.	164
Chloo	44½
Colo. Fuel & Iron	52½
Crucible Steel	95½
Federal M. & S., pf.	48
Great Nor., ore, etf.	44½
Guggen. Exp	65
Homestake	118
Inspiration Con	35
Mex. Petroleum	87
Miami Copper	27½
Nat'l Lead, com	65½
National Lead, pf	110½
Nev. Consol	14½
Ontario Mlo	3
Quicksilver	2½
Ray Con	22
Republic I&S, com.	45
Republic I&S, pf.	100½
SlossSheff'd, com.	52½
Tennessee Copper	55½
Utah Copper	66½
U. S. Steel, com	76
U. S. Steel, pf.	113½

N. Y. CURB	Sept. 21
Name of Comp.	Clg.
Alaska Juneau	.12
Alta Con	.26
Beaver Con	29
Big Four	05
Blue Bell	03
Braden Copper	.8½
Buffalo Mines	⅛
Can. Cop. Corpn.	¼
Cashboy	.03½
Chambers Ferland	.13
Chile Cop	18
Coo. Ariz. Sm	.75
Con. Copper Mines	1½
Coo. Nev.-Utah	1
Dla. Black B.	05
Florence	.44
Goldfield Con	1⅜
Goldfield Merger	18
Greene Cananea	39
International Nickel	20½
Kennecott Cop	53⅜
Kerr Lake	3⅛
La Rose	⅝
Magma	15½
McKinley-Dar-Sa	.22
Mines of Am	12½
Nevada Hills	.18
New Utah Bingham	3½
Nipissing Mines	7⅛
Oro	07½
St. Joseph Lead	13
South Utah	.15
Stand'd Oil of N.J.	451
Standard S. L.	1½
Stewart	11/16
Success	.89
Tonopah	5⅛
Tonopah Ex	2½
Tonopah Merger	.36
Trihullion	5/16
Tularosa	⅛
Yukon Gold	2½

LONDON	Sept. 9		
Alaska Tre'dwell	£6	16s	3d
Burma Corp.	1	13	1½
Cam & Motor	0	12	9
Camp Bird	0	4	9
El Oro	0	7	7
Esperanza	0	7	3
Mexico Mines	3	11	3
Nechi, pfd.	0	12	0
Oroville	0	14	6
Santa Gert'dis	0	7	6
Tonopoy	0	0	3
Tough Oakes	0	6	6

BOSTON EXCH	Sept. 21
Name of Comp	Clg.
Adventure	1½
Ahmeek	398
Alaska Gold M	32½
Algomah	2½
Alouez	54
Am. Zinc	52½
Ariz. Com., ctfs.	8½
Bonanza	35
Butte-Ballaklava	3½
Butte & Superior	60
Calumet & Ariz	62
Calumet & Hecla	543
Centennial	18
Cliff	‡.90
Copper Range	54½
Daly West	2
East Butte	12
Franklin	9
Granby	86
Hancock	17
Hedley	26
Helvetia	25
Indiana	5
Island Crk. com.	46½
Island Crk. pfd.	89½
Isle Royale	27
Keweenaw	2¾
Lake	13½
La Salle	4½
Mass	10
Mayflower	3½
Michigan	2¾
Mohawk	72½
New Arcadian	9½
North Butte	29½
North Lake	1½
Oilbway	1½
Old Colony	3½
Old Dominion	51½
Osceola	84
Quincy	81
Santa Fe	2½
Shannon	6½
Shattuck-Ariz	24½
Superior	26½
Superior & Bost.	2½
Tamarack	55¾
Trinity	3½
Tuolumne	.37
U. S. Smelting	41½
U. S. Smelt'g, pf.	46
Utah Apex	3½
Utah Con	12
Victoria	2½
Winona	3
Wolverine	58
Wyandot	1½

BOSTON CURB	Sept. 21
Bingham Mines	7½
Boston Ely	.22
Butte & Lon'n Dev	.30
Calaveras	1½
Calumet-Corbin	.04
Chief Con	.90
Cortez	.40
Crown Reserve	.37
Davis-Daly	1½
Eagle & Blue Bell	1½
First Nat. Cop	2¼
Houghton Copper	2½
Iron Cap Cop., pf	5
Majestic	.51
Mexican Metals	19
Nevada-Douglas	75
New Baltic	2½
New Cornelia	9½
Ohio Copper	10
Oneco	50
Raven Copper	12
Rex Cons	51
Smokey Dev	15
So. Lake	5½
Tonopah Victor	.29
Trethewey	11
United Verde Ext	6

†Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.852	28 983	26 553	22.731
February	61 642	57.506	48.477	28.357	26 573	22.753
March	57 870	58.067	50.241	26 669	26 788	23.708
April	59 493	58.519	50 250	27 416	26 958	23 709
May	60.361	58.175	49.918	27 825	26 704	23 570
June	58.990	56 471	49.034	27 199	25 948	23.267
July	58 721	54 678	47.519	27 074	25 219	22 597
August	59 293	54 344	47.163	27 335	25 979	22.780
September	60 640	53.290		27 986	24 260	
October	60 793	50.654		28 083	23 199	
November	58 995	49 082		27 263	22 703	
December	57 760	49.375		26 720	22 900	
Year	59.791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Best Selected	
	1914	1915	1914	1915	1914	1915
January	14 223	13.641	64.304	60.756	69 488	65.719
February	14.491	14 394	65.259	63.494	70 188	*
March	14.131	14.787	64.276	66.152	69 170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66 274	95.333
July	13.223	18.796	60.540	76.011	64 955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53 227		*	
December	12 801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31 707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675		‡	
October	30.284		‡	
November	33.304		1 9.391	
December	33.601		147.102	
Av. year	34 301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19 665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.728	5.531	19.061	24.611
August	3.875	4.656	3 715	4.520	‡	21.946
September	3.828		3 658		‡	
October	3.528		3 384		‡	
November	3.683		3.585		18.500	
December	3 800		3.662		19 097	
Year	3 862		3.747			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6.386	5.112	6.211	21 533	30.844
February	5 377	8.436	5.228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21 569	49.888
May	5 074	14.781	4 924	14.610	21.393	68.100
June	5 809	21.208	4.850	21.038	21 345	100.614
July	4 920	19.026	4 770	18.856	21 568	87.250
August	5 568	12.781	5.418	12.611	‡	67.786
September	5.380		5.230		‡	
October	4.909		4 750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14 59	$13 23	$13.45	$13.99	$13.90
February	15.06	14.55	14 12	13.45	14.08	13.90
March	15 07	14.55	13 91	13.45	14.10	13.95
April	14.90	14.55	13 90	13.45	14 13	13.95
May	14.90	14.61	13 90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14 90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14 90		13 90		14.03	
October	14.84		13.75		13.97	
November	14.50		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14 88		$13.78		$14.01	

The Engineering and Mining Journal

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Roosevelt Drainage Tunnel, Cripple Creek, Colorado

By T. H. Sheldon*

SYNOPSIS—The present tunnel, about 3 mi. long, will be extended about 2 mi. farther and is expected to drain Vindicator, Golden Cycle and other mines beyond a nearly vertical syenite dike, which being impervious, prevents these mines benefiting from drainage now afforded mines on the other side of the dike. Estimated cost $200,000: time to complete, 2 yr. The work, which will be undertaken immediately, is in strong hands.

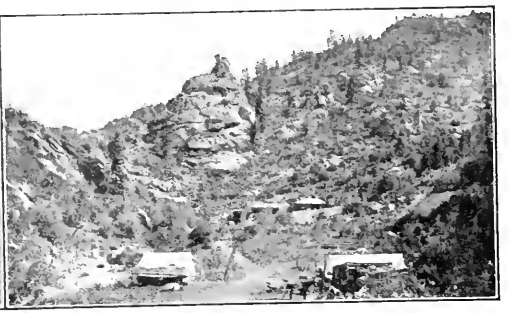
On July 26 and 27 a meeting of the board of directors of the Cripple Creek Deep-Drainage and Tunnel Co. was held in Colorado Springs for the purpose of filling vacancies in the board caused by the death of Frank F. Castello, of the Mary McKinney company, and the resignation of Allen Burris, of the El Paso; also for formulating plans to insure the continuance of the Roosevelt drainage tunnel to the eastern end of the district. The vacancies were filled by the election of Adolph J. Zang, of the Vindicator company, and Richard Roelofs, of the Cresson.

The executive committee, in charge of the work, was increased from three to five members by the addition of Irving T. Snyder, secretary of the Golden Cycle Mining and Reduction Co., and Mr. Roelofs. The other members of this committee are James F. Burns, of the Elkton company, chairman; Irving Howbert, of the Portland, and John Tait Milliken, of the Cycle company. Mr. Snyder is also general manager of the Vindicator company; therefore the addition of these two new members to the executive committee should remove any doubts as to the completion of the tunnel past the Cresson to the Vindicator and Golden Cycle mines, which will benefit also the Portland, Independence and Strong mines.

The board of directors passed a resolution commending the work of Mr. Burns, chairman of the committee, in pushing the tunnel through during the past year in the face of unusual difficulties. A good deal of loose ground was encountered, making the progress slow and requiring a great amount of expensive timbering. The work was suspended for about five months while the El Paso surface plant, destroyed by fire on Nov. 4, was being rebuilt, all the work of excavation being carried on through that shaft.

BATTLE MOUNTAIN, CRIPPLE CREEK DISTRICT

The view includes the Strong, Ajax, Independence and Portland mines and Portland mill



CAMP AT SITE OF THE ROOSEVELT TUNNEL

The entrance to the tunnel is at 8,033 ft. elevation. Present flow from tunnel, 11,000 gal. per min.

On Aug. 16 Mr. Howbert resigned from the board, his place being filled by Mr. Peck, president of the Portland company. A. E. Carlton was elected chairman of the board, and he appointed Mr. Snyder chairman of the executive committee, to take the place of Mr. Burns, who tendered his resignation at that time.

With this reorganization of the executives the work of the tunnel extension is expected to be pushed vigorously and without interruption.

The expense of driving the original Roosevelt tunnel was defrayed by the various larger companies of the district. For the extension, which has been financed in the same manner, $200,000 has been [illegible], the

*Vindicator Consolidated Gold Mining Co., 603 Symes Block, Denver, Colo.

heaviest contributors to this fund being the Portland, the Vindicator and the Cresson—the mines most vitally interested in this work. The distance yet to be driven is a little over 10,000 ft.—about 2 mi.; but as the formation is all breccia and spongy eruptives which can be easily drilled and broken, it is expected that progress will be more rapid and the expense correspondingly less than when the tunnel was being bored through solid granite. The cost of this new work is estimated at $20 a foot.

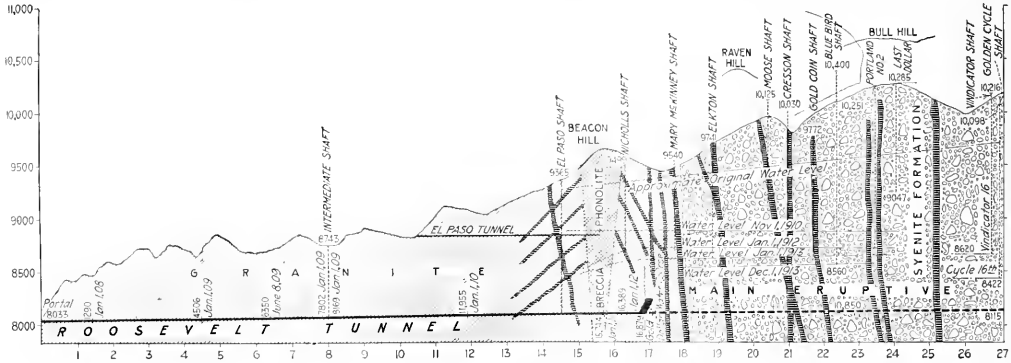
The tunnel extension will pass largely through ground owned by the contributing companies. Right-of-way will be granted by lease, and any veins or orebodies that may be encountered will be worked under these leases.

Even at the risk of repeating what may already be known to some *Journal* readers, a brief sketch of the work of draining the Cripple Creek district may not be out of place at this time. In the earlier days of the camp the water question was not a serious one; but as the more important shafts increased in depth the seepage began to be very troublesome, and below 500 ft. from the surface, operations were greatly hampered by the flow of water. The original water level was about 9,500 ft. above sea level on the western side of the district and 9,700 ft. on the eastern side, the drainage roughly following the contour of the country in its slope from the top of Pike's Peak southwest to the valley of the Arkansas River. The first mines to feel discomfort were those in the southwestern corner of the district, being lower in elevation, especially the El Paso and Elkton.

At first each mine installed its own pumping plant; but as the depth of the workings increased, the unwatering of the mines became so expensive and the outlay of capital for plants adequate to handle the flow of water so enormous, that the mine operators began to consider ways and means for unwatering the entire district by a central pumping plant, or two or three such plants, supported by all the mines interested. This plan was rejected because the benefits to be derived were not considered commensurate with the expense. Several joint pumping plans were tried, but none was particularly successful.

Among the larger individual pumping plants may be mentioned the one at the Portland mine. The first large pump at this mine was a Snow duplex compound condensing unit, installed in 1897 on the 800-ft. level. The dimensions of the steam cylinders of this pump were 18¼ and 34 in.; the plunger, 9¼ in.; the stroke, 36 in.; and the capacity, 1,000 gal. per minute at that depth. A year or two later a Knowles triple-expansion condensing pump was installed on the 900-ft. level. The size of this pump was 18&28&42x10 in., by 36-in. stroke, and the capacity, 1,200 gal. per minute. In 1908 the Snow pump was moved from the 800-ft. to the 1,500-ft. level of the No. 2 shaft, and the water was pumped from that level to the 900 and sluiced over to the No. 1 shaft, where the Knowles pump delivered it to the surface. Water-tight dams were placed in the adjacent old workings on the 900, making an underground reservoir of 400,000 gal. capacity. By this means the Knowles pump could be run 16 hr. a day, while the Snow pump on the 1,500 was working continuously. The cost of operating this plant was about $3,000 a month, handling 525 gal. per minute. The entire cost of the installation was not less than $50,000.

In the meantime the El Paso mine was bending its efforts toward a tunnel to drain its lower workings; and



CROSS-SECTION OF CRIPPLE CREEK DISTRICT TAPPED BY ROOSEVELT TUNNEL

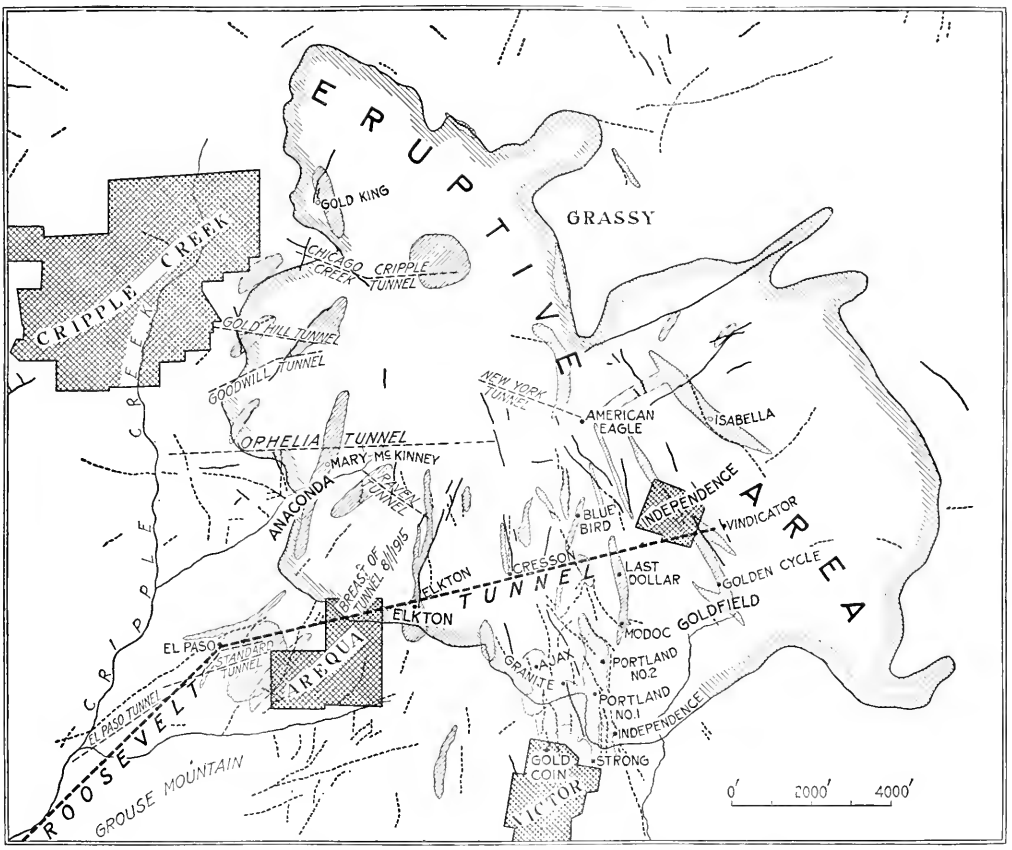
while this was not the first tunnel for drainage only, its success and that of other similar attempts led the mine operators to abandon the plans for pumping and to concentrate on the tunnel project. Financing this undertaking was no mean task and the choice of location no small problem. Every 100 ft. added to the depth of drainage meant 1,000 ft. added to the length of the tunnel to be driven, $30,000 to the capital to be raised, and six months to the time of waiting for the relief from the seemingly constant water level. Finally, however, the money was all pledged and the present Roosevelt tunnel, which is the only concerted effort at the drainage of the entire district to a great depth, was decided upon.

Among the former drainage-tunnel projects may be mentioned the Blue Bell, at 9,350 ft. elevation above sea level; the Ophelia, at 9,300 ft.; the Standard, at 9,050 ft.; the Newell, at 8,941 ft.; and the El Paso, at 8,800 ft. These tunnels, with the exception of the Newell, which does not tap the mineral-bearing area, all produced a heavy discharge of water, which continued until the level was lowered to their respective elevations.

The theory upon which the drainage-tunnel idea is based is that the mineralized area of the Cripple Creek

district is a more or less spongy eruptive formation surrounded by impervious Archean rock, which holds a supply of water like a reservoir; that tapping this crater would drain the entire district; and that this drainage would be permanent because of the relatively light rainfall. This theory was opposed by some engineers, who maintained that the crater is composed of a series of watercourses having no connection with one another, and that tapping one would by no means drain any of the others. This opposition delayed the financing of the Roosevelt tunnel to a considerable degree; and indeed it was not without grounds, for the Vindicator and Golden Cycle mines have not been drained at all, while all the rest of the district has been benefited, until now these two mines are the only ones that find it necessary to pump in order to keep their lower levels dry. But if the theory of separate watercourses were entirely true, the whole district, with the exception of the Vindicator and Cycle, would not be so well drained from one point as it now is; and the lack of drainage in these two mines is thought to be caused by an impervious syenite dike just east of the Last Dollar mine. Piercing this dike is expected to relieve the situation, and is one of the reasons for the extension of the tunnel; more rapid drainage of the mines already benefited being another.

Work on the Roosevelt tunnel was started in June, 1907, at a point in Cripple Creek Cañon about five miles below the city of Cripple Creek and at an elevation of 8,033 ft. above sea level. After several months' effort a contract for the completion of the tunnel was let to A. E. Carlton, president of the First National Bank of Cripple Creek, under whose energetic management the tunnel was driven 14,167 ft. at an average cost of $27.27 per foot. The first eruptive formation was struck Nov. 19, 1910, and with it a flow of water of more than 10,000 gal. per minute. The tunnel, however, was continued to the El Paso shaft, then deflected toward the east until the Gold Dollar watercourse in Arequa gulch was struck in March, 1912, when work was discontinued. About a year ago it was resumed under the direction of Mr. Burns, who drove the tunnel 970 ft. toward the Elkton shaft, the flow of water increasing by about 2,000 gal. per minute as a result of this extension. In the meantime a churn-drill hole was driven from the bottom of the El Paso shaft to the tunnel, quickly and effectively draining this mine. The shaft has since been sunk to the tunnel level. The so-called Fuller crosscut to the north was also driven to intersect the C. K. & N. watercourse. The total length driven is about 17,000 ft., or a little over three miles.



MAP OF CRIPPLE CREEK DISTRICT TAPPED BY ROOSEVELT TUNNEL

The following figures giving the elevations of the water level in the Portland No. 2 shaft show the effect the tunnel has had on the drainage of the eastern end of the district:

	El. Above Sea Level
Nov 3, 1910	8,858 95
Jan. 1, 1911	8,850 95
Feb. 1	8,843 29
Mar 1	8,837 29
Apr. 1	8,830 62
May 1	8,824 95
June 1	8,817 62
July 1	8,811 62
Aug. 1	8,806 95
Sept. 1	8,803 45
Nov. 1	8,794 45
Dec. 1	8,787 75
Dec 2	8,779 95
Shaft dry, drainage tunnel.	
May 2, 1913, water struck	8,606 00
Mar. 1, 1914, water struck	8,535 00
Jan. 20, 1915, water struck	8,425 00
Total drainage in 50 months	434 ft
Average drainage per month	8 7 ft

The driving of the drainage tunnel has presented no particular engineering difficulties, being more a test of financial strength and endurance. The section of the tunnel is 10 ft. wide by 7 ft. high, with a ditch on one side 3 ft. deep by 6 ft. wide, leaving a shelf 4 ft. wide on the other side for tracks and passage way. The grade is 0.3%. An intermediate shaft was sunk about

COST OF DRIVING SHAFT HEADINGS

Month	Footage	Total Cost	Cost per Ft.
Oct., 1908	49	$5,170 46	$105 520
Nov	141	6,254 25	44 380
Dec	177	7,099 45	40 110
Jan., 1909	261	6,280 45	24 060
Feb	601	14,246 56	23 700
Mar	639	16,777 40	26 256
Apr	670	16 763 94	25 020
May	552	15,642 87	28 340
June	498	13,632 46	27 375
July	319	10,486 95	32 871
Aug	410	11,377 35	27 747
Sept	355	11,502 21	32 400
Oct	380	10,708 21	28 178
Nov	298	10,191 96	34 200
Dec	251	8,823 21	35 153
Jan., 1910	282	8,127 36	28 820
Feb	259	7,934 92	30 636
Mar	344	9,501 43	27 620
Apr	376	9,517 64	25 313
May	393	9,768 58	24 856
June	373	9,927 75	26 616
July	350	8,836 47	25 247
Aug	372	9,310 98	25 029
Sept	342	9,731 03	28 450
Oct	372	10,178 47	27 361
Nov	192	5,335 09	27 786
	9,256	$263,126 55	

COST OF DRIVING PORTAL HEADING

Month	Footage	Total Cost	Cost per Ft.
Feb. and Mar., 1909	514 2	$11,607 77	$22 690
Apr	262 0	8,113 89	30 970
May	268 0	7,232 52	26 760
June	187 0	6,548 16	35 010
July	203 0	6,045 31	29 600
Aug	309 0	6,527 71	21 760
Sept	351 0	6,877 25	19 600
Oct	287 0	6,601 67	23 000
Nov	360 0	7,604 59	21 120
Dec	334 0	6,127 46	18 350
Jan., 1910	135 0	7,139 81	16 410
Feb	200 0	6,439 98	22 206
Mar	340 0	7,053 24	21 745
Apr	316 0	6,720 07	21 266
May	402 0	7,542 19	18 762
June	62 0	2,516 21	40 600
July, finishing drift		1,132 44	
	4,911 2	$111,890 27	

RECAPITULATION

Cost of portal work		$111,890 06
Contractor's percent		11,404 88
Total cost of portal		$123,294 94
Cost of shaft work		263,126 55
Total cost of tunnel		$386,421 49
Total number of feet driven		14,167 20
Average cost per foot of tunnel		$27.27

700 ft. to the level of the tunnel, and after October, 1908, work was carried on in both directions from the bottom of this shaft, simultaneously with the work from the portal. In July, 1909, a connection was made between the portal heading and the south heading from the shaft. Water-Leyner drills were used; and the haulage was done by mule-power. The average cost under the Carlton contract was, as has been stated, $27.27 per foot; the cost by months is given in the accompanying table:

The following itemized expenses are given for the month of July, 1908, in the portal heading, as a fairly representative month (from Bulletin 57, United States Bureau of Mines):

	Cost per Foot of Tunnel
Machinery and repairs	$0.61
Air drills and parts	0.99
Picks, shovels and steel	1.90
Ditch men	1.09
Explosives	6.90
Candles	0.36
Oil and waste	0.09
Electric power	2.06
Blacksmith supplies	0.09
General expense	0.16
Liability insurance	0.17
Lumber, ties and wedges	0.01
Horses and feed	0.01
Compressor men	1.79
Drillers and helpers	4.21
Blacksmiths and helpers	3.43
Muckers and drivers	4.11
Foremen	1.50
Bookkeeper	0.12
	$29.60

The rock up to the contact was hard, tough, Pike's Peak granite. No veins or unusual formations of any

Victor Studio, Victor, Colo.

PORTAL OF TUNNEL, 11,000 GAL. PER MIN. FLOWING

importance were encountered, and no water impeded the work until the main course was struck.

This year a great deal of interest on the part of mining men is being centered in the Cripple Creek district, and this interest has been stimulated in no small degree by developments on the lower levels of the larger mines, made possible by deep drainage. The only large mines not directly benefited by the drainage tunnel are the Vindicator and the Golden Cycle, both now owned by the Vindicator company, although they have contributed heavily to the drainage project. Pumping is now costing the Vindicator company about $4,000 a month to drain both mines. A battery of three triplex electric pumps,

each driven by a G. E. 150-hp. motor, is installed on the 18th level of the Cycle shaft, a depth of 1,900 ft. from the surface, or 8,173 ft. above sea-level—only 60 ft. above the level of the drainage tunnel when it reaches this mine. When lower levels are opened, in the future, it will be necessary to pump only up to this level. The pumps are now handling about 500 gal. of water per minute.

In order to avoid this heavy pumping expense, the Vindicator company is particularly desirous of seeing the drainage tunnel pushed through to its territory, although all the other deep mines in the eastern part of the district are also interested to no small degree, as the prosecution of the tunnel means more rapid drainage in their shafts.

The fulfillment of this desire seems only a question of time. The money has all been either raised or pledged. Charles H. Fuller, who did some very creditable work on the Carlton contract, will have charge of the underground work, and T. R. Countryman, of Cripple Creek, will be the engineer. It is estimated that two years and an expenditure of $200,000 will be required to complete the tunnel.

In connection with some of the facts and figures here given, I wish to acknowledge the assistance of Irving T. Snyder, A. E. Carlton and his secretary, Virgil H. Mann; and my indebtedness to T. R. Countryman for the use of the maps, and to Victor G. Hills' paper published in the Portland company's ninth annual report.

Steel Production in Canada

The details of the production of steel in Canada for 1914 and preceding years are given in the preliminary report of the American Iron and Steel Association, as below, in long tons:

	1912		1913		1914	
	Tons	%	Tons	%	Tons	%
Openhearth	645,062	75.6	768,663	73.7	549,716	79.2
Bessemer	207,569	24.3	273,391	26.2	144,447	20.8
Other	400	0.1	449	0.1	284	...
Total	853,031	100.0	1,042,503	100.0	694,447	100.0

The total in 1914 included 675,691 tons ingots and 18,756 tons direct castings. In that year there were 4,800 tons of alloy-treated castings and ingots included.

Finished Iron and Steel

The production of finished rolled iron and steel in Canada for four years past has been, in long tons:

	1911	1912	1913	1914
Steel	695,541	752,212	871,216	612,210
Iron	86,383	109,012	95,881	47,309
Total	781,924	861,224	967,097	659,519

The production in 1914 included 218,125 tons plates, sheets, bars, etc.; 59,050 tons structural shapes and wire rods; 382,344 tons rails. Of the rails 211,490 tons were over 50 lb. and less than 85 lb. per yard; 149,549 tons 85 but less than 100 lb.; 21,305 tons over 100 lb. per yard. Included in the total were 1,548 tons of alloy-steel rails.

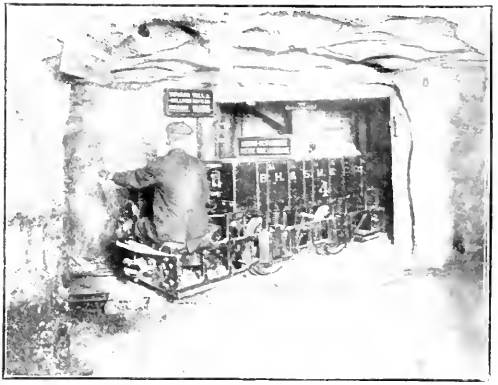
Miscellaneous Production

The total production of iron and steel cut and wire nails in Canada in 1914 was 1,144,000 kegs of 100 lb. each, which compares with 1,520,000 kegs in 1913. The output of finished splice bars, other rail joints and fastenings, not including spikes and bolts, in 1914 was 34,165 long tons, as compared with 51,839 tons in 1913. The make of forgings was: Iron, 1,792 tons; steel, 6,346 tons; total, 8,138 tons, a decrease of 15,267 tons from the preceding year.

The Mine at the Panama-Pacific Exposition

It is peculiarly fitting that the mining industry should be unusually well represented at San Francisco, because of the important part that mining has played in the development of the resources of California. So today the visitor at the Panama-Pacific Exposition has an opportunity to see practically at first hand the development of one of our greatest assets—our underground wealth—and at the same time inspect a mine without any of the discomforts usually attending such a visit. The Bureau of Mines of the Department of the Interior has, through the active and unselfish coöperation of a number of manufacturers and operators of mining equipment, established an exhibit that easily ranks as one of the most interesting of the exposition. Quoting from a pamphlet issued by the Bureau of Mines describing the exhibit:

"This exhibit, as its name implies, is an actual reproduction of full-size entries, drifts, stopes and rooms,



IN "THE MINE," PANAMA-PACIFIC EXPOSITION

elected from typical mines in various parts of the United States. In the several rooms of 'The Mine' are installed the appropriate machinery and appliances used in the modern mines. Visitors who expect to see in the mine ancient appliances famed in story, as the mine mule, the gray-bearded miner with pick and candle, black blasting powder and unventilated working places will be agreeably disappointed to find here a model mine, designed and operated under such modern working conditions as are believed calculated to assure the safety and health of the miners as well as efficiency of operation.

"The mine may be entered either by way of a cage down the shaft or by walking down the slope. The former is a realistic representation of a mine cage descending the shaft. The visitor enters through a typical headframe and sees a panoramic effect of neighboring mines and settlements. As the cage door is closed he experiences the sensation of descending the mine, slowly at first, then faster until full speed is attained. Cribbing, timbers mixed with lagging, then rock strata, and deeper and darker are

seen two entries with miners working. The illusion is produced by the canvas walls of the cage being caused to move past the occupant, and the illusion of rapid descent is greatly accentuated by means of a current of air blown upward through the cage, both the panorama and the blower being operated by a 5-hp. Westinghouse motor. Finally, the cage appears to slow down and then stop, whereupon the opposite door to that which the visitor entered is opened and he is allowed to leave and proceed through a darkened tunnel to the mine under the impression that he has descended to a considerable depth, while as a matter of fact he leaves on the same level as he entered.

"Once in the mine, there is a vast number of interest-compelling exhibits. Ore brought from its native state and the setting reproduced at great pains and expense make the visitor feel as if he were really in a mine. Great credit is due to some of the operating companies for their hearty coöperation in making this exhibit one of the features of the exposition. Some of these have expended large sums of money and the services of expert engineers in reproducing sections of mines on their properties with great accuracy and detail. The timbering used was all taken from actual service in different mines—not 'made for the occasion'—and it bears the earmarks of years of good service. Space does not permit a description of all the exhibits in the mine, but a few of the more important may be mentioned: Mining in the gold mines of Nevada; at Lead in South Dakota; silver in Idaho; copper in Arizona and iron ore in Minnesota are among the representative operations shown."

*

American Mining Congress in San Francisco

The probability of the United States becoming the leading radium producer of the world and of reduction from the present price of $160,000 a gram to $40,000 was announced Sept. 20 by Van. H. Manning, director of the United States Bureau of Mines, speaking at the opening session of the American Mining Congress in the Civic Auditorium. In part he said:

The only fields of carnotite ore known today are in Colorado and Utah. These fields are not inexhaustible, and it is highly desirable that the Government take action that will prevent so much of this ore as now remains in its possession from being wasted or monopolized.

He also stated that in the West losses through wasteful methods in the mining of zinc were startling, but that through investigations of the mining bureau many undeveloped fields can now be operated at a profit. He also predicted the mining of tin as a new industry for California, Idaho, Washington, Wyoming and Alaska.

Dr. George Otis Smith, director of the Geological Survey, delivered a plea for "Plain Writing" in the preparation of scientific papers, and said that it is now the spirit in Washington to prepare Government reports in the "language of the people."

A message from President Wilson expressing regret at his inability to attend the Mining Congress, was read. Among the delegates who spoke before the convention were: Prof. Charles F. Willis, of Arizona; Dr. William B. Phillips, president of the Colorado School of Mines; Gardner F. Williams, of Washington, D. C.; John P. Reece, of Illinois; R. C. Allen, of Michigan; Otto Ruhl, of Missouri; Henry L. Day, of Idaho; George H. Utter, of New Mexico; Dr. J. E. Talmage, of Salt Lake, and Judge J. H. Richards, of Boise, Idaho.

Memorial exercises in honor of the late Dr. Joseph A. Holmes, director of the United States Bureau of Mines, were held on Tuesday morning, Sept. 21.

Among the prominent mining men who spoke in praise of Doctor Holmes were: Carl Scholz, of Chicago, president of the American Mining Congress; Van. H. Manning, director of the United States Bureau of Mines; William L. Saunders, of New York, president of the American Institute of Mining Engineers; M. L. Requa, of the Mining and Metallurgical Society of America; John P. Reece, of Illinois, president of the American Mine Safety Association; Herbert M. Wilson, president of the National Safety Council; Hennen Jennings, of Washington, D. C.; J. F. Callbreath, secretary of the American Mining Congress; Charles L. Dignowity, of Boston; Joseph Hyde Pratt, of North Carolina; E. L. Bartholomew; Dr. J. E. Talmage, of Salt Lake City, and J. W. Paul and George S. Rice, of Pittsburgh, Penn.

At the regular morning session of the Mining Congress in the Civic Auditorium an address was delivered by Rush C. Butler, of Chicago, on the subject, "Constructive Regulation of Business," which topic was discussed in detail by the delegates. The afternoon session was taken up with an address on California's water-infiltration law, by Fletcher McN. Hamilton, state mineralogist of California, followed by a technical discussion.

The following directors were elected to serve three-year terms at the evening session, held at the Palace Hotel: Dr. J. E. Talmage, of Salt Lake; Charles M. Moderwell, of Chicago; Harry L. Day, of Idaho, and Dr. W. B. Phillips, of Colorado. It was decided to hold the next annual convention of the Mining Congress in Chicago. A banquet was held Tuesday evening at the Palace Hotel by the congress as a testimonial to Van. H. Manning, director of the United States Bureau of Mines.

The Wednesday session brought out more lively discussion than did those of the preceding days.

Harry L. Day, of Wallace, Idaho, president of the Federal Mining and Smelting Co., declared that two-thirds of mine accidents are due to the "criminal carelessness" of workers. Dr. Frederick L. Hoffman, the insurance-company statistician, well-known to *Journal* readers by his many contributions, said that the mine operator is responsible in the last analysis for most accidents and disease-spreading conditions.

Herbert M. Wilson, of Pittsburgh, Penn., director of safety for the Associated Mining Companies, agreed with Dr. Hoffman, who recommended an investigation into underground sanitary conditions of mines on the Mother Lode of California with the view of combating the hookworm disease.

A resolution was adopted protesting against the restrictions imposed by the Department of the Interior in granting rights of way over public lands.

The following program was carried out:

Report of committee on freight and ore treatment rates by Imer Pett, chairman, of Salt Lake City; address, "The Future of the American Zinc Industry," by Otto Ruhl, of Joplin, Mo.; "The Development of Mine Taxation in Arizona," by G. H. Dowell, of Bisbee, Ariz.; "The Need of Better Mining Education," by Prof. Charles F. Willis, of Tucson, Ariz.; "Workman's Compensation Insurance and the Coal Mining Industry," by Herbert M. Wilson, of Pittsburgh, Penn.; "The New Plan of Mining Insurance," by David Ross, of Springfield, Ill., and "Mining Hazards of the Pacific Coast," by Dr. F. L. Hoffman, of Newark, N. J.

Some Points in the Economics of Zinc Metallurgy*

SYNOPSIS—A comparison of the chief differences between American and European practice in so far as the main economic points are concerned. The powerful effect of the great supply of Australian zinc ore upon the spelter industry of the world. Prospects for zinc smelting in remote countries.

Even before the war began, the zinc industry of the world was experiencing radical changes. The effect of the war will be to produce more changes, whereof no man can yet clearly foresee the nature and scope. Looking backward, we can now perceive that 1896, when the Wilfley table was introduced, was a historic date in the metallurgy of zinc. Making possible an improved concentration of mixed ores requiring fine grinding, the first step in the solution of the long-baffling mixed-ore problem had been taken and the smelters were offered a new and bountiful supply of lead-bearing zinc ore, often high in iron, to which they had to adjust their metallurgy. Another important step in the separation of mixed ores occurred subsequently, with the introduction of Wetherill's system of magnetic separation and Blake's system of electrostatic separation, but the climax occurred with the successful introduction of the flotation process at Broken Hill.

Effect of Flotation at Broken Hill

The development at Broken Hill had at least three great consequences: It standardized smelting practice in Belgium and Germany; it compelled nearly all of the smelters of those countries to go on a zinc-lead basis; it showed that mixed ores could be profitably treated and caused a search for them to be made in all parts of the world, which within a few years resulted in the development of such mines as the Butte & Superior, of Butte, Mont.; the Bawdwin, of Burma; and the Riddersk, of Siberia, to mention only three of the first order.

Let me be more explicit respecting these statements. The total zinc production of the world in 1913 was about 1,000,000 metric tons, of which Belgium, Holland and Germany produced about 500,000 tons. Broken Hill in 1910-12 produced an average of 450,000 tons of blende concentrate per annum, averaging 46 to 47% zinc, which may be roughly calculated as equivalent to a yield of 170,000 tons of spelter, or about 35% of the total of Germany and the low countries.

The Market for Broken Hill Concentrates

The immense Australian ore supply was contracted to the three great German metal-merchandising firms, which distributed the ore among the smelters of Germany and Belgium. Those smelters coming thus into possession of so large, so uniform and so regular a supply of ore, the like of which in none of those respects had ever previously been experienced in the zinc industry, were able to standardize their smelting practice, not only as to a single works, but also as to many works, which was metallurgically beneficial.

Leady Zinc Ores Now a Matter of Course

The Broken Hill zinc ore was rather high in lead. In previous times zinc smelters generally were averse to smelting ore containing more than 2 or 3% of lead, although there were a few smelters who made a practice of treating ores relatively high in lead and recovering a considerable proportion of the lead therefrom. With the advent of the Broken Hill ore, the recovery of lead as a byproduct in zinc smelting became the regular thing; and in fact, the smelters of Belgium and Germany went practically upon a zinc-lead basis and even became insistent upon having a percentage of lead present in their ore that was far above what in earlier years had been regarded as permissible.

Zinc Smelting Becoming a Widely Distributed Industry

Another radical change in the zinc industry, that was in progress previous to the war, involved the establishment of new loci of zinc smelting and was rather directly connected with the Australian development. The art of zinc smelting is one of a multiplicity of details in which the part played by many workmen spells the difference between success and failure. No matter how careful the plans of the engineer may be, they are likely to come to naught unless there be good workmen to carry them out; and the making of good workmen requires long training. The possession of a class of workmen which has been engaged in zinc smelting during several generations is one reason why Belgium continued to be a great zinc-smelting country long after its own resources were exhausted. And because of the absence of such a class of smelters, it has been universally the experience that the inauguration of new zinc-smelting enterprises in new regions has been attended by difficulties which generally have wrecked the adventurer. With the advent of the great Australian ore-producing interests, however, there entered into the zinc industry a group of concerns with financial resources that enabled them to build zinc-smelting works in any logical location and with equanimity to carry them through the period in which the native population had to be taught how to smelt zinc ore. Thus we have already witnessed the erection and operation of two zinc smelteries in Australia, we have seen the foundations laid for a great zinc smeltery far away in Siberia, and we have reason to believe that ere long a zinc smeltery may be erected at some seaport of India. In the meanwhile, the Japanese, with their extraordinary adaptiveness, have inaugurated zinc smelting within their empire. There were, therefore, plans on foot that promised to make the art of zinc smelting one of far wider application than it had ever been during the century of its commercial history. These conditions were fully in evidence before the war began.

Germany, by virtue of its own great deposits of zinc ore in Upper Silesia and its contracts for the Broken

*A paper entitled "Some Main Points in the Metallurgy of Zinc," by W. R. Ingalls, presented at the International Engineering Congress, San Francisco, Calif., Sept. 20, 1915.

Hill ore, was the great purveyor of spelter to the rest of Europe, especially to England. The first great consequences of the war were to suspend, to a major extent, the production of zinc ore in Australia, there being insufficient surplus smelting capacity outside of Germany and Belgium to receive it, and to throw a large part of the spelter requirements of Great Britain, France and Russia upon the United States, the result of which was to raise the price for spelter to a figure not previously recorded in many years. What other major and minor effects the disturbance of the war may have upon the spelter industry lie within the sphere of prophecy. I will venture no more than the suggestion that they will be profound.

The world's great districts of zinc smelting have heretofore been Upper Silesia and Rheinland-Westphalia, in Germany; the valley of the Meuse and the Campine, in Belgium and Holland; and Kansas, Oklahoma and Illinois, in the United States. The art of zinc smelting was first introduced (from China) into Great Britain, but the British smelters have not, during the last 100 years, been leaders in the art, nor has zinc smelting attained great magnitude in their land.

During the last 50 years, there have been three types of zinc smelting (the earlier English and Carinthian processes having disappeared), which are known as the Silesian, Belgo-Silesian, and Belgian. In recent years, the Belgo-Silesian method has become known as the Rhenish, and this has shown a strong tendency to displace the Belgian process in Belgium and an even stronger tendency to displace the Silesian process in Silesia. The reasons for this are discussed in the metallurgical treatises, of which zinc smelting has recently acquired a rich literature. They may be summarized as a superior economy, as compared with the Belgian furnace; and, in Silesia, a change in the character of the ore which causes this method to be better adapted than the Silesian furnace. In the United States, the method of smelting is essentially the Belgian, which has been modified to conform to peculiar conditions.

Variations in American and European Practice Due to Labor and Material Prices

Considering the art of zinc smelting upon its broadest lines, the variations between European and American practice are explained by variations in fundamental conditions, which may be summarized in the statement that in Europe labor is cheap and coal is dear, while in the United States coal is cheap and labor is dear. Thus we find American smelters striving ever for mechanical substitutes for hand labor and European smelters aiming always to reduce coal consumption. There have been other determinative factors, the differences among which are, however, tending to disappear. One of these is permanence of the smelting districts. Another is scientific attention to the art.

Zinc smelting was begun in Upper Silesia in 1798 and on the Meuse in 1807, and ever since those dates has been conducted in those districts. Their metallurgical stability has induced operators to build substantially. From an early date, moreover, the smelting was directed by educated metallurgists, and both in French and German is there a literature extending backward for a century. In the United States, on the other hand, only two works—those at La Salle and Peru, in Illinois—have a long history and in the main the zinc-smelting industry has been characterized by shifts and uncertainties that stifled ideas of permanent building. About 1871 zinc smelting was begun at Pittsburg, Kan., and for 30 years was conducted with an absurd disregard of scientific control. Not until about 1898 were chemists employed, even to assay the ores bought and smelted. Ore was cheap, and for three decades the precept was "better butcher the ore than butcher the furnace." About 1901 most of the smelteries in this district were scrapped and the Iola district, where natural gas occurred, became paramount. Ten years later Iola was the scene of deserted works and the star of Bartlesville and Collinsville, in Oklahoma, was ascendant, but even now it is waning and the great locus of zinc smelting is becoming the coal fields of Illinois and further eastward. With this last move zinc smelters show that they are building for permanent business, not merely to reap some ephemeral natural advantage, and with the utilization of the services of metallurgists (which has been general only within the last 10 or 15 years), certain differences between European and American results are tending to disappear.

Sulphuric-Acid Recovery More Marketable Abroad

One other basic condition requires mention. European smelters operate generally in highly developed industrial regions affording a market for sulphuric acid and rendering the free discharge of sulphur smoke unpermissible anyhow. Therefore European smelters long ago began to make sulphuric acid as a byproduct of blende roasting. American smelters, on the other hand, were able to emit their smoke without doing great harm and had no market for acid. Consequently they did not make it. This condition, also, is undergoing radical change. Every smelter of blende east of the Mississippi River now makes acid.

In many respects the development of the American zinc-smelting industry has exhibited absence of initiative and curious contradictions. Our two great names are Wetherill and Hegeler. The former invented the process of making zinc oxide direct from ore. The latter introduced the first successful mechanically raked muffle furnace for blende roasting, modified the Belgian distillation furnace and introduced many mechanical contrivances. The best American zinc-smelting practice of the present day follows very closely in Hegeler's footsteps, with certain improvements borrowed from Belgium and Germany.

Early Introduction of Mechanical Roasting

During the last 20 years the vogue of the mechanical furnace for blende-roasting, in the United States has become all but universal. At the present time our works have capacity for roasting about 800,000 tons of blende per annum, and only two or three examples of the old hand-roasting kilns survive. Yet, of our mechanical furnaces, the Hegeler dates back to 1884, and during the last 15 years there has been no introduction of any new type—an emphatic commentary upon the absence of originality that has heretofore characterized zinc smelting in America. In the meanwhile the Germans have exhibited much alertness in developing and adopting mechanical roasting furnaces in spite of their lower rates of wages and consequent lack of incentive to substitute machines for men.

I may best elucidate further comparisons between European and American practice by sketching the principal parts of a modern zinc-smelting works. In all of what follows in this paper I have in mind only the smelting with coal-fired furnaces, dismissing from attention the smelting with natural gas in the United States, which is on the wane. Nor are the figures that I give intended to represent the practice with Silesian furnaces in Upper Silesia, Germany.

The ore is delivered into the works in railway cars, from which it is unloaded directly into the storage bins. The means for unloading, sampling, storing and reclaiming have, heretofore, been rather crude in many of the American works, but recently there has been an increasing tendency to adopt the superior methods that have long obtained among lead and copper smelters.

The ores coming to the zinc smelter are classified as calamine and blende. In Europe the former is still calcined. In America the calcination of calamine was abandoned by the smelters may years ago, the advantages being pronounced unequal to the cost. Blende, of course, must always be roasted. In America we use the Hegeler furnace if sulphuric acid is to be made; otherwise, simpler forms of mechanical furnace. Our object is mainly to save labor. In Europe hand-raked furnaces of the Rhenania, or the later Delplace, type are commonly employed, which are both designed and operated to save coal. The dead-roasting of blende has been regularly effected with a coal consumption of only 10% of the weight of the ore, a lower figure than has ever been achieved in the United States. However, there is a growing usage of mechanical roasting furnaces in Europe and an adoption of such new and excellent types as the Merton and the Spirlet, which American smelters have not yet ventured to try.

The roasted ore goes to the mixer, where it is united with the proper proportion of reduction coal. Mechanical mixing and careful attention to this important part of the process were early practiced at La Salle, but elsewhere in the United States this was generally done in ways far below European standards until recently. However, we are no longer subject to such a reproach.

Variations in Design of Works

Following European practice, our distillation furnaces are now commonly built entirely above the ground, the unclean, uncomfortable and unsanitary subterranean galleries of old being abolished. The Europeans are still ahead of us, however, in ventilation of the furnace houses. The Europeans generally lay out their furnaces in line. We lay them out in rows. The Europeans commonly employ recuperative (both reversing and counter-current) furnaces—again with view to economy of coal—and succeed in smelting a ton of ore with as little as a ton of coal. In the United States we use mostly the long Hegeler furnace. With natural gas firing there is no heat recuperation. With coal firing the economizing of fuel takes the form of generating steam from the waste gases. The long furnaces and the steam-boiler accessories are distinctly American, and both are due to Hegeler. To Hegeler also is due the charging car, metal-drawing car and other mechanical contrivances in aid of the work about the distillation furnaces. The only successful mechanical chargers, however, are of European origin; but a recent American invention of some promise is a mechanical discharger. A distinctive feature of American distillation-furnace practice is the use of blowers for the delivery of the combustion-air to the furnaces.[1]

In the manufacture of retorts the hydraulic press, which originated in Belgium, is now commonly employed both in Europe and America. However, the Europeans give more attention to the manufacture of their retorts and unquestionably make a better retort than we do.

In the handling of material in the works the modern American plants are as well equipped with tramways, elevators, etc., as are lead smelteries of corresponding size. In this respect our best American plants are in no wise inferior to the best European.

European smelters have long recovered lead and silver from their retort residues. American smelters now do so to a considerable extent, but the treatment of lead-bearing ores and recovery of the lead is less a feature of American practice than it is of the European. American zinc smelters pass the whole of their residue to the lead smelters. European zinc smelters commonly concentrate it by jigs and tables and deliver a lead concentrate for smelting.

European Distillation Temperatures Higher Than American

Metallurgically, the essence of zinc smelting is the temperature of distillation. Speaking generally, the higher the temperature the better is the extraction of zinc. But with bad ores and bad practice high temperature is infeasible; for the furnaces and retorts will not stand it. A bad ore may be smelted with but little trouble, at a relatively low temperature, but the extraction of zinc will be poor. The aim of the zinc smelter is to smelt a bad ore and obtain the maximum possible percentage of zinc out of it.

In general, the Europeans excel the Americans in this respect. They mix their ores more scientifically, they make better retorts and they build stronger furnaces, all of which contribute to an ability to drive their furnaces at higher temperature than Americans have yet attained, and at the same time they manage with ores that are rather high in lead. In so smelting, they make a leady spelter, but a simple refining in a reverberatory furnace removes the excess lead. In only one American works is that practiced.

European smelters also generally recover blue powder as a commercial product. This is obtained from the prolongs, which condense a proportion of zinc that would otherwise be lost. American smelters do not use prolongs. Although in trials of them, an additional 1 or 2% of the zinc has been obtained, they have found it to be unprofitable—this again reflecting the difference in labor conditions.

I have outlined the main differences between European and American practice in zinc smelting. The [illegible] explained by the reasons previously mentioned. [illegible] ton of raw sulphide ore the American smelter uses about 2 to 2½ tons of coal and 2 or 3 man-days of labor, and extracts about 84 to 88% of the zinc that is in his ore;

[1]Let it be noted that in offering these broad [illegible]izations of comparative European and American practice [illegible] is well in mind that there are representatives of several [illegible]ve types in the United States. Thus are to be found [illegible]-Belgian furnaces at Peru and Depue, Overpelt-Rhen[illegible] furnaces at Pueblo, and counter-current recuperative furn[illegible] at Palmerton.

if he treats lead-bearing ore, he may recover 50 to 60% of the lead.[2]

The European smelter uses about 1¼ to 1¾ tons of coal and 3 to 3½ man-days of labor, and extracts 88 to 90% of the zinc that is in his ore, and about 50 to 70% of the lead.

I hope to disarm criticism of these figures by stating that such figures properly should be accompanied by qualifications and explanations that would run to pages in length and would constitute a condensed treatise upon the metallurgy of zinc; and that I offer the figures that I have used merely as broad generalizations for the purpose of exhibiting, in tabloid form, the lessons deduced from the differences in the art as practiced in Germany and the low countries and in the United States. They mean that the Europeans, with the aid of better furnaces and superior technical direction, are able to smelt more refractory ore than we Americans, and yet extract a higher proportion of the valuable metals. They have built more substantial plants—secure from fear of geographical migration of their industry—for the sake of increased durability and maximum economy of fuel. While the rates of wages are higher in the United States than in Europe, American zinc smelters have not been able to offset that by the development of superior efficiency in the ways that the copper and lead smelters have done. Man for man, the German and Belgian smelter does as much work as the American. Thus the attendance of the distillation furnaces in Rheinland and Belgium requires 1.75 to 2.5 man-shifts per ton of roasted ore, while in America the requirement is 1.75 to 2.25. The difference in labor in roasting is insignificant when mechanical furnaces are employed. Such economies in labor as America has effected have been chiefly in the handling of material, which, in zinc smelting, is a relatively small part of the process.

Zinc Smelting Not So Backward as Supposed

Before concluding this paper I am bound to refer to certain misconceptions that continue to exist respecting the status of zinc smelting and the possibilities of any radical changes happening in this art, such as have happened in lead and copper smelting.

The art of zinc smelting is far from being at a standstill. When we find 1,000 kg. of ore requiring 1,000 calories of heat being distilled with 1,100 kg. of coal equivalent to 8,000 calories, as is done in the best practice, we are observing a thermal efficiency of 12½%, which compares favorably with good steam practice. When we find a ton of ore being smelted with 2½ man-days of labor, and consider that we are dealing with a concentrated product, and reflect that the total weight of material handled is relatively small and that the work on it from step to step is often more cheaply done by a man than by a machine, we do not feel unduly mortified by our results. Nor does the extraction of only 85 or 90% of the zinc content of the ore shame us very much when we reflect upon the peculiar and troublesome metallurgical properties of zinc.

The Complex-Sulphide Problem

The so-called problem of the mixed sulphide ores that has engaged so much attention during 50 or 60 years is not a question of how such ores can be treated—for means have been known for a long time—but, rather, is it a question of how may such ores be treated with sufficient cheapness. This problem has been solved to a large extent by the improvements in the art of mechanical concentration (especially the flotation process) and the improved ability of the zinc smelter to treat plumbiferous and ferruginous ore. Yet there are still ores whereof the beneficiation is highly unsatisfactory, such, for example, as those ores which contain fluorite and those ores which are a crypto-crystalline mixture of the component sulphide minerals. The present treatment of zinc ores that are high in silver leaves much to be desired. For some of these ores it is possible that hydrometallurgical or hydrometallurgical-electrometallurgical processes may be useful in certain cases. There has been a commercial hydrometallurgy of zinc for many years, but it has not been extensive, simply for the reason that most ores could be more profitably treated in other ways. The precipitation of zinc from solutions by electrolysis used to be troublesome and unsatisfactory, but now that seems to have been mastered.

Electric zinc smelting, which has engaged a good deal of attention during the last 15 years, is metallurgically of the same nature as ordinary smelting; the main difference is that in one case the zinc is distilled by the heat of the electric arc or the heat of electric resistance, while in the other case it is done by the combustion of coal. So far, electric smelting has become an art only in Sweden and Norway, where several thousands of tons of spelter are annually produced by this method. The smelters in Sweden and Norway enjoy very cheap power, whereby they have been able to overcome, or at least meet, the main obstacle that has heretofore prevented electric smelting from becoming a commercial art elsewhere.

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Ontario Mineral Production in First Half of 1915

Supplementing the figures given in the *Journal* of Sept. 25, 1915, on Ontario mineral production for the first half of 1915, the following additional information is given. The quantity of nickel-copper ore raised was 548,579 tons, and the quantity smelted, 550,870 tons.

The chief outlet for cobalt oxide—the ceramic works of Europe—has been closed by the war. Consequently the shipments from the silver refineries have been greatly reduced, falling off in value 85%. Some consignments have been made to Great Britain and the United States. Metallic cobalt is now being produced both at Deloro and Thorold and is finding a use in the manufacture of high-grade and high-speed tools, also for the plating of metallic objects, replacing nickel for this purpose.

[2] The matter of lead recovery can be but vaguely stated, it being so intimately related with the original content of the ore and the character of effecting the recovery. The main sources of loss are (1) by volatilization during roasting; (2) by volatilization during distillation, a portion of which may be recoverable by condensing the spelter; (3) in the tailings of the mill, dressing the retort residues; and finally there are (4) the ordinary losses in the lead-smelting furnace. As a debit against any lead that may be recovered under (2) is the cost of refining the leady spelter. Process (3) is a source of large loss and may be omitted; but then there is an increased weight of material to be treated by the lead furnaces and therefore a higher cost of smelting. Yet, here again there may be an offsetting condition, namely, the residues may be high in iron and the lead smelter may need iron. These few remarks will give an idea of the complexity of this subject, which is indeed incapable of accurate generalization. The only answer is that which is expressed in dollars and cents in each case. What applies to lead also applies to silver. In my generalizations of the requirements of coal and labor in zinc smelting, I have not included anything involved in the refining of spelter or in the treatment of residues remaining after zinc extraction.

Tin-Ore Dressing at Llallagua, Bolivia—III

By Durward Copeland* and Scovill E. Hollister†

SYNOPSIS—The grade of tin "barrilla" made affects markedly the profit of the Bolivian producers, on account of the high freight and smelting charges. The tenor of various products of the Llallagua company is shown in an accompanying diagram. The cost of different operations and of supplies is also given in considerable detail.

The tin concentrates of Bolivia are shipped to Europe for smelting. Freights and smelting charges are heavy so the grade of the *barrilla* is of the greatest importance. This point, in regard to concentrates made, is especially true in times of depressed prices for tin. In fact, when tin is selling for a low price the grade of *barrilla* made may easily determine whether there is a loss or a fairly large profit to the producer. The majority of the Bolivian producers are satisfied with a shipping product containing 60% tin. An average of 65% in the *barrilla* is not common. The idea prevails that any attempt to increase materially the percentage of tin in the concentrate would be accompanied by a loss that would more than overcome any benefits obtained.

An accompanying diagram shows the relation of the tin mineral to the minerals which do not contain tin, in the mine ore, the mill tailings and in the concentrates produced by the company at Llallagua. The mill tailings are at present, because of increased regrinding of jig tailings and better classification, considerably lower in tin than is shown in the diagram. It is true that the higher the percentage of tin in the concentrates the higher the tin in the tailings and the greater the loss, but it has been found that allowing the *barrilla* to contain 10% of minerals which do not contain tin and nearly all of which are lighter than cassiterite is enough to afford a good protection against loss. There is, with a reasonably well managed mill, little more loss when the nonstanniferous minerals in the concentrates are reduced to 10% than when there is allowed to enter the *barrilla* 23% of minerals other than cassiterite. This is the same as saying that there is little more loss when producing a *barrilla* with 70% tin than when making one with only 60%. Diagrams have been prepared to show that by making 12,860 quintals of 70% *barrilla* rather than 15,000 quintals of 60% (there are equal quantities of fine tin in the two cases), there is an extra profit of at least 55,000 bolivianos. With the monthly production mentioned, each increase of 1% in the *barrilla* grade results in an extra earning of 6000 bolivianos.

ANALYSIS OF LLALLAGUA "S.S." BARRILLA

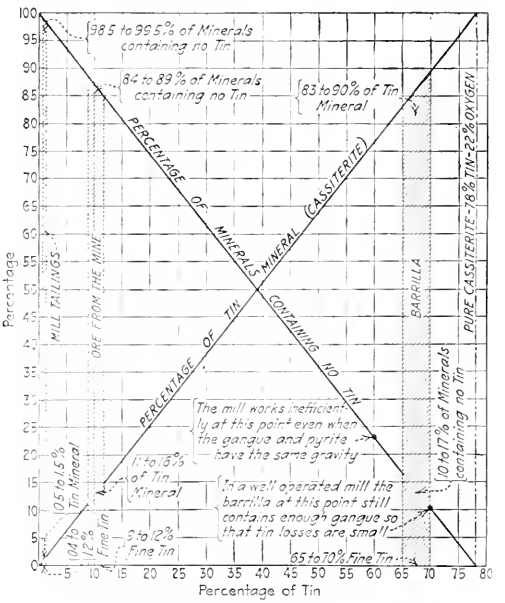
Tin oxide (68.32% Sn)	86.670
Iron	4.746
Nickel	0.023
Copper	0.060
Bismuth	0.360
Lead	0.070
Zinc	0.225
Silver	0.006
Titanium oxide	0.400
Tungstic acid	0.560
Calcium oxide	0.130
Silica	2.240
Sulphur	3.586
Oxygen and loss	0.924
	100.000

In an accompanying table are shown the results of a complete analysis made by Alfred H. Knight, of London, on a sample of *barrilla* of the class "S.S." This analysis was made in 1913 and represents the grade of concentrates as then made. With the present *barrilla*, averaging about 70% tin, the quantities of the metallic impurities are less than those shown in Mr. Knight's analysis.

Tin Assay by Cyanide-Fusion Method

In the making of uniformly high-grade concentrates, the various machines and sections in the mill require careful regulation. In order that this can be done effectively the company has a well-equipped laboratory. The substances in the *barrilla* of greatest importance in determining the profits to the company are the tin, sulphur, arsenic and copper, these being the elements upon which the smelting charges are based. Also, in the mines, payment to many of the contractors depends upon the percentage of tin in their ores, and these assays make [illegible] of the total work of the laboratory.

In Bolivia it is the practice to determine by the cyanide-fusion method, so the laboratory at Llallagua was



COMPOSITION OF LLALLAGUA PRODUCTS

Diagram showing percentage of fine tin, tin mineral (cassiterite) and minerals containing no tin in the ore, the barrilla and the tailings.

*Metallurgist, Cia. Estañifera de Llallagua, and professor of metallurgy, Missouri School of Mines, Rolla, Mo.

†Mill superintendent, Cia. Estañifera de Llallagua, Llallagua, Bolivia.

equipped to make the tin assays in this manner. In the cyanide-fusion assay the sample, after the soluble iron and other impurities which might enter the tin button have been removed by the use of acids, is mixed with "98%" potassium cyanide in crucibles and fused in a coke furnace for half an hour. The fusion being complete the crucible is removed, cooled and broken open, the tin button cleaned and weighed. At Llallagua a 10-gram sample mixed with 20 grams of cyanide is the charge. This is fused in a No. 6 Battersea crucible. On *barrilla* this method gives results uniformly 2% lower than those obtained by the smelters in Europe.

As Llallagua is so far from the markets (Europe and the United States) which can supply chemicals and laboratory equipment, it is necessary to keep on hand at least a year's supply of materials. By the time the freights and duties have been paid, any chemical, piece of glassware or apparatus we use has about four times the value it would have in the United States. This makes the cost of assays very high.

During the first eight months of 1914 an average of 1152 tin assays were made monthly at a cost per assay of 2.40 bolivianos ($0.83). Of this cost 8.8% was for crucibles, 43.2% for cyanide and acids, and 48% was for labor. This last item includes the cost of taking the samples and of preparing them for the laboratory. The cost to the laboratory of the various chemicals and materials is shown in the accompanying table:

MATERIALS USED IN LABORATORY IN AUGUST, 1914

Quantity	Article	Price	Value
1350	Crucibles No. 6	@ $0 07	$94.50
10	Scorifiers, 2½ in.	@ 05	.50
54 kg.	Nitric acid	@ 1 90	102 60
45 kg.	Hydrochloric	@ 1 71	76.95
31 kg.	Potassium cyanide	@ 1 59	49 29
2 reams	Paper for samples	@ 3 28	6.56
2 cans	Paraffin	@ 2 72	5 44
1 drum	Benzine	@ 17 24	17 24
1230	Sample sacks	@ .01	12 30
35 quintals	Coke	@ 2 07	72 45
15 liters	Alcohol	@ 35	5 25
5 liters	Ammonia	@ 1 55	7 75
All other chemicals			6 90
Office supplies			6.90
Total			$463.63

The assays for copper, arsenic, sulphur, and any special analyses for any of the departments are made by the methods employed in common laboratory practice. The one point worth noting is that these analyses cost as much proportionally as the tin assays.

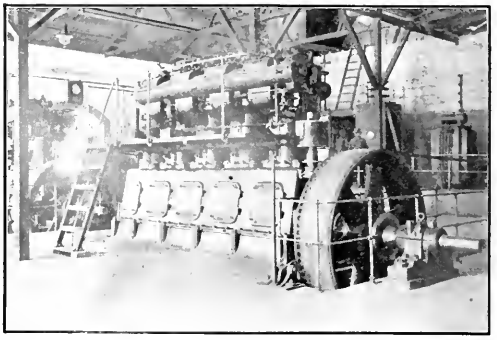
Three Power Sources

The power for the mine and mill is supplied from three power units. A hydro-electric plant capable of generating 800 hp. supplies that amount during nine months of the year, but is not in operation the other three months because of lack of water for the turbines, when power is supplied to the mine by two Diesel engines generating 400 hp. and the mill is run by a 200-hp. Deutz gas engine belted directly to the main transmission line. Power for the roaster-separator plant, machine shop and other power installations at the mill plant is supplied by a second Deutz motor. The entire electric system is connected through a central switchboard and current from any of the three sources can be supplied to any part of the system.

The first estimate of cost for building a 60-m. dam and equipping a hydro-electric plant to develop 450 hp. was 400,000 bolivianos ($138,000). By the end of 1914, because of washouts during construction and landslides into the river below the turbine house, the first cost for dam, overflow tunnels and an 800-hp. installation will amount to 1,350,000 bolivianos (about $470,000). By figuring the life of the mine as five years, a reasonable estimate, and charging 10% on the money invested, the first cost can be paid off in five equal yearly payments of 360,000 bolivianos. Calculating 600 hp. for 12 months (800 hp. for 9 months) the charge per horsepower-day for the first cost is $0.58. Operation and repair costs are as follows: Attendance, $0.025; repairs, $0.002; other costs, $0.002; total operating, $0.029. This makes a total cost for hydro-electric power of $0.58 + $0.029 = $0.61 per horsepower-day, which is 2.54c. per horsepower-hour. After five years, should the mine still produce, this power would be much cheaper, since the first cost of the installation would have been paid.

Diesel Engines at 13,000 Ft. Altitude

The Diesel oil-engine plant is rather interesting in that it affords some data on the operation of Diesels at high altitudes. The two engines installed at the elevation of the mill, 13,000 ft., are each rated at 300 hp. at sea level. The makers, Sulzer Brothers, Winterthur, Switzerland, would guarantee for them but 150 hp. at the elevation of the mine tunnel, 1000 ft. above



SULZER-DIESEL ENGINES AT LLALLAGUA

the point of their installation. At the beginning of the revolution of the Diesel engine the cylinder is filled with air at atmospheric pressure. This air is compressed to not less than 45 atmospheres and then fuel oil is forced into the cylinder. The temperature of the air due to the compression is so high that the oil immediately ignites. The amount of oil that can be burned at one revolution depends upon the weight of oxygen in the compressed air. Since the barometer here reads only about two-thirds as much as at sea level, one would expect the same engine running at the same rate to burn in a given time only about two-thirds as much oil and hence to develop not more than two-thirds as much power as at sea level. Our engines will each give about 200 hp. at this altitude. On actual tests made we have found that, using Peruvian crude oil of about 11,000 cal., the engines will produce when fully loaded 1 hp.-hr. with a consumption of 210 grams (0.463 lb.) of oil. For low fuel consumption the engines must be fully loaded. Using 210 grams of oil per horsepower-hour, the engines have a heat efficiency of 28%. Figuring that the first cost and interest on the investment at 10% should be charged off in five years, as in the case of the hydro-electric plant, with the difference

that we will say the Diesels produce 100 hp. 12 months of the year—since they can do so if necessary—we get the following:

The total cost of the Diesel engine plant, including the engines, generators, building, foundations (containing 200 bbl. of cement), freights and erection, was $52,000, of which the factory cost of the engines was $29,000. With interest at 10%, the principal and interest to be paid in five equal yearly payments, the annual charge will amount to $14,000. This is a cost of 9.6c. per horsepower-day. The operation and fuel costs for the Diesels are as follows: Fuel oil, $0.521 per horsepower-day; attendance, $0.016; cylinder oil, 36 kg. per day, $0.025; cleaning, $1.10 (extra) per month; repairs, $8.60 (extra) per month or $0.001 per horsepower-day; other costs, $17.20 (extra) per month or $0.001 per horsepower-day; cooling water, supplied by gravity; total operating, $0.564. The total cost for power from the Diesel engines from the above figures is 9.6 + 56.4 = 66c. per horsepower-day, which is 2.75c. per horsepower-hour. If the Diesel plant should be used after the five years, the cost per horsepower-day would still be at least 56.4c., the present operating cost.

Cheap Power from Deutz Gas Engines

The Deutz engines use gas generated from anthracite coal and produce power at a total cost of 3.8c. per horsepower-hour. Anthracite costs, at Llallagua, about $50 per ton. These engines were the first power units installed by the company that used anything but *taquia* for fuel and they have been giving excellent service for the last four years. They require cleaning only once in 60 days, and 12 hr. is sufficient for this operation.

Power costs being so high at Llallagua, some modifications are made in the methods of doing things. A horsepower-day developed by the Diesels costs more than the shift's wage of a laborer. It is poor economy to put in a machine needing 5 hp. to do the work that could be performed by two laborers per shift, for the company must have an investment in the machine and must pay for repairs, while the laborer represents no investment. When considering our automatic-roaster, magnetic-separator plant in comparison with the older hand furnaces and buddles, we always have to remember that the 20 hp. used in the new installation would pay the wages of more than 20 laborers (men and women) in the old plant.

The Cost of Doing Things

All machinery and nearly all mining supplies have to be brought to Llallagua from the United States or from Europe. Freights are a big part of the first cost of both machinery and supplies. The gateway to this section of Bolivia is Antofagasta, Chile, and from this port a 30-in.-gage railroad runs to Oruro. The nearest railroad station connected to Llallagua by a good cart road is Challapata, 60 miles from the mine. Ocean freights are cheap. On *barrilla* the rate per ton from Antofagasta to Europe is about £3 and it is expected that the freights through the Panama Canal to the United States will be lower. The rates on large shipments from Europe to West Coast ports are not nearly so high as £3. Considering the mountainous nature of the country and the high fuel cost the freight rates on the Antofagasta & Bolivian R.R. are reasonable, the cost per quintal from Antofagasta to Challapata, a distance of 500 miles, being about 2.80 bolivianos ($21 per ton). To bring material from Challapata to the mine when the weight is too great (that is, more than 100 lb.) for a llama, mule carts are used, and the cost per quintal varies from about 2.25 bolivianos ($15.50 per ton) for pieces of ordinary bulk and weight up to a much higher figure for articles which are especially heavy or bulky. Carts bringing in freight must be given *barrilla* for outgoing cargo even though rates for the same work by llamas are less. The cost of shipping on llamas is now cheap, it being possible to send a quintal of *barrilla* from the mine to Challapata for 1.10 bolivianos ($7.60 per ton). The carts make the 60-mile trip in three days. Llamas require five days for the journey from the mine to the railroad station.

Mining costs in many parts of Bolivia are dependent on freight rates. An instance is our cost of power from the Diesels. Of the total power expense 75% is for freights on the fuel oil and 10% is the cost of bringing the oil barrel from Antofagasta and returning it to the coast. It would make little difference in our power costs if the price of fuel oil at Antofagasta should go up or down 20%, since at Llallagua 80% of the final price is for freight.

Oregon lumber costs 35 centavos per board foot ($125 per M). A barrel of cement is worth 40 bolivianos ($14). Sheet iron costs 7c. per lb. An 18-liter can of Gargoyle lubricating oil has a value of 14.50 bolivianos or $5. We have a Hardinge mill. The first charge of pebbles came with the machine; these stones were valuable by the time they reached Llallagua.

Labor Now Plentiful

The price paid for labor in Bolivia varies greatly according to the place. In the last two years, because of high tin prices and great labor demand, the wages at Llallagua have constantly risen. A drill man received as high as 10 or even 12 bolivianos ($3.45 to $4.15) per 12-hr. shift and the average wage at the mine, including a considerable number of women ore pickers at 1.50 bolivianos and other cheap labor, was 6.30 bolivianos or $2.20. During the first part of 1914 the price of tin declined and with it the wage of the laborer. Then came the European war and practically no price for tin. Many small mines stopped operations. The nitrate fields of Chile curtailed. Railroad projects were stopped. Labor became plentiful and the average wage at the mine is now 3 bolivianos or $1, while at the mill it is about 1.98 bolivianos ($0.69) per shift of 12 hr. At ordinary times the labor is worth just about what we have to pay for it when the amount of work done for a dollar is compared with that performed for the same price in the United States.

The 12-hr. shift used at Llallagua and at Uncia does not mean 12 hr. of work. Custom rules in Bolivia and to the man who attempts to change things that are and have been, many things will happen. In occupations necessitating more or less strenuous work, such as shoveling, it is customary to set aside, each shift, three 20-min. periods for coca chewing. The coca-time is really a rest period as well and the laborer hunts a comfortable place to sit during the time. The custom of chewing the coca leaf is general. It should not cause more remark than the tobacco-chewing habit of the United States; it does not at all interfere with the pleasures of those who do not "chew." The coca seems to be exceedingly stimulating. An Indian eating a little grain and with coca to chew will run in a day distances almost incredibly great. In

traveling among the Indians in Bolivia the purchasing power of coca is more dependable than that of money.

The Bolivian laborer is usually contented and easy to handle. He will work hard and cheerfully. He would rather work for a small wage for a man he likes than for higher pay in the employ of a man he dislikes. He holds it an honor to have served one company for a long time. To his superior he is very respectful and often brings his domestic troubles to his employer for solution. When in charge of Bolivian labor it should always be remembered that, the men having been made to realize that you can be firm, all acts of kindness shown will be returned many-fold.

The costs for operating mine and mill are given in the accompanying table. The figures given are taken at times before the reductions of wages caused by the war were in full effect. With the present labor price the costs will be lower.

COSTS AT LLALLAGUA DURING JUNE, JULY AND AUGUST, 1914*

Item	Per Quintal of Barrilla Produced			Per Ton of Ore Milled			Per Ton of Rock Broken		
	June	July	Aug.	June	July	Aug.	June	July	Aug.
Mining Exploitation:									
Payroll	$1.90	$2.05	$1.81	$6.48	$6.41	$4.98	$2.59	$2.57	$1.99
Materials	.32	.25	.36	1.07	.78	.99	.43	.31	.39
Total	$2.22	$2.30	$2.17	$7.55	$7.19	$5.97	$3.02	$2.88	$2.38
Development:									
Payroll	1.28	1.05	.86	4.28	3.26	2.37	1.72	1.31	.95
Materials	.06	.02		.21	.07		.08	.03	
Total	$1.34	$1.07	$0.86	$4.49	$3.33	$2.37	$1.80	$1.34	$0.95
Total mining	3.56	3.37	3.03	12.04	10.52	8.34	4.82	4.22	3.33
Transportation to mill	.08	.08	07	.26	.30	.20	.10	.12	.08
Milling:									
Payroll	.54	.56	.50	1.79	1.74	1.37	.73	.70	.54
Power	.18	.16	.12	.59	.50	.33	.24	.20	.14
Repairs	.08	.10	.09	.27	.31	.24	.10	.12	.09
Total	$0.80	$0.82	$0.71	$2.65	$2.55	$1.94	$1.07	$1.02	$0.77
New construction	.16	.20	.17	.54	.63	.47	.21	.25	.19
Barrilla sacks	.18	.18	.18	.61	.57	.50	.24	.22	.20
Assays	.06	.07	.08	.21	.22	.21	.08	.09	.08
Supply house	.02	.02	.02	.06	.06	.05	.03	.02	.02
Corral (20 animals)	.03	.04	.05	.10	.12	.12	.04	.05	.05
Costs of administration	.03	.02	.04	.10	.08	.10	.04	.03	.04
Legal matters	.06	.19	.07	.21	.58	.19	.08	.23	.08
Traveling expenses	.06	.04	.03	.19	.12	.08	.08	.05	.03
Office expenses	.10	.09	.10	.33	.29	.27	.13	.12	.11
Interest	.16			.55			.22		
Insurance	.003	.003	.006	.01	.01	.02	.003	.003	.006
Commissions	.05			.17			.07		
General expense	.07	.06	.09	.24	.17	.21	.10	.07	.10
Grand total	$5.26	$5.18	$4.47	$17.73	$15.59	$12.26	$7.10	$6.24	$4.90

* In these months approximately 40% of the ore broken and brought to the surface was sent to the mill.

One of the costs of mining in Bolivia which should not be overlooked is the export duty imposed on metals and concentrates, which for the most part go to other countries for use. One of the important incomes of the Bolivian Government comes from the duties charged on such exports. The duty on copper when the market is at 15c. a pound (£69 2s. 0d. per ton) amounts to $0.004 per pound on metal. Copper concentrates pay duties at the rate of 60% of those on the metal. Copper minerals which have not been concentrated pay 25% of the metal duty. This would appear to be an attempt on the part of the Government to discourage home concentration, although undoubtedly such is not the intention.

For wolfram the export duties are from 1.00 to 3.20 bolivianos per metric quintal when the London price per ton, with the basis of 60% tungstic acid, is from 20s. to 10s. per unit.

In the case of the duties on tin metal, they seem to be figured on the assumption that the amount of tin in a quintal of concentrates is two-thirds of that in a quintal of the metal and charges are made accordingly. This method of charging duties takes no account of the grade of the concentrates. When the price of tin in London ranges from £100 to £300, the export duties in Bolivia range from 2 to 14.55 bolivianos on concentrates and from 3.25 to 20.05 bolivianos on tin metal. The prices of the various metals in Bolivia are announced every 15 days by the government official with the title *Ministro de Hacienda*. The law of Dec. 1, 1911, which places a duty of 3% on the profits of all mining companies in Bolivia has been cancelled.

Investment Chances in Bolivia Good

Bolivia needs foreign capital for the development of its mining industry. The impression seems to prevail that money invested in Bolivian mines has not sufficient security and that it may be subjected to a multitude of actions at law. The fact is that where the titles of property are carefully secured, as would be the case in the United States, no trouble of lawsuits need be expected.

No large mining ventures have been started within the past five years. The country is well settled and in a way has been prospected by the Indians. Old workings of the Spaniards are found in many places. The system of Indian slavery practiced by the Spaniards permitted the working of deposits more cheaply than would at present be possible. There is in Bolivia good opportunity for North American investors. The chances for profit appear to be particularly good in the development of small mines, requiring but a moderate outlay of capital.

The Position of Tungsten

The following communication of W. A. S. Hellvar recently appeared in the London *Financial Times* on the subject of the scarcity of wolfram ores in the British Isles:

I have read the letter of O. J. Stannard in the "Times" of Sept. 4, and, as the part owner of a wolfram mine in Cornwall and a director of a tungsten-powder factory in London, I am perhaps qualified to offer some assistance to your correspondent in his dilemma when he states that he cannot "see why there should be this shortage of wolfram ore."

The ore is rarely produced free from tin, the output of a great number of producing mines containing up to as much as 10% of the latter commodity. Prior to the war 80% of the ore produced in or coming into Europe was consigned to Germany, including the whole of the tin-wolfram ore, for the reason that the Germans were the only people able to separate the tin from the wolfram. To be more explicit, Krupps, of Magdeberg, who were the makers of the Ullrich electromagnetic separator (a German machine), were open to buy tin-wolfram ore just as readily as they would take tin-free ore.

After the outbreak and as a consequence of the war there was no sale for mixed ore containing over 2% of tin, with the result that a large quantity of small native-owned mines in Burma closed down, and have not since restarted. At the present moment, instead of there being a difference of 1s. a unit between high-grade ore and that containing tin as pertained before the war, you have a difference of from 20s. to 25s. a unit. Only a few weeks ago a parcel of 30 tons of ore containing 8% of tin was sold in London at 31s. a unit, at a time when tin-free ore was fetching anything up to 60s. Metallic tin in tungsten is nearly as fatal as carbon.

What is required to solve the difficulty is a cheap and effective separator.

The Virginia-Carolina Chemical Co. reports for the year ended May 31, 1915, net earnings of $4,979,949, after deducting $1,476,126 for repairs and maintenance and setting aside $673,821 to reserve for doubtful debt. From this, interest and discount of $1,265,741 was deducted, leaving net profit for the year of $3,714,209.

Details of Practical Mining

Concrete Underground Ore Pocket at Copper Queen

By Fred M. Heidelberg*

It was the desire of the management to have the 260-ton ore pocket on the 400-ft. level of the Sacramento shaft designed with a barrel, a chute and a neck. The barrel was to contain the 260 tons of ore; the chute was to have the ore fed into it and in turn supply the ore to fill the cartridges; the neck, a necessary evil in this case, was to connect the barrel with the 400-ft. level.

The ore was to be fed into the chute from the barrel in a loose, unpacked condition. How to get the ore to feed in this condition was at first puzzling. A study was made of sand flowing through a hole in a tin can. The can was suspended about 2 in. above a table and sand was poured in. It flowed through the hole until automatically stopped by the sand-heap on the table rising to the hole. Some of the heap was then removed from beneath the can, from which the sand again flowed until stopped as before. It was evident that the [illegible] in the can exerted very little pressure on that which had piled up on the table. It was believed that the [illegible]ation of

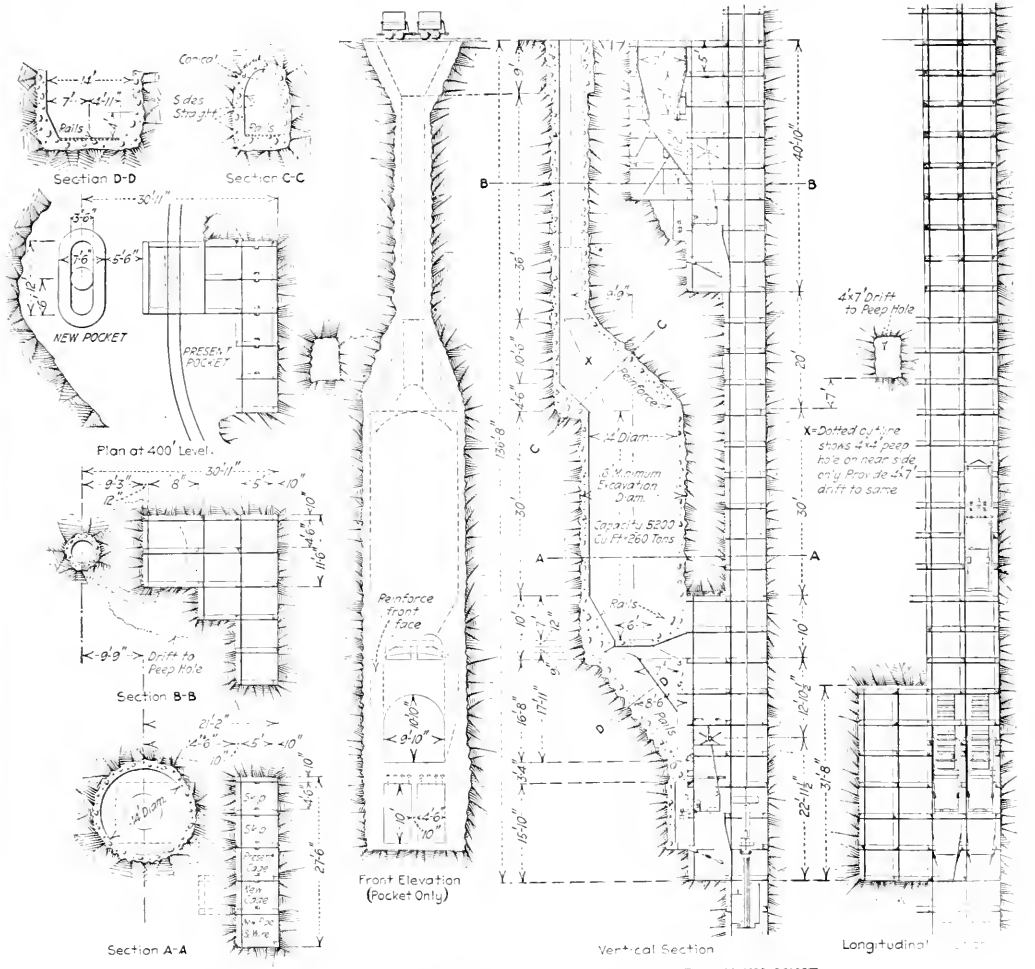


FIG. 1. DETAILS OF 250-TON ORE POCKET AT COPPER QUEEN MINE

*Box 1179, Bisbee, Ariz.

this principle would be most likely to give the results sought. The bottom of the barrel was therefore made in the shape of an inverted frustum of a cone. A diameter of 6 ft. for the opening in the frustum was decided upon as probably being best adapted to feed the ore in the manner desired and not allow it to arch in the barrel.

The long neck was provided to obviate taking out much rock around the old wooden pocket, which would have tended to weaken the pocket and the shaft. On account of the long drop from the level to the barrel, the neck was offset from the barrel so that the fall of the ore would be broken by the shelf before entering the barrel. Had the ore been allowed to fall directly into the pocket undoubtedly it would have packed and caused trouble in emptying the pocket. It will be noted that, had the proper conditions existed, the neck could have been omitted, the length of the pocket thus shortened, and the ore dumped directly into the barrel.

Keeping the ore from packing in the chute was carefully looked after. A razor-back (not shown in the design) was placed against the column in the center so as to divide the ore to the doors; 8-in. channel grizzlies were provided in the front, to allow for punching the ore should it hang up. Circular doors were called for at the end of the incline of the chute.

The cartridge- and skip-loading system, while not a part of this design, are shown. The working of the system can easily be seen from the design. The cartridge is filled and when the skip is in place the bottom of the cartridge is dropped and the ore falls into the skip.

A 4x7-ft. drift was provided from the pipe compartment to a peep hole placed just above the barrel of the pocket. This peep hole was to furnish the means of investigating the condition of the pocket when desired. A small 12x24-in. peep hole (not shown in the design) was provided where the inverted frustum and the barrel joined.

On the level where the cars dump, the neck was flared out to a funnel shape. It was made large enough to allow two cars to dump at the same time. A grizzly of 90-lb. rails, spaced 12 in. centers, was put across the funnel as a safety device.

The concrete in general was to be 1 ft. thick, reinforced where deemed necessary, and protected by 25-lb. rails where excessive wear was likely.

In constructing the pocket the design was followed faithfully except that the pocket was put on the side of the shaft opposite to that on which it is shown. The mining or excavating was done as a raise. Just as soon as enough ground had been taken out, a chute and door were put in so that the blasted rock falling down into the chute could be loaded directly into cars and hoisted to the surface. This little device saved quite a bit in the cost of excavating. Throughout, 10x10-in. timber was used. In the barrel a tower 8 ft. square was first formed, and then short stulls were put into the rock. In concreting, when the short stulls were taken out, the tower served to support the forms.

The manner of making the forms is worthy of attention. The regular 5-ft. long by 2-in. thick mine lagging was used altogether; and when the job was finished it was possible to return all but a small percentage of it to the mine for further use. From the opening in the inverted frustum to the top of the neck the lagging was nailed to 3x3x¼-in. angle-rings bent to the proper diameter. These rings and lagging constituted the forms. The inward thrust was taken up by the 8-ft. tower left in the center. The 3x3x¼-in. angle-rings had two sets of ¾-in. holes punched 1½-in. centers, staggered, with gages ¾ in. and 2¼ in. This left 1½ in. between the rows of holes. For the barrel four sets of rings were used. The cycle consisted in first spiking the lagging to a ring at the bottom of the form; at the top of the lagging another ring was spiked. In this top ring the bottom row of holes was used and the end of the lagging allowed to stick up only half way between the two sets of holes, so that when the form was filled with concrete the bottom of another set of lagging could be butted on the lower forms and the top row of holes in the angle could be used to spike through. In this way 5 ft. was concreted on some days and 10 ft. on others. The same method was used in the neck. At the junction between the neck and the barrel a combination of the rings for the barrel and the neck was used with success.

The concrete was conveyed to the pocket from the surface through a 6-in. pipe, placed in the pipe compartment. From a hopper at the subway station it extended downward 400 ft., then bent and went horizontally

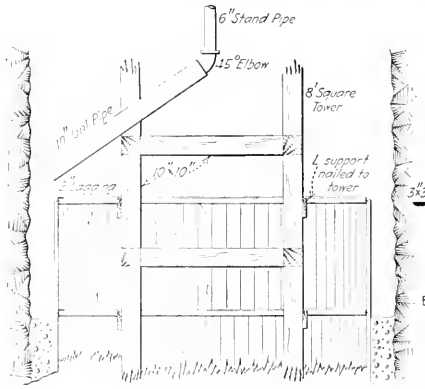


FIG. 2. DETAIL OF CONCRETING AROUND FORMS

to a hopper in the funnel of the neck of the pocket. This hopper was connected to a 6-in. pipe running down to the bottom of the pocket. On the end of the pipe was a 45-deg. elbow, over which was hung a 10-in. galvanized-iron spout which allowed the placing of the concrete wherever desired. As the concreting progressed, a length of 6-in. pipe was taken out, the 45-deg. elbow and galvanized-pipe spout fastened on and the work continued.

Since the quantity of concrete was small, no attempt was made to install a money-saving plant. The concrete was mixed with a mixer just outside the subway entrance, wheeled to the shaft and dumped into the hopper.

Fig. 2 is a section through the barrel. It shows the 8-ft. square tower, the method of using the forms, and the manner in which the concrete was placed by means of the galvanized-iron spout, which could be swung about the pipe as a center.

For dry sulphide ore the pocket worked admirably. The ore could be taken out faster than the conveying system could handle it. Although the pocket was intended for sulphide-ore storage, the management deemed it wise

to try the wet oxide ore also. This ore caused some trouble. The first time the pocket was filled the ore arched in the barrel and stuck to the concrete between the rails in the chute. The pocket was emptied, the 6-ft. hole in the inverted frustum was made 16 in. larger in diameter, and the chute was lined with boiler plate. A spray was also placed at the top of the incline of the chute so that it would keep the sheets wet. The second time the pocket was filled the ore did not arch in the barrel and its passage down the chute was quickened by the spray and the boiler plate. This pocket now works better than any other pocket in the mine handling this class of ore.

Under no circumstance is the ore taken out below the inverted frustum of the cone, for several reasons. The wear on the face of the frustum would be excessive; if the ore fell directly into the chute from such a great height, it would tend to pack there, thus defeating the original purpose of the design. As a matter of fact, through carelessness, the train attendants did fill the pocket several times up to the track on the 100-ft. level; but no trouble was experienced in emptying the pocket.

There was 361 yd. of concrete placed. The maximum progress for concreting in the barrel was 10 ft. per day, while 20 ft. was the maximum reached in the neck. The total cost of the pocket, including excavating, timbering, concreting, cartridge and loading devices, did not amount to $10,000.

Gerald Sherman, superintendent of the mine department; J. P. Hodgson, superintendent of mines, and George Mieyr, master mechanic, were active in working out the idea of the pocket, while the writer acted in the capacity of designer. Mr. Mieyr and Joe Lutz, the shaft boss, successfully carried on the construction.

*

Single- and Double-Hand Drilling Contests at Boulder

The Boulder County Metal Mining Association was sponsor for a successful Labor Day picnic at Boulder, Colo., participated in by both metal and coal miners. The most interesting events of the day were rock-drilling contests by hand. In the single-hand affair, Fred Dopp, of Jamestown, defended and retained his title as state champion and this despite his lack of recent practice. He drilled 17⅝ in. in solid granite in 10 min. In the double-hand contest, Dopp was paired with Roy Peterson. When it was announced, at the completion of their hole, that it was $23\frac{7}{16}$ in. deep, the spectators felt these men had won; but when the Brown brothers next took the stand and started their drilling, it became evident that something was happening. They started in with accurately timed and absolutely square blows that varied throughout the period only in their steadily increasing intensity. The Browns struck exactly one blow per second. Changes of position from striking to turning and changes of steels by the turner were made without the interruption of a single stroke. They drilled $24\frac{3}{16}$ in., Dopp and Peterson taking second place. Dopp has never been defeated in single-hand drilling, and an effort is being made to send him to San Francisco to compete for the world's championship.

Another feature of the day was a first-aid contest between drilled teams from several coal mines in this county. In this the prize, a silver cup, was taken by a team representing the Simpson mine at Lafayette. This picnic was managed by L. E. Girard, of Salina, who states that its most important result was the elimination of "an undercurrent of distrust and unfriendliness" between the men engaged in the industries of metal mining and coal mining.

*

Hand-Drilling Contest at Virginia City

Two contestants in a single-hand drilling contest on Labor Day at Virginia City, Nev., made the following record, the time allowed the men being 15 min. for drilling down holes: Mike Grivic drilled $32\frac{1}{8}$ in.; William Berry, 29 in. Berry got a good start and drilled steadily, but toward the end lacked force. Grivic was the speedier and is estimated to have struck from 95 to 100 blows per minute. His third or fourth drill stuck once, but he lost very little time. George Dewar was judge of the contest. Some money changed hands on the result, but the betting was light. The purse was $100.

*

Mother Lode Drilling Contest

Five teams of Mother Lode miners entered a drilling contest at the union picnic of the California State Federation of Labor at Jackson, Amador County, Aug. 15. One of the teams, Voyivich and Vacilivich, of Jackson, broke one of the drills in the hole, so that their record was not available. Teams were allowed 15 min. Drilling was in Amador County granite. Payton and Dynan, of Amador City, took first prize, drilling 46½ in.; Marcus and Pedro, of Sonora, second, 46¼ in.; Zarkovich and Rupur, of Jackson, $13\frac{1}{8}$ in.; Burbank and Kerr, of Amador City, $33\frac{3}{4}$ in.

*

Hand Drilling at Butte

Sam and Will Roberts drilled $37\frac{3}{4}$ in. in granite in 15 min., working as a team, at an exhibition at Lake Avuca, Butte, on Labor Day. It had been announced previously that two two-men drill teams, the contestants averaging 170 lb. each, would compete, but only one team was on hand.

*

Miami Hand-Drilling Contest

Double-hand drilling contests were held in Miami on Labor Day, the rock being local granite and the time the usual 15-min. period. The first prize of $250 was won by William Gholson and Jess King, who drilled 36½ in. The second prize of $100 was won by Tony Obad and Christ Palovich, who drilled 35¼ in.

*

Jamestown Hand-Drilling Contest

Three teams entered the rock-drilling contest at the Labor Day picnic at Jamestown, Calif. Drilling was in hard granite. Wilson and Kahl took first prize, drilling $32\frac{3}{8}$ in. Burbank and Kerr, second, $32\frac{1}{8}$ in. Marcus and Pedro made 31¼ in., but broke a drill steel and did not complete the contest. Time, 15 min.

Details of Milling and Smelting

Bradford Selective Flotation

Leslie Bradford, of Broken Hill, Australia, has patented a process of preferential flotation for the treatment of mixed sulphides, adding certain mineral salts such as thiosulphates to the water used in the flotation cells. The *Australian Statesman and Mining Standard,* of July 22, 1915, states that the distinguishing feature of the method consists in treating the ores or ore products in a medium which wets zinc sulphide and does not wet lead sulphide or pyrite and therefore leaves the last-named sulphides flotable while rendering the zinc sulphide temporarily immune to flotation. The lead sulphide and any pyrite are thus obtained first as float concentrates; thereafter the residues comprising gangue and zinc sulphide are treated for the separation of the zinc sulphide from the gangue.

This "wetting" effect, according to the patent specification, is procured by adding to an acid flotation solution a limited quantity of a substance which is decomposed by said solution, and produces in this decomposition a reducing gas which is more or less soluble in the solution. Notably thiosulphates, sulphites and bisulphites are so decomposed in a solution of sulphuric acid with the production of such a gas (sulphur dioxide). With substantially equal result, sulphur dioxide may be introduced directly into the solution, either as gas brought into it in a current or added in solution. The like effect is obtained by means of another reducing gas, sulphureted hydrogen, which may be similarly introduced into the solution or may be produced in it by adding sulphides or polysulphides which the solution is capable of decomposing.

In practice a limited quantity of such a reducing agent is introduced into the solution, prior to flotation treatment of the ore therein, with the object of procuring this zinc "wetting" effect. The reducing agents preferred by the inventor are thiosulphates, sulphites and bisulphites—as they are usually more effective than those belonging to the second group.

In the actual application of the invention to a Broken Hill mixed-sulphide ore containing zinc and lead sulphides, the flotation operation is considered in a plant of the type described in two previous Commonwealth patents, using the flotation boxes set in series, and treating ore at the rate of 25 tons per hour. No serious difficulty is experienced in correctly proportioning the sodium thiosulphate (the blende "wetting" agent) so as to insure the rapid floating off of the galena substantially pure or as a high-grade concentrate rich in silver, and to leave the residue in a condition suitable for further flotation treatment for the recovery of the zinc sulphide therefrom.

The flotation treatment is preferably conducted according to the froth-flotation principle; the procuring of the effect aimed at is dependent upon the presence of a frothing agent in the flotation medium, only when a reducing gas is introduced into the medium; it is not dependent upon the presence of a frothing agent in the flotation medium when a reducing gas is generated in the flotation medium by reaction of a substance introduced into it. In some cases enhanced results are obtained by digesting the ore with sulphuric acid and the reducing agent in a thick pulp, prior to subjecting the same to a flotation operation.

*

Chart for Determining Plies of Conveyor Belts

The accompanying chart,[1] drawn by J. D. Mooney and G. L. Darnell, of the B. F. Goodrich Co., Akron, Ohio, offers the means of quickly determining the correct number of plies for conveyor belts operating under various conditions. The calculations are based on the average safe strength (factor of safety, 15) of various standard rubber conveyor belts, and assume maximum loading conditions; that is, the belt is considered as carrying the greatest load it will handle without spillage at ordinary belt speeds. This not only produces the most economical operating condition, but also the maximum tension in the belt. The chart is a graphical representation of the formula:

$$p = k\,g\,W\,(L + 10\,H)$$

where

p = Correct number of plies;
k = A constant depending on the type of drive;
g = Weight in pounds per cubic foot of material handled;
W = Width of the belt in inches;
L = Length of the belt in feet (approximately twice the center distance);
H = Difference in elevation between the head and the tail pulleys in feet.

For a simple drive with a bare pulley, k equals $\frac{1}{250{,}000}$. For a simple drive with a rubber-lagged pulley, k equals $\frac{1}{300{,}000}$. For a tandem drive with bare pulleys, k equals $\frac{1}{375{,}000}$. For a tandem drive with rubber-lagged pulleys, k equals $\frac{1}{455{,}000}$.

The chart is drawn for a simple drive with the bare pulley $\left(k = \frac{1}{250{,}000}\right)$; therefore the number of plies obtained from the chart should be multiplied by the factor 0.83 or $\frac{5}{6}$ for simple, lagged drive; the factor 0.67 or $\frac{2}{3}$ for tandem, bare; and the factor 0.55 or $\frac{11}{20}$ for tandem, lagged drive.

To find the correct number of plies for a conveyor belt, knowing the width, the length, the difference in elevation between the head and the tail end and the kind of mate-

[1] "Bull. of A. I. M. E.," September, 1915.

rial to be handled, proceed as follows: Start with the width given at the top of the chart and move down until this line intersects the line corresponding to the proper length factor ($L + 10\,H$); then move either right or left until the line corresponding to the given material is met; then move down again to the scale of plies where the next largest figure will give the correct number of plies.

For example: To find the correct number of plies for a conveyor belt 36 in. wide and 300 ft. long, with 20 ft. difference in elevation, handling sand and gravel—follow the line from the 36-in. width downward until it intersects the 500 length-factor line; then follow to the right until the sand-and-gravel line is intersected; then down to the ply scale, where the ply will be found to be 7.

The formula $p = k\,g\,W\,(L + 10\,H)$ has been developed mathematically from the following formulas

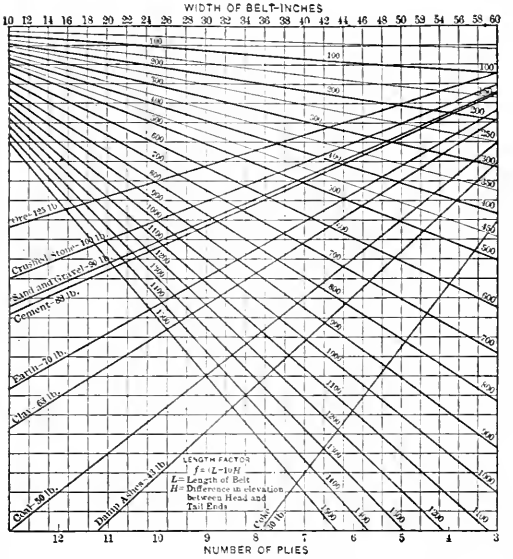


FIG. 1. CONVEYOR BELT CALCULATING CHART

which have been found to work satisfactorily in average practice:

$$U = \frac{0.08\,W^2 S g}{5{,}000} \qquad HP = \left(\frac{0.02\,l}{100} + \frac{0.01\,H}{10}\right) U$$

$$T = \frac{U \times HP}{S} \qquad p = \frac{T}{24\,W}$$

where

U = Capacity in tons per hour;
W = Width of belt in inches;
S = Belt speed in feet per minute;
g = Weight per cubic foot of material handled;
HP = Horsepower developed in driving conveyor belt;
l = Length of conveyor in feet (approximately one-half L);
H = Difference in elevation between the head and tail pulleys in feet;
T = Total tension in the belt in pounds;
p = Correct number of plies; C = The constant of the drive.

For a simple-drive, bare pulley, $C = 600$. For a simple-drive, rubber-lagged pulley, $C = 500$; for a tandem-drive, bare pulleys, $C = 400$; for a tandem-drive, rubber-lagged pulleys, $C = 330$. The length factor f equals $L + 10\,H$, represented on the chart by the lines 500, 600, 700, etc., is a developed factor equal to the sum of the length of the belt and 10 times the difference in elevation between the head and tail pulleys.

Hall Smelting Process to Eliminate Sulphur Dioxide

William A. Hall, of New York, has been granted a patent (U. S. pat. 1,133,637) for a process to prevent the escape of noxious gases in smelting, particularly of SO_2 commonly produced in the focus of the blast furnace. This is accomplished by maintaining at the top of the charge a temperature below that at which free sulphur will ignite and by spraying the top of the charge with a liquid containing water, thereby producing sufficient hydrogen sulphide to reduce the sulphur dioxide in the furnace gases. Spray pipes are placed in the furnace stack, and as the water percolates downward it keeps the top layer of the ore much cooler than in ordinary smelting of sulphide ores. When the water has reached a point where the temperature is high enough to convert it into steam, the latter reacts with a certain amount of sulphide ore and the evolution of H_2S results. This combines with the SO_2 to form water and elemental sulphur, the latter passing upward in the form of vapor and being condensed in the dust chambers. The reaction may not be completed in the furnace stack, but may proceed in the fume-settling system. A high-ore column and the exclusion of false air in the upper part of the stack are recommended.

Rapid Test for Fineness of Paint Pigments

The Multi-Metal Separating Screen Co., of New York, has succeeded in making 350-mesh screens (122,500 apertures per sq.in.) of vanadium-bronze wire about 0.001 in. diam., with which different operators, using different screens, can obtain concordant results, according to C. D. Holley and J. C. Brier, *Oil, Paint and Drug Reporter*, May 10, 1915; abstr. *Journ. Soc. Chem. Ind.*, June 15, 1915. These screens have proved of value for testing the fineness of pigments. The particles passing through can be ground economically in a paint mill, but those retained on the screen, even when present in relatively small amounts, rapidly reduce the efficiency of the mill. The sample (25 grams) is washed through the screen by means of water, using a soft brush to break up lumps. Calcium and manganese oxides, as used by varnish manufacturers, can be tested in a similar manner, using naphtha instead of water. The results obtained with consignments of various commercial pigments varied greatly in many cases from those yielded by the small sample used as a basis of purchase.

E. Laugguth States in a Patent Specification (German, 282,131, Oct. 8, 1913) that when mixed sulphide ores are being treated by the oil flotation process, a solution of zinc chloride acidified by chlorhydric acid, added after the oil, causes the sulphides of zinc and lead to sink while other ores float.

American Institute of Metals

The first technical sessions of the Allied Foundrymen's Organizations were held at Atlantic City, N. J., on Tuesday, Sept. 28. The headquarters of the meeting was at the Traymore Hotel.

A joint opening session of the American Institute of Metals and the American Foundrymen's Association was held in the morning, the papers relating exclusively to foundry practice. In the afternoon the American Foundrymen's Association held a session on Young's Pier, while the American Institute of Metals held a technical meeting at the Traymore. At the latter, the first paper presented, "An Investigation of Fusible Tin Boiler Plugs," by G. R. Burgess and P. D. Merica, was discussed by the latter, who gave some supplementary data. He said that in the case of some boiler plugs which had been overheated, but did not blow out, investigation showed that the metallic tin had been partly transformed into the oxide, the latter having a melting point of about 1,600° C. against 320° C. for pure tin. Oxidation began on the water side of the plug and progressed in the form of a complicated network of fine veinlets, utterly destroying the utility of the plug.

It was also shown that a small percentage of zinc in the tin destroyed its value as a safety plug by changing the melting point. Analysis of various plugs showed that many contained from 0.3% to 1% Zn, while pure Banca tin should not contain more than 0.01% to 0.03% Zn.

The next paper was on "The Influence of the Impurities of Spelter on the Cracking of Slush Castings," read by the author, Gilbert Rigg, of the New Jersey Zinc Co. This paper elicited considerable discussion. The fact was brought out that even small quantities of impurities, among which cadmium was prominently mentioned, tended to produce cracking, often microscopic, which lowered the value of the castings. Incidentally it was brought out that the reasons are the same which have made it necessary to use highest-grade spelter for making brass to be utilized in munitions of war. Small proportions of iron harden the brass, while cadmium has a general deteriorating effect, although the speakers could not definitely name its activities.

The two papers announced to follow—"Cobalt in Nonferrous Metals" and "Furnace Methods for Pure Castings"—were not presented, their preparation having been interferred with.

Doctor Rawdon's paper on "Standard Test Specimen of Zinc Bronze" was read and explained by Dr. G. K. Burgess. The 88:10:2 mixture was discussed at length. One of the points brought out was in response to a question asked as to whether the bad effects of oxidation in this mixture were due to furnace practice or to pouring practice; if the former, a remedy might be found in the electric furnace with its reducing atmosphere. Doctor Burgess was of the opinion that furnace practice was largely responsible.

As to deoxidizing agents, phosphorus, manganese and barium were recommended as the most promising. Little was to be expected from calcium or silicon, since their use introduced features antagonistic to good results.

Doctor Hoyt's paper on copper-rich kalchoids was presented by the secretary, but provoked no discussion. The members attended a theater party in the evening. G. H. Clamer presided at these sessions, W. M. Corse, secretary.

British Mineral Production

The mineral production of Great Britain from mines coming under the Coal Mines and Metalliferous Mines acts was given in the *Journal* for July 3, p. 6. The statement is now completed, the British Government having just issued the statistics covering the production from workings under the Quarries act, which covers all quarries and openpit workings.

Quarry-Production Quantities

The production from these workings in 1914 included 2,342 tons bog ore; 100 tons chromite; 21,363 tons coal; 39 tons copper ore; 9,128 tons fluorspar; 45,269 tons gypsum; 5,561,336 tons iron ore; 25 tons lead ore; 11,845,236 tons limestone; 1,150 tons dressed tin ore.

The most important item of quarry production was iron ore. The total ore mined in Great Britain in 1914 was: Coal mines, 7,241,481; metal mines, 1,743,011; quarries, 5,561,336; total, 14,745,828 long tons, which is a decrease of 1,251,500 tons from 1913. The small quantity of coal from open workings makes the total production of Great Britain 265,664,393 tons in 1914; a total decrease of 21,766,080 tons from the preceding year.

Number of Employees and Accidents

The total number of persons employed at quarries and open works under the Quarries act was 78,908, of whom 50,074 worked inside the actual pits or excavations, and 28,834 outside. Compared with 1913 there is a decrease of 1,192 inside workers, and of 809 outside workers, making a total decrease of 2,001 in the number of persons employed at quarries. The persons employed occasionally at quarries are not included in the above figures.

There were 95 persons killed, or 1.20 per 1,000 employed; the rate for inside workers being 1.54 and for outside 0.62 per 1,000. As compared with 1913 there was an increase of 10 persons killed, but a decrease of 576 in the number injured.

Molybdenite Production in New South Wales

A report on the probable output of molybdenite in New South Wales made by Arthur D. Pedley for the government gives the following estimate:

There are several works for the treatment of molybdenite in Sydney, and several of the mines treat their product in the country.

As to production, there was a letter in the London "Times" on, I think, Apr. 6, stating that the production of molybdenite from that date to June 30 next would be 100 tons. Whoever wrote that letter must have known such would not be the case. It would be impossible. When the statistics are available, it will be found that instead of 100 tons the amount will prove about 10 tons—and perhaps a little under.

As to the future export—say from July to December inclusive—I think it will prove about 60 tons. Any sensational increase or decrease is not to be expected. More than half the amount quoted will come from old dumps that have been left lying on the surface for years; the other half will come from mines now working.

A good many molybdenite mines are now coming to light, but the statements as to their value are inflated. It will require more than present prices to make them pay in most instances.

The ore is found in pipes and not in lodes or reefs; in consequence, a mine may last for a year or two or the pipe may come to an end in a week's time without any previous indication, and thus it is a precarious industry.

Correspondence and Discussion

Mining-Stock Brokers

The editorial on "Mining-Stock Brokers" in the *Journal* of Sept. 4, 1915, not only does an injustice to most of the brokers of the Salt Lake Stock and Mining Exchange, but also states as facts reports which the editors have of course read or received from their correspondents, but concerning which they have been somewhat misinformed.

The brokers of the Salt Lake City Exchange did not "suspend a regular session in order to congregate in the so-called Gold Room of the Commercial Club in order to do honor to a notorious exponent of the black art who was warmly welcomed and feasted" because he was "going to foster a boom in the Alta stocks," nor did they suspend any session, nor extend any official notice of his presence. A luncheon was given for him to which some of the brokers were invited, and when the time arrived for the opening of the exchange one of the members of the exchange proposed that the time of the second call, which usually begins at 1:30 p.m., be postponed until the luncheon was over, and it was postponed for those present. A dinner was also given for him here by some of his business associates and a number of the brokers were invited, but only a small percentage of the members of the exchange attended, and they were well outnumbered by the business men of the city. The editorial written at the time concerning the dinner was certainly approved by a large majority of the members of the Salt Lake Stock and Mining Exchange to whom I showed the article.

This "Alta boom" was not fostered nor matured here but in the city of New York. Practically all the Salt Lake brokers warned their clients of its danger, and those who had Eastern connections warned them as well.

The *Journal* speaks of our Utah Copper Co. in a complimentary way in its editorial and the legitimate speculation in its shares. Every producing mine in Utah which was financed here is, I believe, listed on the Salt Lake Mining Exchange. They were not invited to list their shares, but an application had to be made by each company with a statement showing who the officers were, what the financial condition of the company was at the time of listing, and a fee of $100 was paid by each company upon the acceptance of its application. Surely if the Salt Lake Exchange were "cheap and contemptible," as the *Journal* leads one to infer when it states that nearly all the interior exchanges are, then such men as manage the Silver King Coalition, the Daly Judge Mining Co., the Silver King Consolidated Mining Co., the May Day Mining Co., the Eagle and Blue Bell Mining Co. and many others equally well managed would withdraw their listing from the Exchange. It is not generally known, but is a fact, that the Salt Lake Exchange was one of the very few in the world that did not have to close its doors a year ago.

It will be found on investigation that not only did the majority of the Salt Lake brokers oppose the late "Alta boom" but also that the public of Salt Lake used the opportunity to liquidate practically all their holdings in the manipulated stocks.

I have read the *Journal* many years and know that it would not knowingly misrepresent any circumstances for any purpose. I trust therefore that it will at least correct the misstatements contained in its editorial, even though it is considered that the general tone of the editorial is warranted.

JAMES A. HOGLE.

Salt Lake City, Utah, Sept. 18, 1915.

Cost of Winter Construction

In the *Journal* of Aug. 28 I have noticed an article entitled "Cost of Mill Construction," by Harry T. Curran. Any description of methods of using concrete is interesting to me, but I must take exception to some of the recommendations which Mr. Curran makes in that portion of his article under the heading, "Difficulties of Winter Construction."

While I realize, of course, that the increased cost of concrete work done in cold weather may range within wide limits, I question whether the statement that such increased cost will easily reach 50% over costs under favorable conditions is true. In fact, where such results follow, I question whether the conditions would be such as to warrant undertaking the construction, from the standpoint of safety as well as other standpoints.

Furthermore, I question the statement that "after 12 hr., freezing can only retard the final set but cannot injure the concrete," especially in view of the fact that later on in Mr. Curran's discussion he advocates the use of integral salts, either calcium or sodium chloride, to lower the freezing point of concrete.

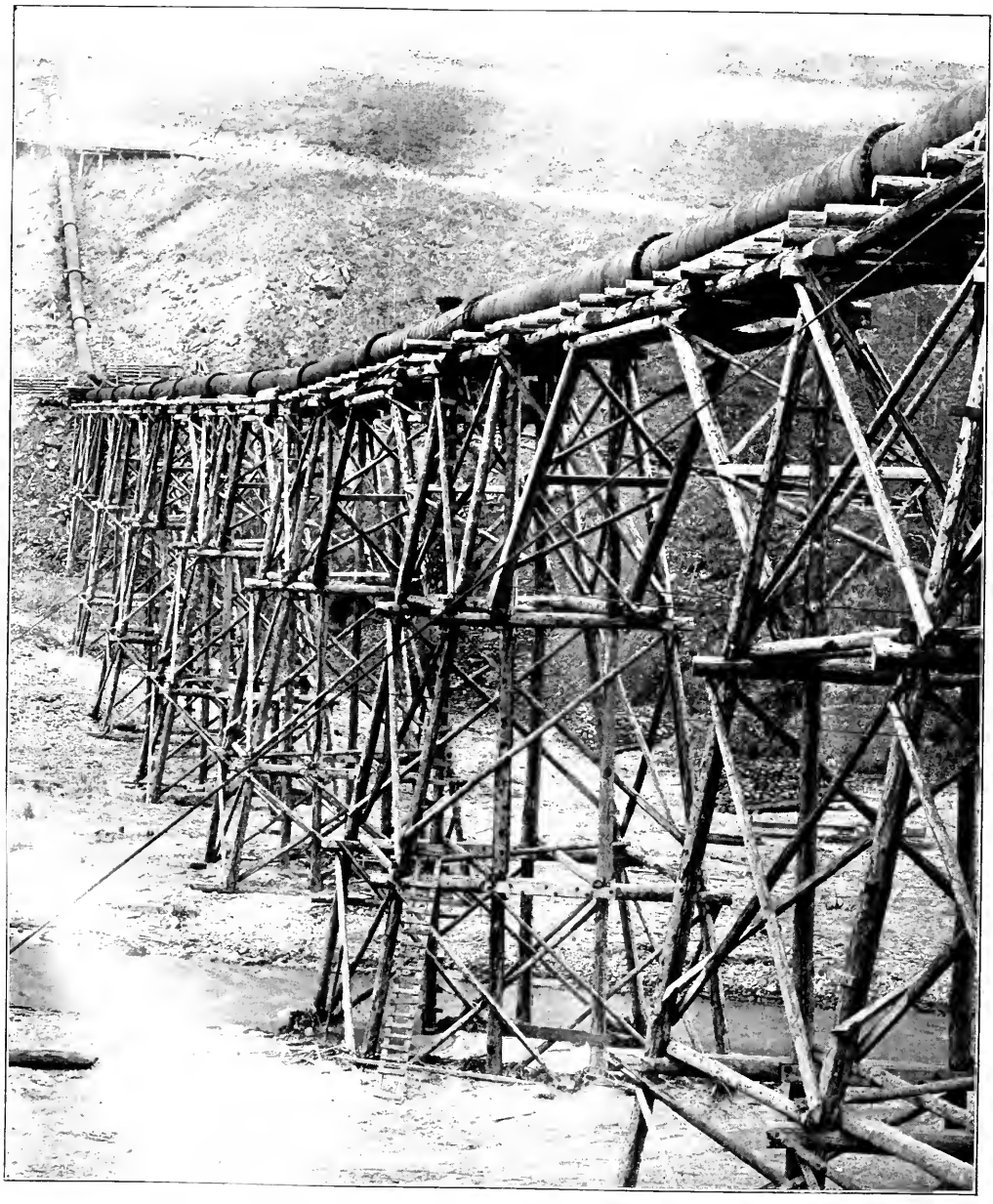
All experience in concrete construction in winter points to the desirability of heating aggregates and mixing water, and so effectively protecting freshly deposited concrete that early hardening will be hastened as much as possible under favorable conditions, which means in the presence of heat and moisture. Adding integral salts defeats these desirable ends. Furthermore, if any portion of the construction is eventually to be exposed to view, there will develop in the course of time more or less unpleasing efflorescence.

In view of the fact that cold weather is approaching and it will be necessary, perhaps, to complete some unfinished concrete work under less favorable conditions than when such work was started, I believe it is well to call attention to methods that have proved best and to emphasize these methods rather than confuse the worker with a lot of possibilities, some of which had now better be avoided, when it is generally such an easy matter to arrange for heating the materials and doing the work in the best way.

H. COLIN CAMPBELL.

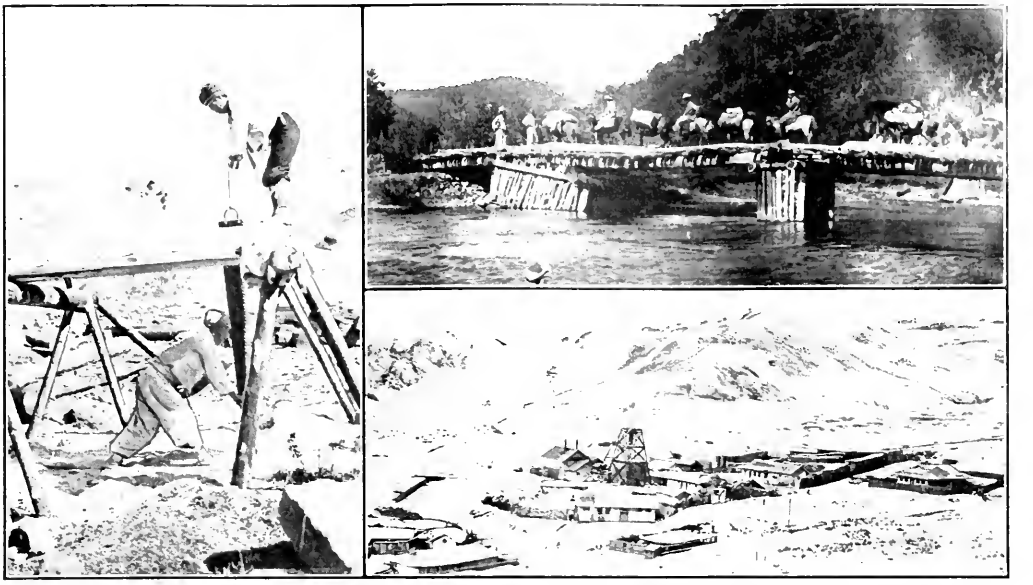
Chicago, Sept. 4, 1915.

Photographs from the Field



YUKON GOLD CO'S PIPE LINE CROSSING A VALLEY

Trestle carrying the line over Bonanza Creek, bringing water under pressure for the hydraulic workings. Spiral riveted pipe, 49 in. in diameter, with a maximum head of 1,100 ft



KAPSAN COPPER MINES OF COLLBRAN-BOSTWICK DEVELOPMENT CO., CHOSEN

At the left is shown the Korean method of sawing mine timbers. At the right, above, is the mine-supply train crossing a native bridge, and below is shown the company's mine and office building

DISCHARGING A SAND TANK BY SLUICING AT THE HOMESTAKE MILL, LEAD, S. D.

Timbering in the New York Subway

By Percy E. Barbour*

SYNOPSIS—An analysis of conditions that brought about the recent subway disasters in New York City, which resulted in a tie-up of many car lines and much street traffic and in considerable loss of life, and how the accidents could have been avoided by proper mine timbering.

During the last four days of the past week there were two serious accidents in the New York subways under construction, resulting in the killing of nine persons and the injuring of a great many more, besides the tying up of many blocks of New York's already congested streets. These subways are being constructed with as little interference to surface traffic as possible. This is accomplished by digging up the surface of the streets, laying heavy timbers and on top of these placing heavy planking, and then, in effect, stoping out the ground underneath these timbers and catching them up on vertical bents or sets with long vertical legs. These excavations vary in depth, and in the two sections where these accidents have occurred they were from 30 to 36 ft. below the surface of the street. Were it not for the fact that street traffic is allowed above excavations, it would simply be an opencut proposition, but with the load being carried on the timbers above it is strictly analogous to underground stoping, with the hanging wall flat but offering very little weight, not nearly so much as would be the case in any ordinary mining operation requiring timbering. The height of this excavation would not be greater than an ordinary four- or five-set stope.

*Mining engineer, editorial staff of the "Engineering and Mining Journal."

The first accident occurred Sept. 22 on Seventh Ave. between 24th and 25th St. It was caused by shooting a round of four holes, "one 10-ft. hole and three others," which was done by electric battery. Some of the timbers were shot out, and the entire supporting structure for a distance of about 300 ft. went down like a row of dominoes, carrying with it a loaded street car, several vehicles and many pedestrians.

The rock being blasted is a hard but brittle rock which breaks short and, being traversed by joint planes, close together—breaks "blocky," as a miner would say. The shooting out of a timber or a set of timbers is a forgivable thing, either in a mine or a New York subway, but if a light blast such as was used in this subway work resulted in the destruction of an entire stope, the mining engineer would not consider the matter excusable.

The *Engineering News* in describing the accident says:

> There is no longitudinal diagonal bracing in either upper or lower tier of posts. Although the posts—considering the whole height from floor to street—are virtually jointed in the middle by the interposition of the 24-in. I-beams (with flanges 7 in. wide), the framework is held firm under normal conditions by its continuous connection to some abutment at the extreme forward and rear ends of the work.
>
> As a precautionary measure since the collapse, longitudinal diagonals have been bolted to the lower tier of posts at intervals in the remaining timbering of this contract section.

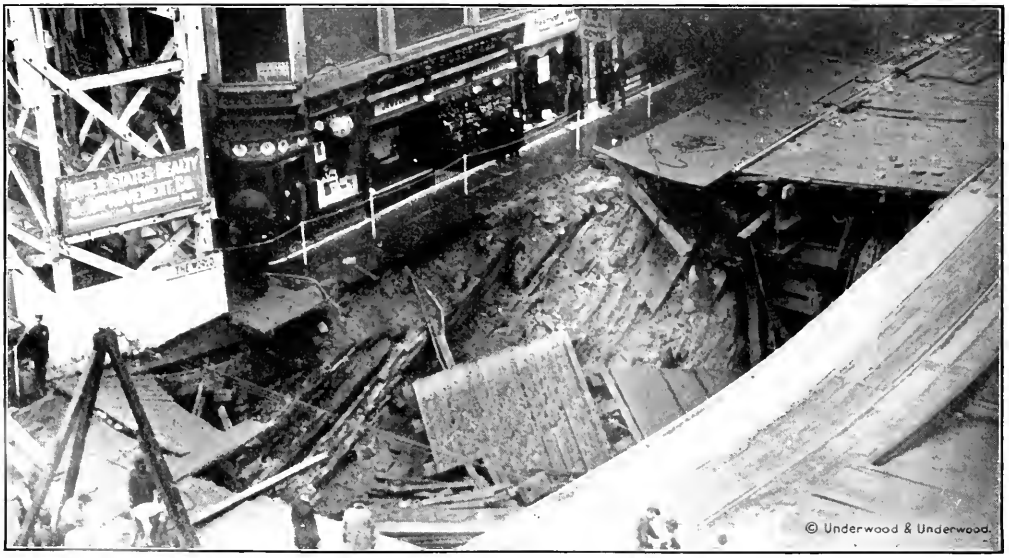


FIG. 1. CAVE AT CORNER OF BROADWAY AND 38TH ST. AND STEEP WESTERLY DIP OF SCHIST

The second accident occurred Sept. 25 at the corner of Broadway and 38th St., when a fall of rock from the western wall of the excavation wrecked some of the timber supports and caused the collapse of the supporting structure and the sinking of the street for its entire width and for a distance of 70 ft. along Broadway.

One pedestrian was killed and several were seriously injured. The point of collapse is directly in front of a

theater, and four or five other theaters are within a radius of 300 ft. Had the collapse occurred half an hour later the results would have been more serious.

Method of Timbering Used

Fig. 2 shows a cross-section looking north, taken just south of where the cave occurred. The original timbering is shown in full lines and the dotted lines represent the timbers which have been added for safety since the cave-in. The rock at this point is Manhattan schist, dipping in a westerly direction about 60 deg., as can be plainly seen in the illustration (Fig. 1). On the east side, or right-hand portion of the cut, this schist slabbed off to such an extent and so frequently and caused such inconvenience and danger that dowel pins were put in the rock, being long iron bars driven into drill holes and grouted in with cement. These were supposed to pin the slabs to one another and to solid rock beneath.

These pins did not prove fully efficacious and blocking was later resorted to. Almost the entire length of the east side of this excavation shows that a large amount of this slabby material has had to be removed, either before it fell into the cut or afterward, and there is a large opening generally at the top of the timbering along this east side. The work done here and the precautions taken indicate that the slabby nature of this ground was perfectly well known. On the west side of this excavation the schist of course is "dipping into the ground." One of the engineers in describing it said that "on this side it dipped the wrong way," and his tone implied a helpless, grieved feeling because the problem presented was not as easily solved as that on the right side.

Explanation of Fall of Rock

In discussing bedding, schistosity and cleavage, Spurr* says:

"When any rock, but particularly a shale, is exposed to pressure by the movements of the earth's crust it is apt to break easily into sheets along certain planes determined by the direction of the applied forces. These planes are called cleavage planes. They may lie at any angle to the bedding planes, or may even coincide; they may be straight while the bedding planes are folded; in short, the two sets of parting planes have no relation to one another.

"A rock may not split at all along its true bedding planes, while it may separate perfectly along cleavage planes which run across the stratification; but the cleavage must not for that reason be mistaken for bedding."

Therein lies the explanation of the rock slide so variously attributed by different investigators to "soft pockets," "unknown seams," "rotten rock" and other mysterious causes. The west side of the excavation being insufficiently timbered, the schist slabbed off in blocks determined by these planes. The planes are not lines of dangerous weakness when the opening is adequately timbered. They are so common in mining that no special consideration is given them, except to timber such blocky ground properly.

The timbering, as shown in Fig. 2, was put in at intervals of 10 ft. The posts were very infrequently and insecurely blocked against the ground and no lagging whatever was used.

*"Geology Applied to Mining," pages 32 and 33.

It is an axiom of mine timbering to prevent the rock in place from moving, not to hold it after it has started to move, because then an easy problem becomes difficult.

It is evident from looking at the sketch that this timbering was not put in with any idea of following mining methods. As originally placed these bents had no transverse or longitudinal bracing, with the exception of the member marked *A*. Just why this member was put in the original scheme is not apparent.

The diagonal added at *B* since the accident happened is of practically no use, but the diagonal at *C*, of which three were put in, in the three bays immediately south of the cave, is a good "stull" and its use recognizes the fact that the rock on the west side needs and can be supported. The timbering at *E* is of more than doubtful value, even as a precautionary measure. The longitudinal bracing at *D* was placed after the accident, to prevent any likelihood of these bents "dominoing" as did those in the Seventh Ave. section.

The timbering was put in for either or both of two reasons—to support the street load above or to support the side walls and preventing their caving. If put in for the former reason alone, there was grave fault in not providing for the second; and if put in with any thought of the

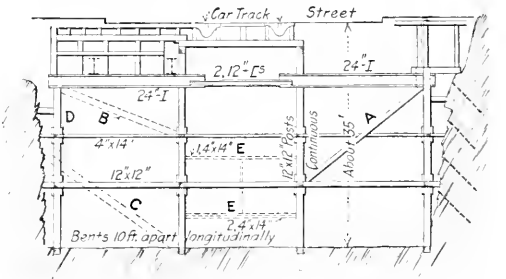


FIG. 2. SKETCH OF TIMBERING BROADWAY SUBWAY SOUTH OF 38TH ST.

second purpose, the inadequacy of the timbering for that purpose is, to a mining man, manifestly evident.

In Fig. 3 is shown the method of square-set timbering developed on the Comstock lode more than 40 years ago, which has been widely used throughout the mining world ever since. This method is used in all kinds of ground, heavy or otherwise, and regardless of the dip of the strata. In square-set timbering, in ground which presents any difficulties, kneebraces or diagonals are commonly used. It is not usual to have the greatest dimensions of any set more than 8 ft.

The timbering as shown in Fig. 2 cannot be said to approach square-set timbering in any way, but it does indicate that square-set timbering could have been used without any inconvenience to subsequent construction—in the way of putting in concrete piers or erecting the steel work for the permanent structure. This would have afforded complete security against the fall of rock which caused the second accident and would have prevented the collapse of the entire structure if it had been used at the time of the first accident.

Thus two serious accidents causing much damage and loss of life have occurred through overlooking the precautions taken by the miner in his every-day work when confronted by similar problems.

A special committee has been appointed to investigate subway conditions. An effort was made to reach D. C. Jackling, failing which John Hays Hammond was invited to serve, but declined, suggesting B. B. Thayer,

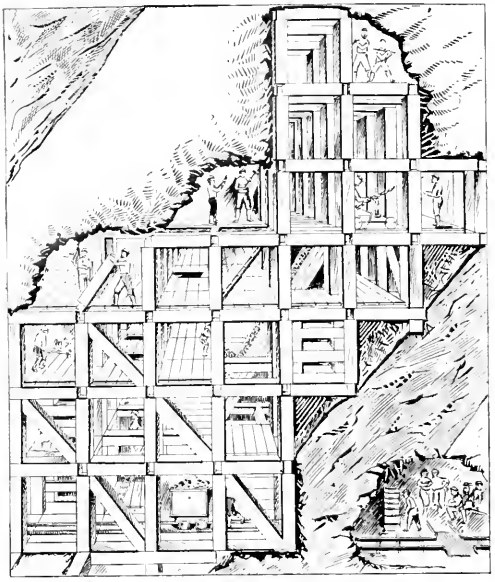


FIG. 3. AN EXAMPLE OF SQUARE-SET TIMBERING

of the Anaconda. A wise but belated move on the part of the Public Service Commission, this consulting the mining engineer.

Forfeiture of Co-Owner's Interest in Claim

By A. L. H. Street*

The Federal statutes relating to the forfeiture of a mining claim on failure of claimant to perform labor or make improvements to the value of at least $100 annually, until patent has been issued, provide that upon failure of any one of several coöwners to contribute his proportion of such expenditures, the coöwners who have performed the labor or made the improvements may, at the expiration of the year, give the delinquent coöwner personal notice in writing or notice by publication at least once a week for 90 days in the newspaper published nearest the claim. If, at the expiration of 90 days after such notice, the delinquent fails to contribute his proportion of the expenditure, his interest becomes the property of his coöwners who have made the required expenditures.

This provision has just been applied by the United States Circuit Court of Appeals, Ninth Circuit, in the case of Thompson vs. Pack, 223 Federal Reporter, 635. The parties were coöwners of 175 mining claims, upon which, under the law, $17,500 assessment work was required annually. Defendant served notice that for two years he had expended $5,600 for labor and improvements, and this notice was asserted as the basis for forfeiting plaintiff's interest. In deciding that the notice was insufficient, the Circuit Court of Appeals says:

> The only labor or improvement required by the statute which will entitle a coöwner doing the work or making the improvement to forfeiture from a delinquent coöwner of his interest is the expenditure of the full sum required by the statute, namely, not less than $100 for each claim. In order that the interest of a delinquent coöwner may be forfeited, it is essential that the entire work shall be performed by one or more of the coöwners claiming the forfeiture. . . . The notice did not claim that the entire work required by the statute had been performed for the years 1911 and 1912. On the contrary, it conclusively appears from the notice that only a small proportion of the work required had been performed, and if the amount stated in the notice was all the work that had been performed on all the claims, and it is so stated in the notice, they were then all subject to relocation, and no interest was saved by a partial compliance with the statute. The notice being insufficient on its face to entitle the defendant to claim a forfeiture of the plaintiff's interest in the mining claims mentioned therein, and this also appearing by direct and positive allegations of the complaint, the court below was right in issuing its temporary injunction suspending defendant's forfeiture proceedings until the actual facts can be ascertained and the questions involved determined upon the merits.

*Attorney, St. Paul, Minn.

Imports and Exports of Metals

Advance reports from the Department of Commerce just issued give the imports and exports of the principal metals in detail for the month of July. These are of especial interest at the present time.

Imports and exports of copper in July are given as follows, in pounds:

	Imports	Exports
Ore and matte, contents	11,302,587	339,342
Unrefined, bars, etc	17,742,587	200,071
Refined, bar, plates, wire, etc	4,253,889	46,561,376
Scrap and clippings	991,950	106,355
Totals	34,291,013	47,207,144

For the seven months ended July 31 the total imports of copper were 73,944 long tons; exports, 177,842 tons.

Imports of lead in all forms in July were, in pounds:

Lead contents of ores	2,024,488
Lead in bullion and base bullion	5,057,234
Lead, metallic	9,375
Total	7,091,097

Of the total imports 6,719,991 lb. came from Mexico and 248,315 lb. from Canada. For the seven months ended July 31 the total imports of lead reported were 34,692 short tons.

Imports and exports of zinc in July are reported below, the figure being in pounds:

Imports	
Zinc contents of ore	9,813,820
Zinc, metallic	119,593
Total imports	9,933,413
Exports	
Pigs, bars, plates, etc	15,914,602
Zinc dross	791,175
Zinc dust, re-exports	22,400

Of the metallic zinc, 3,752,248 lb. is reported as produced from foreign ores. The tonnage of ore imported was: Canada, 324; Mexico, 3,353; Japan, 1,011; Australia, 5,808; total, 10,496 tons. The total exports of metallic zinc for the seven months ended July 31 were 77,976 short tons.

Aluminum Manufacture in Russia is said to be probable. The British Aluminium Co. has secured control of some large bauxite deposits in that country, and plans are being prepared for a plant. The location is uncertain as yet, but it will be in the brown-coal district of South Russia, or near the Imitra Falls, where a large waterpower can be utilized.

Editorials

Subway Cavings in New York

The caving of portions of the subway under construction in New York has been locally the absorbing theme of the day. The municipal authorities, the Public Service Commission and the public generally have given a disagreeable exhibition of loss of both nerve and common sense. The redeeming feature has been the soberness and good judgment of the better class of the daily papers.

In the first cave, Sept. 22, many persons passing upon the street dropped into the hole when the street fell from under them and several were killed. The second cave occurred Sept. 25, about half a mile from the first, and one of the persons who fell in with the street was killed. It is significant that both of these accidents occurred in portions of the subway that are being built by one contractor.

There is no use in going into hysterics over these particular accidents. In the construction of any big piece of work—a skyscraper, a subway or a canal—there is inevitably a certain toll of human life. It is part of the expense. The subway construction in New York—a work performed under singular difficulties—has been on the whole remarkably free from disasters. This is no excuse, however, for accidents outside of the ordinary ones that are bound to happen in doing any work. The most unfortunate thing about the recent events was that the fatalities were of citizens walking the streets, where they had a right to be, not of men engaged in the work, who might be more or less responsible for what befell them.

The subway construction in New York is being done by what is called the "cover-and-cut" system; that is, the street is planked over and the earth and rock are undercut, the planking being supported by beams and posts in order that street traffic may proceed as the subterranean work goes on. The process is therefore analogous to many operations in mining.

An investigation of the places of the recent disasters by the *Journal* has convinced it, however, that no such methods of supporting the ground were in use as would be in ordinary mining practice. The problems confronting the subway engineers were no different from what the mining engineer has to meet all the time. Indeed they were of very ordinary character. The technical points are described and discussed elsewhere in this issue.

Summarizing, any mining engineer would pronounce the recent subway caves to be due in one case to "shooting out timbers" and in the other to "run of ground," both resulting in disasters owing to "bad timbering." In the case of the second accident, the subway trench was being cut through mica schist—not an especially treacherous rock—the sheeting of the schist passing diagonally through the trench. As the trench was excavated the schist had the natural tendency to slide off on one side and slab off and fall on the other side. This was recognized by the subway engineers, who tried to prevent the slides on one side by drilling holes into the rock and driving in steel bars—"lewie" pins, they called them—spiking down the rock, so to speak. On the other side (which was where the cave occurred) they did not apparently know what to do. The proper safeguard here—and on the other side as well—was adequate timbering.

The timbering that was done in these portions of the subway—in other portions there is similar work—was manifestly designed mainly with a view to holding up the roof. For holding back the rock at the sides there was neither timber enough nor was it properly placed, the imperfection of placing being more important, however than the deficiency of quantity. A mining engineer often accidentally shoots out a portion of his timbering or experiences a run of ground, but when either of those things happens he does not lose a whole stope and let the upper floor come tumbling down upon him.

As well as we can make out, the engineers of the Public Service Commission have left the matter of supporting the ground to the engineers of the contractors. All of them have manifestly proceeded on the theory that they were doing nothing more serious than digging a sewer. The services of mining engineers seem neither to have been solicited nor wanted. After the occurrence of these accidents, however, the Public Service Commission, in inviting a committee of three distinguished engineers to investigate and report, thought of having a mining engineer for one of the three. It probably would be better if they had thought of having mining engineers in a larger proportion, say two out of three, or three out of three.

If any blame is to be fixed for the two cave-ins, the *Journal* is of the opinion that it should fall upon the responsible heads of the Public Service Commission for not obtaining the assistance of some mining engineers when the subway work was begun. The engineers in actual charge of the work found themselves against problems for which they had no previous experience and simply did not know how to meet. In other portions of the subway there may be stretches of ground that also are treacherous and there may be stretches that would be safe without any timbering. The whole thing ought to be looked over by some mining engineers who are experts in timbering, not merely by mining engineers, for there are a lot of them who do not know anything about timbering. In the meanwhile it is ridiculous for Mayor Mitchel to be giving directions for more braces and having his orders carried out by somebody *spiking* on a few 3x10-in. diagonals with *four 60-penny nails* per end.

The Public Service Commission thought to obtain the advice of John Hays Hammond in this emergency. Mr. Hammond recommended them to draft B. B. Thayer. Nobody could be better. Mr. Thayer—the head of the Anaconda Copper Mining Co.—is not only a great engineer but also is one who worked himself up from the stopes, and during most of his long and active career he has had to do with the mines of Butte where the problems of timbering are of the first order of magnitude.

How Copper Is Bought

A characteristic of the copper market in recent years has been the buying of copper in great operations extending over a period of two or three weeks, followed by a period of two or three months during which the market is dull, relatively little business being done. With a production of refined copper at the rate of 150,000,000 lb. a month there must be sold about 6,000,000 lb. per day, or 36,000,000 lb. per week, on the average, to dispose of the output of new copper. Taking into account the reclaimed copper—the product of the junk smelters—and the speculative business, and occasionally the reselling by consumers themselves, the aggregate of transactions in copper exceeds an average of 6,000,000 lb. per day. With so huge a business it is unlikely that there is ever a day without some transaction by somebody, but with a total of three or four million pounds per day the market would doubtless be described as dull. After a long period of such a market there comes what we speak of as a "great buying movement," when during a week there may be sales of 100,000,000 lb. of copper, or in a fortnight twice as much. The buying in this way has been becoming more and more pronounced. What is the reason for it?

We may offer an explanation without getting at the reason. The explanation is that the American consumers have got the idea of acting in concert. They remain out of the market together and come in to buy together. More and more do they appear to be acting in concert. What is their reason will have to be surmised. Of course they figure on buying their copper more cheaply than otherwise—a matter that is well worthy of consideration; for has not Mr. Ryan pointed out several times that the American consumer has in the past paid considerably more for his copper than the foreigner? But do they figure that by their concerted abstention they will tire out timid producers and thus obtain cheap copper? It is certain on the other hand that when they try to buy at the same time they hoist the price up on themselves, perhaps 1c. per lb. between the opening and closing of a day, whereupon they accuse somebody other than themselves of rigging the market.

If consumers abandoned the idea of playing a speculative game, if each one bought his copper as he needed it, we fancy that things would be better for them in the long run. But while the present policy obtains we may look for periodic "buying movements," intermediate spells of dullness, slow declines in price and sudden, sharp upturns, and in general conditions more erratic than they ought to be.

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Lead Smelting Developments in the Coeur d'Alene

Interesting news comes from the Coeur d'Alene, where the relations between the miners and smelters, especially the A. S. & R. Co., have been simmering for a long time. The mines of this district have heretofore been tied up with long-running contracts under which they have been restive. The pros and cons of this controversy need not now be discussed. The complaint was directed chiefly against the A. S. & R. Co., but there was competition in the district by other smelters—the International, Ohio & Colorado, United States and Pennsylvania. However, the terms offered by them have not differed greatly. Of course, the Coeur d'Alene ore has always been regarded by the smelters as a marginal ore—that is, one out of which they should make a profit—whereas in some other districts lead ores have been taken at a loss, the profit being earned from other classes of ore. Nevertheless, there are some features in the Coeur d'Alene contracts that have always seemed to us to be objectionable. Especially so is the arrangement whereby the price for lead is based upon a certain arbitrary figure, the difference between that price and the market-price, when the latter is in excess, being divided between miner and smelter on the basis of 50-50.

Anyway, the dissatisfaction of the mining interests expressed itself not long ago when certain stockholders of the Federal Mining and Smelting Co. brought suit against the A. S. & R. Co. for annulment of contract. This year the Hercules contract expired and the owners of that mine refused to renew. Through the Tamarack & Custer Mining Co., in which they are interested, they have acquired the old smeltery at Northport, Wash., which they are rebuilding, and hereafter they propose to do their own smelting there.

Now comes the report, officially verified, that the Bunker Hill & Sullivan company is going to do its own smelting. Whether this will be in the Coeur d'Alene or at some place on the Pacific Coast has not yet been determined. The controlling interests of this company have had experience in smelting, being formerly concerned in the Tacoma Smelting Co., which they sold out to the American Smelters Securities Co.

This is a more formidable insurrection in the lead-smelting business than the A. S. & R. Co. has ever had to face. Both the Hercules and the Bunker Hill & Sullivan companies possess ample resources and are well able to carry through anything they undertake. The Bunker Hill & Sullivan company is sure to be well advised, both technically and commercially. It is to be hoped that the Hercules people also will get the right kind of assistance. It is but natural that these big mining companies should want to do their own smelting. That they are taking steps in that direction is an interesting and healthful development.

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The policy of watchful waiting for things to happen in Mexico still prevails, the present idea being evidently to wait for Carranza to get the upper hand and then recognize him. The stars of Villa and Zapata are waning unmistakably. Probably it was fear of further turbulence in the north, following the disruption of Villa's army, that inspired the new warning to Americans to leave Mexico. Shall we venture to hope for the peace of weariness? It looks as if that were the only kind of peace there would be, for Washington will not contribute toward anything else. Our Mexican policy is still an enigma. Poor little Haiti indulges in rioting and the Administration goes down there overnight, assumes a protectorate and does not turn a hair over the job. Is it merely a question of size, not of principle?

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The sale of the Midvale Steel Works in Philadelphia, one of the three producers of armor-plate and heavy ordnance in this country, to a strong financial syndicate has started up again the reports of a new steel combination with rather more appearance of probability than before

PERSONALS

C. C. Semple has gone to Nacozari, Mexico, expecting to remain for several weeks.

George P. Wilson, of Salt Lake, was in San Francisco at the Engineering Congress meeting.

E. Norris Hobart has recently been examining lead-silver prospects in the Alamo District of Texas.

Prof. T. L. Walker, of Toronto University, recently spent a week in Kootenay district of British Columbia.

C. H. Poirier is consulting engineer for Dominion Gold Mines, Ltd., operating in Munro Township, Ontario.

W. L. Cumings, of the Bethlehem Steel Co., is in Chile from which he expects to return in November or December.

W. H. Wright, of the Malm-Wolf Co., has completed placer xaminations in northern Idaho and has gone to Seattle.

J. M. Bidwell, manager of the Murray plant of the American Smelting & Refining Co., is visiting San Francisco.

Albert G. Wolf has completed mine-examination work in northern California and western Nevada and has returned to Denver.

J. H. Stovel, of the Mond Nickel Co., formerly in charge of the Frood Extension, is opening the Bruce Mine for the Mond company.

Corey C. Brayton has returned to San Francisco after a summer's work examining dredging ground in the Lowe District in Alaska.

Charles J. Harrah, for many years president of the Midvale Steel Co., has retired from that position, having sold his large interest in the stock.

J. H. Curle has been detached from field service in the British Army and has been detailed as assistant to the Parliamentary Savings Committee.

John W. Swift, auditor of the Bureau of Mines and acting secretary to Director Manning, is in San Francisco to assist in he field meet under the auspices of the Bureau.

Justin S. De Lury, a graduate of the University of Toronto, and for some years on the staff of the University of Idaho, has accepted a position as lecturer in geology at the University of Manitoba.

Capt. John L. Retallack, of Kaslo, B. C., long actively connected with mining in Ainsworth and Slocan mining divisions of British Columbia, is now in England with other soldiers from that province.

Karl Eilers, member of the executive committee of the American Smelting & Refining Co., in charge of the metallurgical department in the Western states, is visiting the Panama-Pacific Exposition.

George S. Rice, chief mining engineer, and J. W. Paul, chief rescue engineer, of the Bureau of Mines, are in San Francisco at the Panama-Pacific Exposition in connection with the first-aid and rescue demonstrations.

H. B. Zeller, assistant superintendent of the coke plant of the Republic Iron & Steel Co. at Youngstown, has resigned to become superintendent of the new byproduct plant of the Toledo Furnace Co., Toledo, Ohio.

Chas. A. Banks, general manager of the Jewel-Denero Mines, Ltd., has returned to the Jewel mine, near Greenwood, B. C., from a trip to Cobalt and Poreupine districts and thence to Chicago, St. Louis and Salt Lake City.

S. I. Silverman, of Spokane, Wash., is arranging to send into the Stikine mining division of British Columbia supplies for a party of men who will spend some time in prospecting and developing mineral claims in that country.

J. H. East, foreman miner, K. H. Chism, first-aid miner, and C. J. Roberts, engineer, are at the Panama-Pacific Exposition with the new rescue car which is on the Exposition grounds used in connection with the demonstration of first-aid and rescue work.

C. J. Hicks, formerly assistant to the president of the International Harvester Co., has been appointed executive assistant to President J. F. Welborn, of the Colorado Fuel & Iron Co. His duties will relate to social and industrial betterment of the company's employees.

Harold C. E. Spence returned recently from Europe where he has been associated with various oil-shale interests and is now directing development and distillation at the oil-shale enterprises in Newfoundland and Nova Scotia. His present address is New Glasgow, Nova Scotia.

G. H. Dowell, assistant general manager of the Copper Queen Consolidated Mining Co., Bisbee, Ariz., attended the conventions in San Francisco and visited the Exposition where his company is represented in "the mine." Mr. Dowell addressed the Mining Congress on the "History of Mine Taxation in Arizona."

J. H. Farrell has resigned the position of consulting engineer to the Yellow Aster Mining and Milling Co. In April, 1914, Mr. Farrell completed a geological report upon the Yellow Aster mine and was subsequently retained during the initial period of new work planned as a result of the examination.

OBITUARY

Paul Gottheil died in New York, Sept. 21. He had been for 42 years connected with the firm of Funch Edye & Co., beginning as office boy and rising gradually by capacity and hard work to be head of the firm. His death is mourned by the metal trade, which for many years had dealings with him as agent for the Rotterdam Line, to which port heavy shipments of copper have been constantly made. In shipping circles he was regarded as one of the leaders and was frequently called upon by the Government as a shipping expert.

Andrew Gordon French died on Aug. 16 last at Glasgow, Scotland, at the age of 78. He was well known in Nelson, B. C., where he spent several years working on the French process for the treatment of complex ores. Mr. French, who was a metallurgical chemist, spent most of his life in the study of the treatment of complex ores. While in Swansea, Wales, he invented a process for the treatment of the Constantine zinc ores, which are mined in Algeria. He spent several years in Australia studying the treatment of the complex ores of that country and was associated with the Broken Hill Proprietary Co. in New South Wales.

Ralph Baggaley died in Pittsburgh, Penn., Sept. 23, aged 68 years. He was born in Allegheny, Penn., was educated in the schools there and at Dresden, Germany, where he remained two years. He was a man of great activity of mind and marked business ability, and was interested in many enterprises in the course of his active life. His first business connection was with the firm of Bollman & Co. Later he joined George Westinghouse, who was then working on his invention of the air brake. Mr. Baggaley took the business side of the enterprise and organized the Westinghouse Air Brake Co. which he brought into a prosperous and successful condition. Later he reorganized and successfully managed the Westinghouse Manufacturing Co. About 1875 he went into the newspaper business and bought the Pittsburgh "Telegraph" and "Chronicle," consolidating the two papers and managing them for some years. After the panic of 1873 he had bought some large tracts of land in the Lake Superior country, but he never mined there, and later sold his properties, which are now operated by the Oliver Iron Mining Co. In 1880 he bought coal lands in the Connellsville region and organized the Hostetter-Connellsville and the Puritan Coke companies, which subsequently became interested in mining coke combination. About 1901 he became interested in mining property in Butte, Mont., and organized the Pittsburgh & Montana Mining and Smelting Co. While managing that company he became interested in new processes of smelting and converting and took out a large number of patents for processes and machinery. Of recent years he has not been active in business except in connection with the United States Glass Co. In 1879, with the late Henry W. Oliver, Mr. Baggaley organized the Duquesne Club. He was also a charter member of the Pittsburgh Club. Mr. Baggaley was also a life member of the American Association for the Advancement of Science, of the Strollers' Club of New York, the Art Society of Pittsburgh, the American Institute of Mining Engineers and the American Society of Mechanical Engineers. He was also a member of Franklin Lodge, F. & A. M. He leaves a widow, two sons and four daughters.

SOCIETIES

American Institute of Mining Engineers The October meeting of the Montana Section will be held [illegible] at the Silver Bow Club, Butte, Mont. A technical session will be held immediately after the dinner. The following paper will be read and ample time provided for discussion: "Preliminary Outline of Paper on Mines in the Boulder Batholith." By J. A. Grimes and Paul Billingsley.

Editorial Correspondence

SAN FRANCISCO—Sept. 22

Highgrading at the Empire Mine in Grass Valley has been exposed by the arrest and alleged confession of A. H. Coggins, formerly employed as specimen boss at the Empire. It was reported that the cache contained $35,000 worth of high-grade and specimen ore alleged to have been stolen from the Empire mine. Coggins was a trusted employee of the Empire and probably would not have been suspected had not the other men given the information.

A Lead-Smelting Plant will be built by the Bunker Hill & Sullivan Mining and Concentrating Co. F. W. Bradley, president of the company, is authority for the statement that ample funds have been accumulated and saved for this purpose and that the engineering and construction work will be done by the firm of Bradley & Labarthe. The plant will be located either at the mine or on the Pacific coast, according to which point affords the most favorable operating and transportation facilities.

Production of Petroleum in all fields in California in August totaled 7,680,047 bbl. Midway-Sunset field produced 3,334,516 bbl.; Coalinga, 1,148,678 bbl.; Whittier-Fullerton, 1,053,375 bbl; Kern River, 791,445 bbl. All the other fields produced less than 500,000 bbl. each. Total shipments from fields in August amounted to 7,924,656 bbl. The total crude stocks on hand Aug. 31 were 60,162,277 bbl. Only 12 wells were completed in August. This is the lowest record of new wells in any month since February, 1907. It is plain evidence of the inactivity in the fields. The small decrease in production in August as compared with July, amounting to 58,596 bbl., is merely added evidence of the necessity for curtailing production until the market conditions caused by the war have been improved. The operators have the satisfaction of knowing that the oil is still in the ground.

DENVER—Sept. 23

Ore Buyers in This State have suddenly realized the existence of a law passed last winter by the legislature. In an effort to stop the practice of highgrading—especially in the Cripple Creek district—the lawmakers made it compulsory upon all purchasers of ore (of any sort) to fill out a prescribed document and to pay the secretary of state an annual license fee of $100. This official has announced that he has set Nov. 1 as the date after which this law will be rigidly enforced.

United States Reduction & Refining Co. Officials believe the bill of complaint filed some time ago by the New York Trust Co. was a direct attempt to remove them from competition in the ore-purchasing business. The Golden Cycle company operates its big mill at Colorado City close to the disused plant of the United States company. Judge Lewis, of the United States district court at Denver, on Sept. 11, overruled the United States company's motion to dismiss the case. J. Arthur Connell was named receiver, it being proved that the Reduction company had defaulted in the payment of interest on bonds held by the Trust company. The Reduction company was given 10 days in which to answer this action, after which the original case will be held on its merits.

Defunct Mining Companies in Colorado—Secretary of State Ramer has gone over his records and has declared the following corporations defunct and inoperative and no longer competent to transact business within the state of Colorado. The list may prove of interest to readers who have stock or other interests in these corporations whose activities were in mining, metallurgical and allied branches. Almont Mining Co.; Amphitheater Gold Mining Co.; American Consolidated Gold Mining Co.; American Gold Standard Mining Co.; American Ozokerite Mining Co.; American Star Mining and Milling Co.; Anderson-Halter Mines Co.; Annamosa Mining Co.; Arcade Mining and Milling Co.; Argentine Milling Co.; B. & O. Mining, Milling and Manufacturing Co.; Badger Mines Co.; Barnes Mining Co.; Bernadette Tunnel Mining and Milling Co.; Berthoud Mining Co.; Beam Converter Mill Co.; Belvidere-Leadville Mining Co.; Big Six Mining Co.; Big Five Tunnel, Ore Reduction and Transportation Co.; Brandon Gold Mining Co.; Bright Star Mining and Milling Co.; Buckley Mining Co.; Burns-Moore Stockholders Leasing Co.; Boston & Cripple Creek Gold Mining Co.; British American Mining Co.; Cashen Mining and Leasing Co.; Cosmopolitan Mining and Leasing Co.; Cripple Creek Free Gold Mining and Milling Co.; Cripple Creek Mining and Leasing Co.; Diamond M. Leasing Co.; Champion Mining and Milling Co.; Clear Creek Mining and Leasing Co.; Cloud City Mining Co.; C. M. S. Mines Co.; Cottonwood Mining and Milling Co.; Colorado Apex Mines Co.; Colorado Fluorspar Mining Co.; Colorado Gold Mining and Investment Co.; Colorado Gold Reserve Mining Co.; Colorado-Idaho Mining and Exploration Co.; Colorado-Idaho Mines and Development Co.; Colorado Molybdenum Co.; Colorado Smelting and Mining Co.; Colorado-Toledo Mining Co.; Conniemac Mining and Realty Co.; Continental Consolidated Mines Co.; Copperfield Reduction Co.; Creede United Mines Co.; Creede Local Mining Co.; Crown Lode Mining Co.; Curtis Dry Placer Machine Co.; Development and Mines Co.; Deerfield Mining and Milling Co.; Deadwood-Dallas Placer Co., Delmas Mining and Milling Co.; Denver Leadville Mining and Tunnel Co.; Denver Mining and Reduction Co.; Denver Mining Investment Co.; D. Pendon Leasing and Mining Co.; Earle Concentrator and Manufacturing Co.; Eagle Mining Co.; East Bellman Mining Co.; East Lake Mining Co.; El Valle Mines Co.; Emery Baryta Mining and Separating Co.; Empire Mines Co.; Excelsior Consolidated Gold Mining Co.; Excelsior Drill and Manufacturing Co.; Federal Graphite Co.; 4-C Mine, Mill and Tunnel Co.; Frisco Mining, Milling and Development Co.; Francesca Mining and Leasing Co.; Fredonia Mine and Milling Co.; Frisco Milling Co.; Gilpin Mining and Leasing Co.; Gladys Gold Mining and Development Co.; Globe Mining, Milling, Power, Lighting, Drainage and Tramway Co.; Gold Divide Mining, Milling and Tunnel Co.; Gold Hammer Mines and Tunnel Co.; Gold Ledge Mining Co.; Gold Queen Mining, Milling and Development Co.; Goldwin Mining and Milling Co.; Golden Amethyst Mining Co.; Golden Age Mining and Reduction Co.; Great Nevada Mining and Milling Co.; Great Western Copper Mining Co.; Guerrero Mining and Exploration Co.; Gypsy Mines Co.; Hawkeye Consolidated Mines Co.; Hanna Mining and Milling Co.; Handies Peak Gold Mining and Milling Co.; Hibbs Mining and Milling Co.; Howard Mines Co.; Horn Rotary Slime Concentrator Co.; Ida Mining and Milling Co.; Incidental Gold Mining Co.; Independence Placer Mining Co.; Interstate Mining and Milling Co.; Jewell Mining and Milling Co.; Kerns Colorado Mining Co.; Kings Phillips Mining Co.; Laurium Mining Co.; Last Chance Mining, Milling and Tunneling Co.; LBS. Mining and Leasing Co.; Lenawer Mining, Milling, Tunnel and Transportation Co.; Leadville Smelting and Reduction Co.; Lilly Levy Mining and Milling Co.; Little Muggins Mining Co.; Lotta J. Mining Co.; Lucky Strike Gold Mining Co.; Mammoth Gold Mining Co.; Mackey Gold Mining and Milling Co.; Manhattan Placer Mining Co.; Marks Pulverizing Mining and Milling Machinery Co.; Mary Jane Mining and Milling Co.; Mary Ellen Gold Mining and Leasing Co.; Melba Mines Co.; Meriden Mining Co.; Miami Mines Co.; Mono Baltic Mining and Smelting Co.; Montezuma Chiefs Mines Co.; Mountain Peak Gold Mining Co.; Mountain Mining and Investment Co.; Murray Mining, Milling and Leasing Co.; Muscovite Mining Co.; McCulloch Mines Co.; McNulty Gulch Mining and Milling Co.; McQuarrie Creek Placer Mining and Prospecting Co.; Navarrio Mining, Milling and Tunnel Co.; National Mining and Investment Co.; New England Gold and Copper Mining Co.; Newark Gold Mining Co.; New England Mining Co.; North American Smelter and Mines Co.; North Creede Mining Co.; North American Ore Purchasing Co.; Nellie K. Gold Mining, Milling and Leasing Co.; Northwestern Leasing, Mining and Milling Co.; Occidental Exploration Co.; Oklahoma and Colorado Mining and Milling Co.; Ophir Tidal Wave Mining Co.; Oriole Mining Co.; Onida Gold Mining Co.; Pine Twentieth Century Manufacturing and Reduction Co.; Pittsburgh-Ely Copper Co.; Plymouth Ring Mining and Milling Co.; Prussian Gold Mines Co.; Princess Alice Gold Mining and Milling Co.; Providence Mining and Milling Co.; Protection Mining Co.; Quaker Mining and Milling Co.; Raymond Tunnel and Mining Co.; Red Mountain Gold Mining Co.; Red Cloud Gold Mining and Prospecting Co.; Reinforced Cement Mining Timber Co.; Reliance Gold Mining Co.; Reinert Gold Mining Co.; Recovery Concentrating Milling and Mining Co.; Red Oak Gold Mining and Milling Co.; Rexall Gold Mining Co.; Rhyolite Placer and Mining Co.; Ridge-Mexico Mining and Milling Co.; Rosebud Gold Mining and Milling Co.; Rocky Mountain Rare Metals

Co.; Rockyfellow Mining and Milling Co.; Rocky Mountain Mine Development Co.; Saratoga Mining Co.; Sand Mountain Mining, Leasing and Industrial Co.; Silver Wave Mining Co.; Silver Princess Mining Co.; Silver Horn Mines Co.; South Homestake Mining Co.; Spanish Basin Gold Mining Co.; Square Deal Mining, Milling, Drainage, Tunnel and Transportation Co.; St. John Extension Mining and Power Co.; Stahler Concentrator Co.; Swedish-American Gold Mining and Milling Co.; Treasure Mining and Reduction Co.; Tasmania Copper Mining and Milling Co.; Teal Brothers Mill and Mines Co.; Ten Spot Mining, Milling and Leasing Co.; Thomson Mining and Milling Co.; Tomahawk Mines Co.; Two Brothers Gold Mining and Milling Co ; Two Thousand Two Gold Mining Co.; Uncle Sam Gold Mining Co.; Union Consolidated Mining and Milling Co.; United Mines Corporation; United Colorado Mines Co.; United States Mining Corporation; U. S. Smelting and Refining Co.; Walter A. Weber Mining Co.; Western Ore Reduction Machinery Co.; Western States Mining and Milling Co.; Western Investment Co.; Western Ore Reduction Co.; Whale Mining and Developing Co.; Whitepine Mining Co.; Woods Investment Co.; World's Fair Gold Mining and Milling Co.; Wynn Gold Extraction Co.; Yellow Medicine Gold Mining and Milling Co.; Yellow Metal Gold Mining, Milling, Water, Irrigation and Power Co.; Yreka Mining and Milling Co.

In addition to the above Colorado corporations, the following corporations of so-called "foreign" standing have been declared debarred from doing further business in this state: Alameda Gold Mining and Milling Co.; Anaconda Mining Co.; Argonaut Gold Mining Co.; Burns Moore Mining and Tunnel Co.; Buckeye Gold Mining, Milling and Tunnel Co.; Colorado Ore Reduction Co.; Dorex Mining and Milling and Tunnel Co.; Elkhorn Tunnel and Mining Co.; Futurity Mining and Milling Co.; F. M. & D. Copper Mining Co.; Gold Issue Mining and Milling Co.; Governor Mining Co.; Huntington Gold Mining and Milling Co.; Kansas City Tunnel Site Mining Co.; Mines Intersection Syndicate, Ltd.; Mineral Point Gold Mining Co.; Mines Developing Co.; Prize Mining Co.; Refractory Ores Recovery Co.; Retla Mining Co.; Rhyolite Beacon Gold Mines Co.; Shenandoah Gold Mines and Smelting Co.; South Mosquito Mining Co.; Suffolk-Globe Mining and Milling Co.; St. Paul Mining, Milling and Investment Co.; Teutonic Consolidated Gold Mines Co.

SALT LAKE CITY—Sept. 23

The Magna and Arthur Mills of the Utah Copper Co. are now treating 30,000 tons of ore daily; 18,000 tons going to the Magna, and the remainder to the Arthur. Some ore running 3 to 4% copper is being handled. There are now employed at the mine and mills about 3,300 men.

The Fatal Accident in the Alblon at Alta, mentioned in the news item of the "Journal" last week was due, not to the failure of the oxygen helmet as at first supposed, but to the fact that the men wearing the helmets remained at their work too long and the 30-min. supply of oxygen was exhausted, after which they were overcome by the carbon-dioxide gas. The two men wearing the helmets were both experienced. One of them was Captain Andrew E. Eikram of the Salt Lake Fire Department, a veteran "smoke eater," and the other was James Hendrickson, a mining engineer of experience, formerly employed in mine-rescue work by the United States Government. The oxygen helmets were borrowed from the Salt Lake Fire Department. The work of rescuing the body of James Hendrickson who was suffocated was accomplished by A. O Jacobson with a party of five experienced miners of his selection. Instead of equipping his men with oxygen helmets he gave each man a hammer and a steel punch. They advanced into the workings and every four feet a man punched a hole in the air pipe. In the meantime air was forced into the pipe line at the highest pressure possible. By tapping the pipe at frequent intervals the rescue party was well supplied with fresh air and reached the body of Hendrickson who had been dead for several hours.

SEATTLE—Sept. 22

Another Third Beach Line has been uncovered on the Seward Peninsula, this time at the original delta of the Solomon River, five miles east by north of the present mouth of that stream and 35 miles from the great beach at Nome. News of the discovery similar to that at Nome which produced $20,000,000 has caused a wild stampede from the Nome district and everything for miles around the new discovery has been staked. The new beach is at the Nome level and was uncovered by H. G. Harvey and Otto Halla. A cross-cut made shows that the beach deposit is nearly 275 ft. wide, carrying pay 5 ft. deep. The theory advanced and generally accepted at Nome for several years that the beaches are all on the east and west course are entirely upset by this discovery, the course there being northwest and southeast. It forms, in fact, a half-moon bay. Search for such a beach has been in progress since the discovery of Nome and immediately after the discovery of the third beach line at Nome which turned out such enormous profits, prospecting activities were carried on at nearly all the larger streams on the peninsula emptying into Bering Sea and notably on Solomon. A beach was found near Pine Creek but this proved to be barren of gold. Enough information was gained to establish the fact that there were three beach levels on the Solomon River but following the discovery of a high gravel bank carrying little gold it was presumed that the beaches would not produce much and active prospecting was abandoned. These same gravel banks under the prospecting of Harvey proved to be the delta of the ancient Solomon River and formed the bed of the stream, the surf washing and concentrating the gold up the hillside. The discovery has caused the biggest stir in the Seward peninsula since the discovery of the third beach line at Nome.

Chisana Development is Active and a good production is being made considering the fact that the season has been backward and water has been scarce. Some exceptional cleanups have come from Bonanza Creek which contained considerable coarse gold. On Bonanza Creek, Briggan & Hocker, with a crew of 5 men, is working on the lower end of No. 7 and John Ludwig and partner are sluicing on No. 7 Fraction which was worked successfully last season by William Taylor. The ground on No. 9 is being stripped with a hydraulic nozzle by Billy James, the discoverer, and his brother. F. T. Hamshaw has a crew of 12 men at work on the lower end of No. 5 in ground that is still frozen at bedrock. He also has a crew at work on No. 6. Good results are reported by Max Altman's crew on the upstream end of No. 6, where they have taken out a number of cuts. On Johnson Creek, Hawkins & Dahl has made good progress on the claims between the town of Chisana and Bonanza. On Little Eldorado, Johnson & McGovern is working on No. 1 on the left limit at the upper end and taking out rich dirt. Carl Whitham is sluicing on No. 2 and W. McLennon is sluicing on No. 3. W. E. Nelson is working on No. 3 Snow Gulch and Eagan & Co. is sluicing on No. 1 Coarse Money Creek. On Big Eldorado cleanups are made regularly on 4 below upper discovery. The flume now supplying a number of the operators is being extended by James & Nelson and will enable Bob Clark and his partners on the lower end of No. 10 to carry on greater sluicing activities. Wright & Anderson on the upper end of No. 11 Fraction has a small crew sluicing good ground. Considerable prospecting is going on on various creeks in the immediate neighborhood, notably on Lucky Pup and Cañon Creek, Shamrock Creek and Coarse Money. Pay is now being taken out and regular cleanups being made by about 150 operators, the greatest number working in the district since its discovery, and the output is expected to be much greater than in 1914.

SPOKANE—Sept. 22

"Both Plants of the Granby company are running at full capacity and between them turning out copper at the rate of 3,500,000 lb. per month, or 42,000,000 lb. per year," said Frank M. Sylvester, general manager of the Granby Consolidated Mining, Smelting and Power Co., while in Spokane this week, after his return from a visit of inspection to both Anyox and Grand Forks, B. C. "The Grand Forks smelter has eight furnaces in operation, treating 100,000 tons of ore monthly. At Anyox, the fourth furnace was blown in about Aug. 15. The tonnage of ore treated there averaged 62,500 tons monthly during May, June and July. In August, 75,000 tons were handled. The working force at Anyox, where there is more or less construction still going on, is between 850 and 900 men. About a year ago the company added the Bonanza mine on Granby Bay to its holdings, but we have done nothing yet toward putting it in shape for production, as we do not need the ore. We also acquired some idle and supposed-to-be worked-out mines on Prince-of-Wales Island, Alaska. We have been taking a little ore out of them, mainly from the Mamie, worked at one time by Sam Silverman. The Midas mine, at Valdez, Alaska, we have put into shape to ship, but we have had no ore from it yet, owing to the scarcity of boats in those waters. We have plenty of work in sight to keep one steamer busy, so we may be forced to buy one. We are encouraging miners in northern British Columbia and Alaska to the best of our ability, but not much custom ore has come to us yet. About the only considerable shipper has been the Rocher de Boule mine, near Hazleton, B. C., which has sent us 6,000 tons in the last two months."

The ore from the company's mines near Anyox averages from 1.4 to 2.2% copper and the gold and silver amounts to about 30c. per ton.

GOLDFIELD, NEV.—Sept. 25

Conditions in the Goldfield Camp would seem to be pretty well reflected by the dismal aspect of the city as compared to what it was five years ago. Numerous vacant stores and buildings, with "For Rent" or "For Sale" signs displayed, rows of houses in a dilapidated condition, and the conditions of the streets themselves bespeak the departure of the prosperity they once enjoyed. The Goldfield Consolidated is of course treating more ore per day now than it did formerly, the amount averaging over 1,000 tons per day; some work is being done by the Merger company, by the Jumbo Extension, Kewanas and a few other properties, but despite this, evidences of healthy activity are not apparent. Business is dull, and one hears a good deal of conversation about whether Goldfield can "come back" or not. Others look forward to better things this autumn, but generally admit that such betterment will come rather from strengthening of the stocks than from improvements in the mines. The impressions of a visitor to the camp are, however, that it needs the stimulus of an important discovery to revive it from its present torpidity.

Tonopah Conditions, despite the low price of silver, are in strong contrast with those obtaining in Goldfield. The larger companies such as the Tonopah Mining, Tonopah-Belmont, Tonopah Extension and West End are running at the full capacity of their mills, while the many properties that operate no treatment plants but dispose of their ores to the other companies, are for the most part keeping up production, and none of that laxity is apparent that in some places gives a "run-down" impression not always merited. The town seems fairly busy and prosperous, a healthy tone being maintained, perhaps due as much to activity in camps adjacent to Tonopah as in the place itself. Several miles out from Tonopah, recent work has disclosed the existence of good-grade ore containing silver, gold, copper and lead. Several such disclosures have been made but apparently little has so far been done toward determining their worth. Leasers seem to be numerous and generally report satisfactory results; leasing, apparently, being on the increase. Considerable interest is being taken in the camp of Manhattan where gold is being found both in placers and quartz veins. Tonopah people are interested, and there is a considerable amount of automobile traffic between Tonopah and Manhattan. The MacNamara mill has just been cleaned up for turning over to the company by Jones and Carpenter who had leased the plant to treat sweepings from the old tailings pond, it being stated that results were not financially successful. The Tonopah Mining Co. has now a full staff at its gold property in the Pis-Pis district in Nicaragua. This property, now known as the Eden, was originally the Panama mine which was developed by Philadelphia men. A larger proportion of foreign laborers is employed in the Tonopah mines now than formerly, but recently there has been quite an exodus of Montenegrins and Serbians who are returning home to go to war.

WALLACE, IDA.—Sept. 23

A Lead-Smelting Plant for the Coeur d'Alenes is assured since it is authoritatively announced that the Bunker Hill & Sullivan Mining and Concentrating Co. will build a smeltery to treat its own ores. The purpose of the company became known to the public through A. E. Goodell, formerly northwestern representative of the International Smelting & Refining Co., who it is now learned has been in the service of the Bunker Hill & Sullivan company most of the time since severing his connection with the International. Mr. Goodell is now engaged in securing easements from owners of land in the vicinity of the proposed plant a short distance below Kellogg, and upon his success depends the definite location of the plant. If he is successful in obtaining releases from possible smoke damages, the smeltery will be built a short distance from the mine; otherwise the company will select a site at some favorable place on the coast. No difficulty is anticipated, however, and it is practically certain that it will be located near the mine. The announcement that the Bunker Hill & Sullivan would go into the smelting business created almost a sensation in mining circles, following so closely the action of the Days in buying and rebuilding the old Le Roi smeltery at Northport, Wash. It will be recalled that on May 1 last the Hercules contract with the American Smelting & Refining Co. expired, and because the smelting company declined to renew it or to make satisfactory terms in a new contract, the Hercules mine, of which the Days are the controlling owners, closed down, and the next move in the controversy was their purchase of the Northport which is now being remodeled preparatory to handling the output of the Hercules and the Tamarack & Custer another Day-controlled mine. The fact that Harry L. Day is still retained as president and general manager of the Federal company, a subsidiary of the A. S. & R. Co., and the further fact that the A. S. & R. Co. is still treating Hercules ore pending the completion of the Northport plant, has created the impression that the American is in reality back of the Days in that enterprise. Assuming that this impression has a substantial basis, the action of the A. S. & R. Co. is explained by the terms of its contract with the Bunker Hill & Sullivan. The Bunker Hill contract is for 25 years and has 15 years to run, and it stipulates that it may be revised every five years to conform to the terms upon which "a majority" of the ores of the district are being smelted. By a significant coincidence the date for revision was on June 1, the day following the expiration of the Hercules contract, which represented "a majority" of the ores outside of the Federal company owned by the smelter. To renew the Hercules contract meant that the Bunker Hill & Sullivan would have to be given the same terms, or a reduction of $2 from the present rate of $16 per ton for freight and treatment, and the full New York quotation for 90% of the lead content. That it was to avoid making these concessions to the Bunker Hill & Sullivan, and also to the Stewart, is the basis for the belief that the A. S. & R. Co. is back of the Days in the Northport enterprise. This is also accepted as a reasonable explanation of the action of the Bunker Hill & Sullivan in deciding to smelt its own ores. It will also handle the output of the Caledonia, Ontario and Sierra Nevada, which are closely affiliated with the Bunker Hill either by ownership or lease. It is also believed that the new plant will handle the ore from the Hecla and Marsh upon the expiration of their contracts with the International.

METALINE, WASH.—Sept. 23

There is Considerable Activity in the Metaline mining district, Stevens County. The Metaline Oriole Mining Co. will start work on a 50-ton concentrating mill Oct. 1. The lumber has been contracted for. The capital stock of the company is assessable and the assessments will be continued until this mill is up and in operation; there is estimated to be $25,000 worth of ore now in sight. The Zinc-Lead Co. installed a 50-ton concentrating mill on its property this summer and has been running 60 days and is shipping a car load of concentrates every week. It is now making arrangements to install a ball mill and increase the capacity of the plant to 200 tons per day. The ore is averaging about 16% zinc. The Silver-Lead Co. will start work next week on its lead property just below the Falls. It will continue the lower tunnel which will cut the ledge in about 100 ft. It is rumored that the Sterling Silver Co. has bonded its property to some Spokane people, who are on the ground now and expect to put about 12 men to work immediately. The company is the owner of 16 patented claims. The Riverside property expects to start work early in October. The Proudy brothers will be in next month to work all winter. They have a very promising copper prospect. They will work four men. The camp in general is looking very good—much better than ever before. Every one seems to be very anxious to do much more than the usual assessment work and is making preparations now to do so. There is some chance of a several-million-dollar power plant going in at S Cañon. Hugh L. Cooper is now testing the ground for the big dam.

TORONTO—Sept. 25

The Northern Ontario Power Co. will increase the capacity of its power plants at Porcupine at a cost of over $500,000. The increased quantity of power is necessary to supply the growing demands of the Hollinger and the Dome and to take care of the future developments in the camp.

The Reported Discovery of Silver in the Fond du Lac District of Lake Athabasca has been reported on by Canadian Government geologists who were sent to investigate. They state that no minerals of economic importance have as yet been discovered in that country. There was a good deal of excitement last winter when high-grade silver was reported from Fond du Lac.

The David A. Thomas Interests, which for the last three years, have done extensive exploration work in the district to the north of Edmonton, Alta., have now begun active development. Three test holes for oil are being drilled at a point 3 miles above The Chutes, on the Peace River, near Fort Vermilion, under the direction of C. F. Law, of Vancouver, the Canadian representative of Mr. Thomas. Drillers have been brought from San Francisco with a modern plant capable of drilling 2,000 ft. Fifty men are engaged in the work of exploration. In order to provide adequate transportation on 2,400 miles of northern waterways, three large steamers are to be built and placed in commission north of Edmonton. The first of these is now under construction at Peace River Crossing by a force of 30 men brought from San Francisco

The Mining News

ALASKA

QUARTZ CREEK MINING (Valdez)—W. W. Getchel has taken an option to buy the two miles of ground owned by this company on Quartz Creek in Moose Pass district.

ALASKA TREASURE CONSOLIDATED (Juneau)—Union Trust Co., of San Francisco, through E. S. Heller, its representative at Juneau, has purchased this property for $374,500. Sale is result of judgment recently secured. H. A. Bishop is vendor.

ALASKA TREADWELL (Treadwell)—New shaft at central hoist will soon be in place and in working order, again permitting full operation for first time in several months or since break which has been most costly this company has experienced in several years. Shaft was 20 in. in diameter and 40 ft. long and had to be shipped from Pittsburgh.

ALASKA COAL (Seward)—Captain J. A. Herbert, who was one of the first men to secure lease of coal lands from government, has completed arrangements to furnish Seward with lignite coal from his mine near Seldovia. Coal has already been used to advantage in new town of Anchorage and by several canneries to westward. It will be laid down in Seward at little over one-half price charged for soft coal brought from Seattle. Capacity of mine is 40 tons a day at present, but this output can be increased whenever demand warrants.

ARIZONA

Greenlee County

THE STATUS OF AFFAIRS IN THE CLIFTON-MORENCI DISTRICT is quiet and unchanged. President Moyer, of the Western Federation of Miners, is quoted as advising the union to yield on the point of recognition of the union and to have its committee meet the mine operators to discuss the wage scale, which the union claims is lower at Clifton and Morenci than at Bisbee, Ray, Miami or Globe; the reinstatement of men discharged since Sept. 1 for agitating recognition of the Federation; and assurances that there will be no discrimination against men who have led the strike or who have held out for recognition for the union.

CALIFORNIA

Amador County

VOLCANO DISTRICT is attracting attention of placer miners. Joseph Garibaldi recently made shipment of $1,200, being result of placer cleanup on ground that had been previously worked.

CENTRAL EUREKA (Sutter Creek)—Ore of good grade has been disclosed on the 3,200 level about 100 ft. south of the orebody on 3,100 level. At present 30 stamps are dropping but it is expected that full 40 stamps will be in commission in about two weeks.

Calaveras County

UTICA (Angels Camp)—D. Castle, miner working at the winze at Cross shaft, fell into the skipway, distance of about 40 ft., and landed on skip. He was badly injured on head, face and body but it is believed will recover. Had the skip not been below him he would have fallen a distance of 800 ft.

MONARCH MINING (Valleeito)—George Morris, of Sonora, and associates, of San Francisco, have taken bond on the Ora Plata gravel mine. Company owns 70 acres adjoining and also has bond on Sloane property. Tunnel from Coyote Creek under old channel for purpose of handling water is contemplated. Handling of water in district is problem that has disturbed miners in past.

Placer County

PIONEER (Towle)—Forty men are employed and about 1,800 tons of ore extracted per month. Improvement in grade of ore is reported.

DEWEY CONSOLIDATED (Iowa Hill)—Tunnel driven in to rim of channel disclosed gold-bearing gravel. Drift will be continued across the channel to opposite rim before saving gravel will begin. Property consists of 137 acres, said to be crossed by Blue Lead channel.

BIG OAK (Colfax)—Mine is being unwatered by F. N. Hubble and associates, who have taken property on purchase option. Development consists of shaft 190 ft. deep and some drifting. Mine was closed down 21 years ago by litigation. Mrs. Rose Werry, of Colfax, and Mrs. T. B. Valentine, of San Francisco, are owners.

SLUICE-BOX MINING is in progress on middle fork of American River. Number of men are working with primitive methods and taking out from $3 to $12 a day each. One miner is operating with diving suit, taking gold from crevices in river bottom. His wife works with him and runs the air pump.

Siskiyou County

COPPER ORES from property east of Fort Jones are being shipped to Kennett for treatment at Mammoth smeltery. Ore is hauled by wagons to Southern Pacific R.R. at Yreka and Gazelle. Recent road improvement will add other shippers of base ores.

Tulare County

PORTERVILLE MAGNESITE CO. (Porterville)—Magnesite deposits included in 80 acres of land east of Porterville will be developed. Reported that the company has contracts for 100 tons per day, delivery to begin Nov. 1. C. F. Woody, of San Francisco, is manager; H. L. Doyle, superintendent.

COLORADO

San Miguel County

COLUMBIA (Telluride)—Recent development by leasers has opened pay ore. Shipments are being made to Durango smeltery.

STANDARD CHEMICAL (Placerville)—Development work is in progress on this company's property in Paradox Valley, under direction of John I. Mullen, manager.

SMUGGLER-UNION (Telluride)—Has taken over Ice Lake and is installing pipe-line to conduct water to Blue Lake, whence it will be used at Bridal Vein generating station.

LA SALLE MOUNTAIN MINING AND MILLING (Telluride)—This is new incorporation formed to take over and develop group of gold-bearing claims in La Salle Mts. Incorporators are Galloway brothers, W. E. Rice and Clark Akers. Capital stock is $50,000. Small force of men is at work on preliminary development.

PRIMOS CHEMICAL (Vanadium)—Shaft sunk on Bear Creek property is down 400 ft. On account of high cost of pumping, company has pulled pumps from this shaft and will continue development of property by driving tunnel from surface to tap bottom of shaft. This tunnel, which is now in progress, will be about 500 ft. long. Company is operating seven 6-horse teams from mine to mill, each team making three round trips a day. Hauling about eight tons per load.

HUMBOLDT (Telluride)—Three shifts are now employed in adit being driven toward Humboldt shaft, which must be advanced 700 ft. to make desired connection. All ore mined from property on Ouray side of range will be hauled through Sheridan adit to San Miguel County portal, whence it will be trammed to Pandora mills for treatment. Electric haulage will be installed in adit and electric hoisting equipment placed at shaft. As soon as tramway terminal is finished, boarding house large enough to house 125 men will be built near portal of adit in Marshall Basin.

BLACK BEAR (Telluride)—Development on third and fourth levels has opened an 8-ft. vein of silver-lead ore. Property is operated by Colorado-Superior Mining Co. Isaac Nevels has recently been appointed manager. During first six months of 1915 the company milled 16,366 tons of ore in the Smuggler-Union mills where it leases 20 stamps. Total recovery amounted to $75,201; operating expenses were $69,221; net profit, $5,980. During period under review boarding house earned $791, making a total profit of $6,771. About 50 men are on payroll. Zinc concentrate which is shipped to Blende is worth about $600 a car and gold-silver-lead concentrate which is shipped to Durango is worth from $2,000 to $3,500 a car, averaging about 30 tons per car.

San Juan County

LEE (Silverton)—This property being developed by the Silver Crown Mining and Milling Co., with option to purchase, under management of Jas. T. Burns. Breast of main tunnel is now in 3 ft. of high-grade ore.

MAYFLOWER (Silverton)—American Ore Flotation Co. has made payment of $3,000 on purchase price of this property in Arastra Gulch, formerly owned by Gus Malchus. Purchasing company is sinking winze on vein from upper workings. A 3-ft. vein has been opened which is almost solid galena. It is planned to drive crosscut at lower level for purpose of determining downward continuity of shoot.

IDAHO

Shoshone County

AMY (Kellogg)—Inclined winze following ore is being sunk 1,000 ft. from portal of tunnel. Company plans to construct mill soon.

INDEPENDENCE (Mullan)—Working small force on property between Morning and Hunter mines. Have 5 ft. lead milling ore in upper tunnel. Company understood to be under control of Stewart Mining Co.

RAINBOW (Little North Fork)—Recently struck 8 or 10 in. of practically clean zinc ore and face of drift is mixture of zinc, lead and quartz. Depth has been gained and surface showing indicates extensive orebody within 300 ft.

NELLIE (Osburn)—This old producer, lying in so-called "dry belt" between Wardner-Kellogg and Wallace, has been leased to Ernest Kelly and associates for three years. Ore is mainly tetrahedrite associated with silver.

CALEDONIA (Kellogg)—Raise to connect with the 75-ft. winze sunk from the main working tunnel last week encountered rich oreshoot which had been cut off by winze by fault. Ore is combination of lead and copper with very high silver content.

MAYFLOWER (Wallace)—This company, operating on Nine Mile, is encountering ore in lower tunnel being driven 300 ft. below No. 2, in which there is good body of shipping ore. Portal of lower tunnel is near railroad. Property has recently been equipped with modern compressor.

ST. LAWRENCE (Wallace)—This copper property is situated at head of Silver Creek near the Idaho-Montana boundary and is owned by Angus Sutherland, of Wallace. Work during past summer has consisted of driving main tunnel. First-class ore is being taken from upper tunnel and hauled to Saltese for shipment.

HIGHLAND-SURPRISE (Kellogg)—Has secured contract for entire output of lead and zinc concentrates and will

commence shipments at once. New mill, originally designed for 100 tons daily capacity, can treat 150 if crowded and is so constructed that it can easily be enlarged to 300 tons capacity. Raise is being driven on ore from Surprise drift to Highland Chief lower tunnel.

RICHMOND (Adair)—Planned to resume shipments from Richmond group of six claims lying 14 miles east of Mullan and 2 miles from Adair, Montana. Two cars are being loaded at Saltese. Fifteen men are employed at mine at present. Group was located 20 years ago by Charles Heidenreich and worked intermittently for number of years. In 1910 forest fires destroyed mine buildings and damaged timbering. Operations were resumed in 1914 and car of ore assaying 29.75% copper was shipped, but mine was again closed down. Gasoline engine is used for hoisting; drilling is done by hand. If developments are satisfactory aërial tram will be built from mine to Adair, with drop of 1700 ft. in 2 miles. There are three shafts on property, 50, 85 and 120 ft. deep. Crosscut adit taps vein at depth of 320 ft. Best showing is in 120-ft. shaft, where both drifts are in ore.

MONTANA

Silver Bow County

BUTTE & SUPERIOR (Butte)—August earnings, biggest for any month in history of company, were at rate of $4.50 per share, due principally to deliveries of spelter at higher prices during past few months.

BUTTE-DULUTH (Butte)—Federal court has not yet given decision in involuntary bankruptcy proceeding brought against Butte-Duluth Mining Co., but one is expected within week or ten days. Should decision be against bankruptcy petitioners, receiver, who was appointed before bankruptcy suit was brought, will resume operations at property, and he claims that he can, under present copper prices and lower price of acid, earn good profit on operations.

EAST BUTTE (Butte)—August production about 1,785,000 lb. of copper against 2,000,000 lb. in July. September will also show about latter figure, which was high production record for this company. June output was 1,500,000 lb. and May, 580,000 lb. In 10 weeks of operation company shows net profit of $303,000. Last year actual output of company was but 9,175,579 lb. of copper and in 1913 it was 14,401,108 lb., present production being at rate of 24,000,000 lb. per annum, and it is not unlikely that coming 12 months will show total of 25,000,000 lb.

DAVIS-DALY (Butte)—Find made by Davis-Daly on the 2,500-ft. level of Colorado mine is developing in importance. Drifting on vein has proceeded distance of 80 ft. and size of vein and quantity of ore is holding out well. For width of 10 ft. ore averages about 5% copper. It is claimed there are 3 ft. of copper glance in vein. Station is being cut at 2,500 and preparations are being made to stope ore. About 80 tons of ore per day are now being hoisted from Colorado. All this ore has been taken from sill floor in course of development work.

BOSTON & MONTANA DEVELOPMENT (Butte)—Good progress being made in two crosscuts from 2,040-ft. point of big tunnel, and it is expected that in about 40 days one of the large veins will be cut. Central, Park and Idanah veins will be intercepted by two crosscuts. A 10-ft. cross vein has been cut, and samples from it assay 1.6% copper, 2 oz. of silver and 23% zinc. Showing indicates that crosscut is approaching mineral zone and that values go down. The 10-ft. vein does not outcrop on surface, and is one of several such blind veins that have been encountered in big tunnel. Developments are confirming report and predictions made by Walter Harvey Weed, who made an exhaustive examination of the Boston & Montana properties and recently issued a supplementary report on them.

NEVADA

Storey County

COMSTOCK PUMPING ASSOCIATION (Virginia)—Enlarged drain and laid floor and track 174 ft. in old north drift on 2,700 level.

CROWN POINT-BELCHER (Gold Hill)—New pump started on 1,500 joint station. Water held at 125-ft. point below 1,500 station. Belcher 1,300 raise advanced 30 ft. and 86 cars of mill rock saved.

MEXICAN (Virginia)—On 2,700 level, east crosscut No. 3 shows porphyry and quartz of low assay value. On 2,500 level south drift, Nos. 3 and 4 from west crosscut extended through similar formation. Mill crushed 61 tons of Union ore assaying $7.92 per ton, and 83 tons of Mexican wedge rock.

UNION CON (Virginia)—On 2,500 level extracted 12 cars of ore averaging $29.28 per ton, and from southwest drift 4 cars averaging $35.75 per ton. Saved 45 cars low-grade ore in cutting out for timbers in north drift. Joint work with Sierra Nevada on 2,450 raise and reopening southwest drift to Union shaft continued.

CON. VIRGINIA AND OPHIR (Virginia)—Preparations being made for operating on 2,700 level. On 2,500 level in Ophir, raise made to third floor on the vein in southwest drift. Saved 14 cars of ore assaying $9.23 per ton. In Central tunnel, north drift extended 16 ft. Quartz in bottom assays from small amounts up to $10 per ton. Ophir saved 320 cars of ore from development and milled 275 tons.

SOUTH DAKOTA

Lawrence County

NORTH HOMESTAKE (Lead)—One shift of miners is employed in development work on 600 level of main shaft.

ORO HONDO (Lead)—Shaft is 1,700 ft. deep. Crosscutting is under way both easterly and westerly from 1,500 level. Rock continues hard in bottom.

GOLDEN REWARD (Deadwood)—Astoria roaster is being operated steadily, principally upon blue ores from Billy mine. About 75 tons daily being thus prepared for cyanidation. Deadwood mill makes 96% extraction on roasted product.

UTAH

Beaver County

LEONORA (Milford)—Drifting along east-west fissure is being continued, and it is expected that north-south fissure will be cut soon. Former fissure, which carries silver-lead ore, is growing wider.

PALOMA GOLD AND SILVER (Milford)—Progress of about a foot a day is being made in shaft sinking. Better progress will be made when compressor is installed early in October. Shaft is still in ore. Shipment of copper ore of good grade was made recently; also shipments of lead-silver ore.

Salt Lake County

OHIO COPPER (Bingham)—Mill at Lark is now treating 2,000 tons of ore daily.

WASATCH MINES (Alta)—High-grade shipment of silver-lead ore has been made from No. 2 workings on Brain fissure.

LOGGER MINING (Salt Lake)—Stringers of galena have been cut in face of this company's tunnel. Property is in Big Cottonwood. J. A. Maxfield is president.

PRICE MINING (Salt Lake)—Two-story bunk-house is being built for better accommodation of men at this property in Big Cottonwood.

MONTANA-BINGHAM (Bingham)—Tunnel is in 4,048 ft., face being in quartzite. Number of viens have been cut. Last fissure carried 2 ft. of pyritic ore, showing chalcopyrite and black copper sulphide.

AMERICAN CONSOLIDATED COPPER (Salt Lake)—Stock of this company, owning 16 claims in Big Cottonwood, was listed on Salt Lake Stock and Mining Exchange on Sept. 14. Capitalization is 500,000 shares, par value, $1. John E. Barnard is president.

Summit County

PARK CITY ORE PRODUCTION for week ended Sept. 18 totaled 1,727 tons, valued at $68,000, compared with 1,425 tons week previous. Four shippers.

SNAKE CREEK TUNNEL (Park City)—Tunnel is in more than 12,200 ft., with face still in diorite. Ground is getting softer, and flow of water is increasing.

NAILORIVER (Park City)—An assessment of 2c. a share has been levied, and it is expected that development work will be started shortly. Pipe-line is being laid, and surface equipment put in order.

DALY-JUDGE (Park City)—Building for new flotation plant is in process of construction. Shipments for week ended Sept. 18, amounted to 1,133,650 lb. of ore and concentrates. Development is being kept up, and new orebodies opened.

WASHINGTON

Ferry County

KNOB HILL (Republic, Wash.)—Car of 75,299 lb. of ore sent to Trail smeltery yielded 2.4 oz. gold and 7.2 oz. silver per ton. Gross value was $1,837 and net profit was $1,545. "There are nine cars now en route to the smelter that probably will run about the same," states Mr. LaRue, a heavy stockholder. "The net earnings for August are estimated at $12,000, and the average monthly profit for the current year probably will be not less than $10,000."

King County

ANTIMONY SMELTING AND REFINING CO. (Seattle)—This company, with a capital of $200,000, has been formed by W. D. Wood and H. M. Grifith, who have taken over the sewer-pipe manufacturing plant of the Denny-Renton Clay Co., at Van Asselt, and will convert same into a smeltery for the treatment of antimony ores. The plant covers several acres and has fifteen 20-ft. furnaces with several smaller furnaces, an ore-grinding plant and laboratories.

WISCONSIN

Zinc-Lead District

ZINC HILL (Platteville)—Charles Wolfe and associates of Davenport, Iowa, have struck good ore in number of drill holes on Charles Harris and Felix Murphy farms, four miles south of Platteville.

VINEGAR HILL ZINC (Platteville)—Plans are made for big surface equipment on Blackstone property adjacent to Champion mine at New Diggings.

GRANT COUNTY (Platteville)—Kistler and Stephens have encountered big body of zinc ore in heavy sheet formation in old workings just unwatered.

POWDER MILL (Platteville)—Fritz Hoppe and others are developing promising prospect on old Powder Mill tract just west of city limits of Platteville. Ore was found at shallow depth of 11 ft. Makes in disseminated formation and will turn out high-grade zinc concentrate.

CANADA

Ontario

ORE SHIPMENTS over the T. & N. O. Ry. for the month of August, 1915, from Cobalt proper were: Chambers Ferland, 29 tons; Cobalt Comet, 64; Coniagas, 78; Crown-Reserve, 99; Kerr Lake, 57; La Rose, 131; McKinley-Darragh, 114; Mining Corporation of Canada, Ltd., Cobalt Lake mine, 86.20 and Townsite City, 138.62; Nipissing, 65; O'Brien, 32; Penn Canadian, 89; Peterson Lake—Seneca Superior ore, 65; Temiskaming, 41; from New Liskeard, Casey Cobalt, 39; from Elk Lake, Miller Lake O'Brien, 24; total silver ore shipments, 1,131 tons. From South Porcupine, Dome Lake (gold), 31 tons; from Schumacher, Porcupine Vipond (gold), 1 ton; from Porquis Junction, Alexo mine, (nickel), 767 tons.

CUBA

McLAUGHLIN BROS. (Bayamo)—Have discontinued work on their matte-smelting plant on account of excessively rainy season

The Market Report

Metal Markets

NEW YORK—Sept. 29

All of the principal metals were stronger during the last week, with the exception of tin, which was dull and stationary.

Copper, Tin, Lead and Zinc

Copper—The improvement noted in our last report continued and at the beginning of our week of record, sales began to be made more freely at 18c., regular terms, equivalent to about 17.80c., cash, New York, although there was a little shading of that price in some quarters. It was noteworthy, moreover, that the buyers were now principally domestic manufacturers, whereas in the previous week the sales had been chiefly for export. By Sept. 25, the principal producer had sold all it wanted to at 18c., regular terms, and then it raised its asking price to 18¼c., expecting the market to rise to that figure, which, however, has not yet transpired. On Sept. 27, the market was rather irregular, considerable sales being made at a variety of prices ranging from 17.95c. to 18⅛c., both regular terms. Apparently the market had not become firmly established on the 18c. basis, although more than one of the large producers had raised their asking price to 18¼c., and some sales were actually made as high as 18⅛c. Perceiving this situation, other sellers apparently became more liberal in their offers to furnish supplies at 18c., and at the close a good deal of copper was still available at that price.

Sales for export were made right through the week at £86½@87, c.i.f., London, Havre, etc.

The buying in this market was chiefly by domestic brass makers. There seemed to be rather more inquiry for wire bars. On the other hand, the demand for cakes was rather light, the business of the rolling mills still being slack. The striking feature of the domestic copper buying last week was that the consumers did not exhibit the signs of acting in concert that they have upon previous occasions. The aggregate of the transactions during the week was fair, but the total did not attain any such proportions as to excite special comment.

Some relatively cheap copper appears to be available as the result of arbitrage transactions between prompt and future deliveries. Purchasers of such copper for prompt delivery are naturally willing to sell it at a slight advance. Some profitable business also appears to be done in sales of refined against purchases of crude copper from foreign sources.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19½c. per lb. at mill. The chief maker does not quote base price.

Tin—The market was very quiet with but slight changes of price. The deliveries in September have been very large and the opinion is expressed in the trade that the market is becoming overstocked.

Lead—Good business was done right through the week, and it was anticipated in several quarters that the A. S. & R. Co. would advance its price. It did not do so, but continued to sell freely at 4½c., New York. Its competitors supplied their regular customers with lead at that price but some of them seemed to be averse to selling anything they did not have to. One large producer sold out its October production, and on Sept. 28 began to talk about 4.75c. In the St. Louis market, the price advanced right through the week, and toward the close became established at the list price of the A. S. & R. Co., which is above the ordinary differential. Some sales of lead for export were made.

Spelter—This market has worked itself into a more peculiar position than ever. A rather large tonnage was sold during the week and the curious thing is that this was mostly for delivery in the first quarter of 1916, while there was but relatively little business done for prompt delivery or for deliveries anywhere during the last quarter of 1915. Considering the latter as the market for ordinary contracts, prices ranged from 13@14c. in the latter part of the week, which was a slight advance from the beginning. Business done for the first quarter of 1916 was at prices from 10½@11½c. The orders for this spelter came from abroad. But little domestic business was done during the whole week. Indeed, consumers might be characterized as apathetic. On the other hand, producers evinced no eagerness to sell, although the supplies available are not, perhaps, so small as is represented.

Rapid progress is being made at Donora. The pottery is now in operation and it is expected that spelter will be produced before the middle of October.

Exports from Baltimore for the past week included 394,384 lb. zinc dross and skimmings to Liverpool. Imports at Baltimore included 4,122 tons zinc concentrates from Port Pirie, Australia.

Zinc Sheets—Business has been active, and sales good. Prices are unchanged. The base price for carload lots is $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Sept	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Spot, Cts. per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis, Cts. per Lb.	Zinc: St. Louis, Cts. per Lb.
23	4 7125	49⅛	17 60 @ 17 80	32¼	4 50	4 35 @4 42½	12 75 @13 50
24	4 7050	49⅜	17 70 @ 17 80	32¼	4 50	4 35 @ 4 42½	13 00 @13 75
25	4 7075	49⅜	17 70 @ 17 90	32½	4.50	4 37½ @4 42½	13 00 @13 75
27	4 7063	49¼	17 80 @ 17 90	33	4.50	4 40 @4 42½	13.00 @14.00
28	4 7050	49⅛	17.80 @ 17 85	33½	4.50	4 42½ @4 42½	13.00 @14 00
29	4 7200	49¾	17 80 @ 17 85	33	4 50	4 42½	13 00 @14 00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Sept	Silver	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic £ per Ton	Copper: Electrolytic Cts. per Lb.	Tin: Spot	Tin: 3 Mos.	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts. per Lb.
23	23⅜	69⅜	70½	87	18 30	150	150¼	23½	4 94	63	13.25
24	23¼	69¼	70⅜	87	18 27	151¼	152	23⅝	4 96	63	13 22
25	23½										
27	23¼	70⅛	71⅛	87½	18 38	152½	153	23¼	4.99	63	13 23
28	23⅜	71	72	87½	18 37	153¼	154	23¾	4 98	63	13 22
29	23⅜	71¼	72¼	87½	18 44	153	154	23¾	5 00	63	13 27

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations of £1 = 0.213c.

Other Metals

NEW YORK—Sept. 29

Aluminum—Spot supplies are still scarce and prices firm. Sales of No. 1 ingots have been made at 47@50c. per lb. The American manufacturer has not advanced its prices, nominally, but is unable to make deliveries on new business for several months.

Antimony—The market has been quiet, with only the usual small jobbing trade, and no large business reported. Chinese and other ordinary brands are quoted at 28@29c. per lb.; while 43@45c. is asked for Cookson's.

Nickel—Quotations for ordinary forms are 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—The market is firmer, demand being good and stocks only moderate. New York quotations are $89 per flask of 75 lb. for large lots, $90 for smaller orders. San Francisco reports by telegraph a firm market at $87.50@90 per flask. London price is £16 per flask, with no discount from second hands.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium** metal, 75c. per lb., New York.—**Cobalt** metal, 97% pure is sold at $2 per lb.—**Magnesium**, pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.—**Tellurium** is quoted at 8os. per lb. in London.

Gold, Silver and Platinum

NEW YORK—Sept. 29

Gold and Silver Movement in the United States eight months ended Aug. 31 as reported by the Department of Commerce:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$135,769,576	$10,902,690	$33,030,463	$32,195,543
Imports	37,180,356	223,796,660	15,927,273	22,489,419
Excess	E. $98,589,220	I. $212,893,970	E. $17,103,190	E. $9,706,124

Exports of merchandise for the eight months are valued at $2,232,758,886; imports at $1,150,784,196; excess of exports, $1,081,974,690. Adding the gold and silver gives $878,786,844 as the net export balance.

Iridium—This metal is in rather short supply and prices are at a high level. About $75@80 per oz. is quoted nominally, but purchases are subject to negotiation.

Platinum—Prices remain high and irregular, and transactions have not been large. The market is uneasy and the future depends largely upon the possibility of new imports. Dealers ask $50@54 per oz. for refined platinum, while $56@58 per oz. is quoted for hard metal.

Silver has been steady for several days at 23⅝ to 23¾d. The tone of the market continues good. It is to be noted, however, that recently Indian orders have not come to London, and it is probable that they have been filled from China, as the stock in Bombay has increased.

Zinc and Lead Ore Markets

JOPLIN, MO.—Sept. 25

Blende, high price, $82.80; base per ton 60% zinc, premium ore, $80; medium, $79@77; lower, $75@73, with a few lots at $70, in car lots, while ton lots sold at $65; calamine base 40% zinc, car lots, $65@55, and ton lots down to $45; average, all grades of zinc, $75.82 per ton. Lead, high price, $55.50; base, $55@50 per 80% metal content; average all grades of lead, $49.34 per ton.

SHIPMENTS WEEK ENDED SEPT 25

	Blende	Calamine	Lead	Values
Totals this week	14,299,130	267,390	1,939,530	$600,090
Totals 9 months	420,706,110	42,934,680	65,341,640	18,455,190

Blende value this week, $544,750; 9 months, $15,989,820.
Calamine value this week, $7,510; 9 months, $747,770.
Lead value, this week, $47,830, 9 months, $1,717,600.

PLATTEVILLE, WIS.—Sept. 25

The base price paid this week for 60% zinc ore was $70@72 per ton, down to $65 per ton bid for medium grades. No sales of lead ore were reported.

SHIPMENTS, WEEK ENDED SEPT. 25

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,869,180	.....	*379,400
Year	143,511,600	4,543,160	20,020,310

*Shipped during week to separating plants, 4,418,700 lb. zinc ore.

Iron Trade Review

NEW YORK—Sept. 29

The market continues strong and active, with but little change. It is largely dependent on export business, though domestic trade is improving.

The pig-iron market is in good condition and demand is heavy for basic pig. Foundry iron is a little slower, especially for 1916 business.

The greatest sensation in the trade is the purchase of the Midvale Steel Works by a syndicate of which W. E. Corey, formerly president of the Steel Corporation, is head, and in which Standard Oil interests are reported to be prominent. The transfer has been made by the purchase of the stock, which was owned chiefly by Charles J. Harrah and the Sellers family. The purchase was made through Philadelphia bankers, the reported price being $185 per share.

The Midvale plant is at Nicetown, Philadelphia, and covers about 52 acres. The company's latest balance sheet valued this plant at $11,743,782 and showed total assets of $15,551,504. The business dates back to 1866. The Midvale is one of the three armorplate manufacturing companies in the United States. It also makes ordnance, heavy steel forgings and locomotive tires. About 5,500 men are employed now, the works running to capacity. The new owners, it is understood, will increase the capital and enlarge the works.

This transaction has started up again the talk about the sale of the Cambria and the Pennsylvania steel works and the possibility of a new combination. Thus far, however, this is mainly in the air and there is nothing definite known.

PITTSBURGH—Sept. 28

The volume of steel business has increased in the past week. Domestic consuming industries generally are increasing their specifications, and the railroads are actively in the market. They have made fairly large purchases of bars and plates for their car repair shops, and of plates and shapes for their fitting shops, while rail orders are being placed freely and there is heavier inquiry for cars. The New York Central lines have bought 2,500 cars for two divisions and are expected to buy shortly for other divisions.

Demand for war material seems still to be increasing, inquiry being particularly heavy for large forging billets, for making large shells. Another advance in wire prices is expected shortly, following that of Sept. 20, on account of the heavy export movement. Steel exports to neutral countries are now increasing sharply, having thus far been below the average for normally good times. Steel prices are advancing.

Pig Iron—Price advances seem to have halted. The steel mills are not actively in the market, while foundries are covered for this year and are showing little interest in next year's deliveries. Prices are firm but are not advancing and the fact that several idle furnaces would get into blast if they could sell a backlog of tonnage is probably assuring consumers that there will be no runaway market at any early date. In some quarters a general buying movement for first half is predicted before the middle of November. We quote: Bessemer, $16; basic, $15; foundry and malleable, $14.50@15; forge, $14.25@14.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There is heavy inquiry for large forging billets and fairly insistent inquiry for rolling billets, sheet bars being neglected. Sellers are not making regular quotations. Openhearth billets are all of $26, Youngstown, with bessemer about $1 less, while prices delivered Pittsburgh are 50c.@$1 above Youngstown.

COKE

Connellsville—Spot furnace coke has advanced 10c. to $1.75@1.80, on account of decreased offerings rather than heavier buying. Negotiations on first-half contracts seem nearer the closing stage, minimum prices being between $1.75 and $2. Operators would quote flat prices of $2.40 or $2.50 but the sliding-scale basis seems to be preferred by both buyers and sellers.

Chemicals

NEW YORK—Sept. 29

The general markets are fairly active, and seem rather steadier than they have been.

Arsenic—The market is quiet and unchanged. Prices are $3.50 per 100 lb. for large lots, and up to $4 for smaller orders.

Copper Sulphate—Business is fairly steady and sales moderate. Quotations are $6.75 per 100 lb. for carload lots and $7 per 100 lb. for smaller parcels.

Nitrate of Soda—There is no change of importance in this market. Prices continue about 2.42½c. per lb. for spot and 2.45c. for futures.

Assessments

Company	Delinq.	Sale	Amt.
Bonanza Con., Utah	Sept. 15	Oct. 6	$0.015
Buffalo, Mont	Sept. 10	Oct. 10	0.003
Cash Boy, Nev	Sept. 29	Oct. 30	0.01
Coeur d'Alene, Ida	Sept. 14	Oct. 14	0.002
Columbus Ext., Utah	Oct. 10	Oct. 30	0.025
Comstock, Ida	Sept. 30	Oct. 30	0.001
Con. Virginia, Nev	Sept. 28	Oct. 19	0.05
Diam'field Black Butte, Nev.	Oct. 4	Nov. 4	0.01
E. Hercules Ext., Ida. (post.)		Oct. 11	0.0015
Exchequer, Nev.	Oct. 4	Oct. 25	0.02
Four Timbers, Wash	Oct. 4	Nov. 4	0.001
Gethin Le Roy, Utah	Sept. 25	Oct. 13	0.01
Giant M. & D., Ida	Oct. 7	Nov. 8	0.003
Goldstrike M. & L., Utah	Oct. 1	Oct. 20	0.01
Great Bend, Nev.	Sept. 10	Oct. 10	0.01
Hancock Cons., Mich.	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1.00
Hector, Ida	Sept. 4	Oct. 4	0.005
Idaho Nevada, Ida	Sept. 7	Oct. 1	0.002
Idora, Ida	Oct. 11	Nov. 11	0.005
Imperial, Ida	Aug. 31	Oct. 1	0.005
Keweenaw, Mich	Sept. 1		1.00
Lake Superior & West., Ariz.			0.02
LeRoy, Ida	Sept. 25	Oct. 25	0.002
M. & P. Gold, Utah	Sept. 15	Oct. 12	0.0025
Mount Pleasant Con., Calif.		Oct. 7	0.08
Naildriver, Utah	Oct. 9	Nov. 8	0.02
Nevada Cooperative, Nev	Sept. 15	Oct. 15	0.01
Nevada-Douglas, Nev	Sept. 27	Oct. 20	0.10
New Arcadian, Mich.	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0.50
New Quincy, Utah	Sept. 2	Sept. 23	0.01
Northern Light, Ida	Nov. 2	Dec. 2	0.004
Oom Paul Con. Ida	Aug. 30	Oct. 4	0.01
Ophir, Nev.	Oct. 12	Nov. 2	0.05
Phedora, Ida	Sept. 21	Oct. 21	0.0005
Phoenix, Mich.	Sept. 1		1.00
Phoenix, Mich	Jan. 1		1.00
Pioche Metals, Nev	Oct. 20	Nov. 20	0.00½
Rainbow, Ida	Oct. 15	Nov. 20	0.002
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Rockford, Ida	Oct. 4	Oct. 30	0.005
Royal, Ida	Sept. 1	Oct. 1	0.001
Silver Moon, Ida	Oct. 15	Nov. 18	0.005
Silver Pick Cons., Nev	Oct. 16	Nov. 23	0.01
Snowstorm Ext	Sept. 16	Oct. 18	0.003
Sunset M. & D., Nev	Oct. 18	Nov. 22	0.02
Sunshine, Ida	Oct. 15	Nov. 15	0.0006
Syndicate, Utah	Sept. 11	Oct. 2	0.001
Temple, Ida	Sept. 20	Oct. 20	0.002
Tonopah Bonanza, Nev	Sept. 13	Oct. 11	0.01

Stock Quotations

Among sales at auction on Sept. 22 in New York City was 5,000 San Toy Mining, par value $1, at 15c. each.

COLO. SPRINGS Sept. 28	
Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	.008
C. K. & N.	.02
Doctor Jack Pot	.09
Elkton Con.	.24½
El Paso	.75
Findlay	.04
Gold Dollar	.01
Gold Sovereign	.03½
Golden Cycle	1.79½
Isabella	.16½
Jack Pot	.06½
Jennie Sample	‡.02
Jerry Johnson	.04
Lexington	.005
Mary McKinney	.37
Pharmacist	.008
Portland	1.54
Raven B. H	.03½
Vindicator	1.54

SALT LAKE Sept. 28	
Name of Comp.	Bid.
Beck Tunnel	.06
Black Jack	.05
Colorado Mining	.08½
Crown Point	.01½
Daly-Judge	6.60
Emma Cop	.28
Gold Chain	.16
Grand Central	.54
Iron Blossom	.72
Little Bell	‡.10
Lower Mammoth	.00½
May Day	.16½
Opohongo	.00½
Prince Con	.62
Seven Troughs	.01
Silver King Coal'n	3.30
Silver King Con	2.00
Sioux Con.	.01½
Uncle Sam	.04
Yankee	.33

TORONTO Sept. 28			
Bailey	.05	Dome Exten.	.27
Coniagas	4.00	Foley O'Brien	.30
Peterson Lake	.22	Hollinger	25.00
Right of Way	.04	Imperial	.05
Seneca Superior	‡.78	Jupiter	.12
Silver Queen	‡.01	McIntyre	.49
T. & Hudson Bay	20.00	Pearl Lake	‡.00½
Timiskaming	.37	Porcu Crown	.73
Wettlaufer-Lor.	.07	Preston E. D.	.04½
Dome Mines	22.37½	Rea	‡.09

SAN FRANCISCO Sept. 28			
Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡.05	Belmont	3.50
Andes	.07	Jim Butler	.78
Best & Belcher	.05	Lone Star	.05
Caledonia	.52	MacNamara	.02
Challenge Con	.04	Midway	.11
Chollar	.03	Mont.-Tonopah	.30
Confidence	.16	North Star	.11
Con. Virginia	.13	Rescue Eula	.10
Gould & Curry	.03	West End Con	.59
Hale & Norcross	.03	Atlanta	.29
Jacket-Cr. Pt	.13	Booth	.44
Julia	‡.03	C.O.D. Con	.04
Mexican	.32	Comb. Frac.	.09
Occidental	.79	D'field Daisy	.04
Ophir	.18	Jumbo Extension	1.30
Overman	.07	Pitts.-Silver Peak	.07
Potosi	.04	Round Mountain	.40
Savage	.04	Sandstorm Kendall	.12
Sierra Nevada	.19	Silver Pick	.07
Union Con	.34	Central Eureka	.12

N. Y. EXCH. Sept. 28	
Name of Comp.	Clg.
Am.Sm.&Ref.,com	86¼
Am. Sm. & Ref., pf.	108½
Am. Sm. Sec., pf. B.	80½
Anaconda	73¾
Batopilas Min	1½
Bethlehem Steel	365
Bethlehem Steel, pf.	165
Chino	45¾
Colo. Fuel & Iron.	62½
Crucible Steel	101½
Federal M. & S., pf.	47
Great Nor., ore., ctf.	48½
Guggen. Exp.	66½
Homestake	118
Inspiration Con.	37¼
International Nickel	214
Mex. Petroleum	89
Miami Copper	28
Nat'l Lead, com.	66¼
National Lead, pf.	110½
Nev. Consol.	14½
Ontario Min	3½
Quicksilver	‡2½
Ray Con.	22½
Republic I&S, com.	53½
Republic I&S, pf.	103½
SlossSheffi'd, com.	57
Tennessee Copper	60¼
Utah Copper	68½
U. S. Steel, com	78½
U. S. Steel, pf.	114¾

N. Y. CURB Sept. 28	
Alaska Juneau	11½
Alta Con	.31
Beaver Con	.28
Big Four	.05
Blue Bell	.03
Braden Copper	9½
Buffalo Mines	.75
Can. Cop. Corpn.	1½
Cashboy	.04½
Chambers Ferland	.13
Chile Cop.	19
Con. Ariz. Sm	1 1/16
Con. Coppermines	1½
Con. Nev.-Utah	.25
Dia. Black B.	.07½
Florence	.50
Goldfield Con.	1 11/16
Goldfield Merger	.19
Greene Cananea	39
Kennecott Cop.	53½
Kerr Lake	3½
La Rose	7/16
Magma	14½
McKinley-Dar-Sa.	.25
Mines of Am.	2
Nevada Hills	.18
New Utah Bingham	3½
Nipissing Mines	7½
Oro.	.07
St. Joseph Lead	12½
South Utah	.15
Stand'd Oil of N.J.	500
Standard S. L.	1 9/16
Stewart	11/16
Success	.86
Tonopah	5½
Tonopah Ex.	2 7/16
Tonopah Merger	.33
Tribullion	.25
Tularosa	½
Yukon Gold	2½

LONDON Sept. 15	
Alaska Tre'dwell	£6 12s 6d
Burma Corp.	1 13 1½
Cam & Motor	0 12 9
Camp Bird	0 4 9
El Oro	0 7 0
Esperanza	0 7 3
Mexico Mines	3 11 3
Nechi, pfd.	0 12 6
Oroville	0 14 9
Santa Gert'dis	0 7 6
Tomboy	1 0 3
Tough Oakes	0 6 6

BOSTON EXCH Sept. 28	
Name of Comp.	Clg.
Adventure	1½
Ahmeek	300
Alaska Gold M	32½
Algomah	2
Allouez	55
Am. Zinc	75
Ariz. Com., ctfs	8
Bonanza	.5
Butte-Balaklava	.3½
Butte & Superior	68
Calumet & Ariz	62½
Calumet & Hecla	550
Centennial	18
Copper Range	55½
Daly West	12
East Butte	12½
Franklin	6
Granby	85½
Hancock	17
Hedley	27
Helvetia	.30
Indiana	.51
Island Cr'k, com.	45
Island Cr'k, pfd.	88½
Isle Royale	28
Keweenaw	2½
Lake	13¾
La Salle	5½
Mason Valley	1½
Mass	11
Mayflower	4½
Michigan	2½
Mohawk	74
New Arcadian	10
North Butte	30
North Lake	1½
Ojibway	1½
Old Colony	3½
Old Dominion	53
Osceola	84
Quincy	82
Santa Fe	3½
Shannon	7
Shattuck-Ariz.	27½
Superior	27
Superior & Bost.	2½
Tamarack	56½
Trinity	4½
Tuolumne	.44
U. S. Smelting	41
U. S. Smelt'g, pf.	47
Utah Apex	3½
Utah Con	12½
Victoria	2½
Winona	3
Wolverine	58½
Wyandot	1½

BOSTON CURB Sept. 28	
Bingham Mines	7½
Boston Ely	.22
Butte & Lon'n Dev	.30
Calaveras	1½
Calumet-Corbin	.04
Chief Con	.88
Cortez	.42
Crown Reserve	.37
Davis-Daly	1¾
Eagle & Blue Bell	1½
First Nat. Cop	2½
Houghton Copper	2½
Iron Cap Cop., pf	5
Majestic	.67
Mexican Metals	21
Nevada-Douglas	.75
New Baltic	2½
New Cornelia	9
Ohio Copper	.08
Oneco	.50
Raven Copper	.10
Rex Cons	.51
Smokey Dev	.15
So. Lake	5½
Tonopah Victor	.28
Trethewey	.14
United Verde Ext	5½

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62 938	57 572	48.855	28 983	26 553	22.731
February	61 642	57 506	48.477	28 357	26 573	22 753
March	57 870	58 067	50.241	26 669	26 788	23.708
April	59 490	58 519	50.250	27 416	26 958	23 709
May	60 361	58.175	49.915	27 825	26 704	23.570
June	58 990	56.471	49.034	27 199	25 948	23 267
July	58 721	54.678	47.519	27 074	25 219	22 597
August	59.293	54 344	47.163	27 335	25 979	22 780
September	60 640	53.290		27 986	24 260	.
October	60 793	50 654		28 083	23.199	..
November	58 995	49 082		27 263	22 703	..
December	57.760	49.375		26 720	22 900	..
Year	59 791	54 811		27 576	25 314	

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

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	13.641	64.304	60 756	64 488	65 719
February	14.491	14.391	65 259	63 494	70 188	
March	14.131	14.787	64.276	66.152	69 170	*
April	14.211	16.811	64.747	75 096	69.313	*
May	13.996	18.506	63 182	77.600	67.786	*
June	13.603	19 477	61 336	82 574	66 274	95 333
July	13 223	18.796	60 540	76 011	64 955	91 409
August	*	16 941	‡	68 673	‡	82 333
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53 227			
December	12 801		56.841		*	
Year	....				.	

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37 779	34 260	171 905	156.550
February	39.830	37 415	181 556	176.925
March	38.038	48 426	173 619	180.141
April	36.154	47 884	163 963	166.225
May	33 360	38 790	150 702	162.675
June	30 577	40 288	138 321	167.636
July	31 707	37.423	142 517	167 080
August	*	34 389	‡	151 440
September	32.675		‡	
October	30 284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34 301		.	

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4 111	3.729	4 011	3.548	19 665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3 970	4 053	3.850	3.997	19 651	21.883
April	3.810	4.221	3.688	4.142	18 225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5 932	3.810	5 836	19.411	25.170
July	3 891	5.659	3 738	5 531	19 051	24 611
August	3 875	4.656	3 715	4.520	‡	21.946
September	3.828	..	3 658		‡	
October	3.528	.	3 384		‡	
November	3.683	.	3.585		18 500	
December	3 800		3.662		19 097	
Year	3 862		3 737	.		.

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5 262	6.386	5 112	6.211	21.533	30.844
February	5 377	8.436	5 228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5 113	10.012	4 963	9 837	21 569	49.888
May	5 074	14 781	4 924	14 610	21.393	68.100
June	5 000	21 208	4 850	21.038	21.345	100.614
July	4 920	19.026	4 770	18 856	21 568	97.250
August	5 568	12.781	5 418	12 611	‡	67.786
September	5 380		5.230		‡	.
October	4 909		4 750		‡	..
November	5 112	.	4 962		25.016	.
December	5.592	.	5.430		27.369	.
Year	5 213		5 061	.	..	.

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14 94	$14.59	$13 23	$13.45	[illegible]	[illegible] 90
February	15 06	14.55	14.12	13 4[illegible]	[illegible]	13 90
March	15 07	14.55	13 91	13 4[illegible]	[illegible]	13 95
April	14.90	14.55	13 90	13 4[illegible]	[illegible]	13 95
May	14 90	14.61	13 90	[illegible]	[illegible]	13 83
June	14 90	14.70	13 90	[illegible]	[illegible]	13 77
July	14 90	14.94	13 90	[illegible]	[illegible]	13 68
August	14 90	16.01	13 90	[illegible]	[illegible]	14 75
September	14 90		13 90		[illegible]	
October	14.84		13 75		[illegible]	
November	14 59		13 43		[illegible]	
December	14 70		13 45		[illegible]	
Year	$14 88		$13 78		$1[illegible] 01	

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1911—ORE DEPOSITS—Experiments in the Enrichment of Silver Ores. Louis C. Ravicz. (Econ. Geol., June, 1915; 22 pp.) 60c

GOLD DREDGING AND PLACER MINING

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IRON ORE DEPOSITS, MINING, ETC.

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OTHER METALS

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The Engineering and Mining Journal

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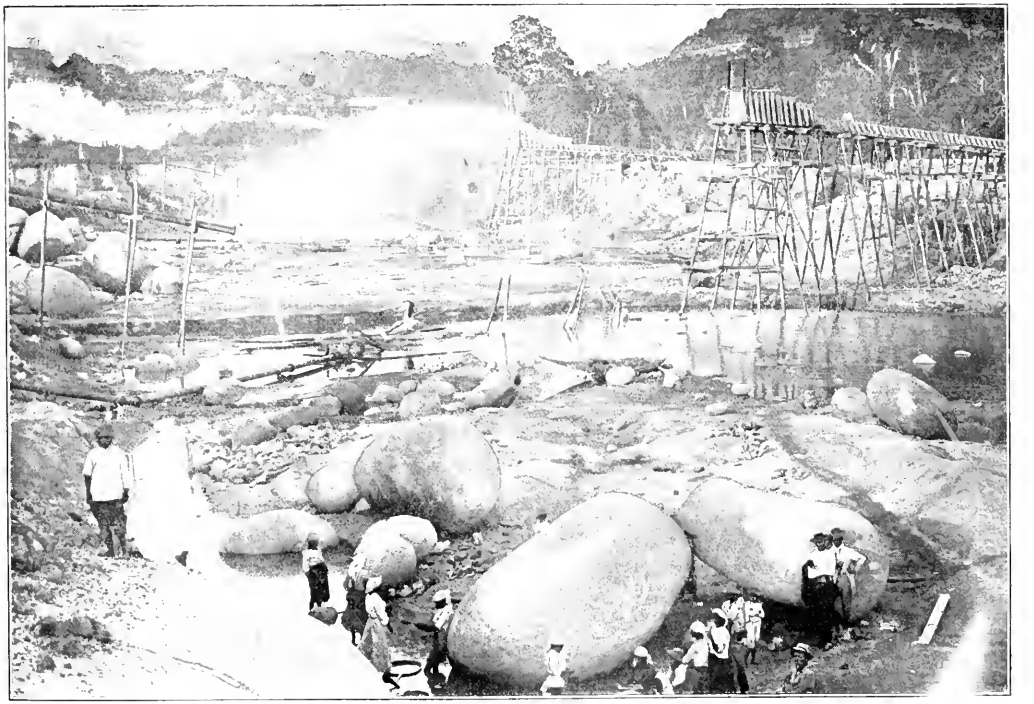
Placers of Antioquia, Colombia

By Ralph W. Perry

SYNOPSIS—Practically all the river gravels in the department of Antioquia, Colombia, are gold-bearing, but the greater part of the gold production comes from a few districts, especially from the Porce, Nare and upper Nechi valleys, where enrichment has been marked. Increased gold output may be expected during the next few years.

In speaking of the placers of Antioquia, Colombia, it is commonly said that there is not a stream in the department that is not gold-bearing; and while there are a few exceptions, this statement is practically true. The bulk of the gold, however, has been derived from a few of the many districts or from the rivers running through them. In other parts of the department, while "colors" can be obtained nearly everywhere, the deposits are not large enough to warrant work on a commercial scale, and these are either residual deposits or local concentrations of them. The majority of these deposits were worked out years ago, but some work is continually being done on streams in which the supply of gold is renewed each rainy season from the residual deposits.

The distribution of the profitable placer mines has been to a large extent determined by the past history of the country and its relation to the present topography and drainage. The original source of the gold has also been an important factor in this distribution, or rather in the relative richness of the deposits. The placers of Antioquia can be divided into four classes—(1) [illegible] placers; (2) recent placers derived to a large extent from [illegible] class 1; (3) recent placers having no connection with [illegible] 1; (4) residual deposits.



LA CLARA HYDRAULIC MINE, OPERATED BY McGUIRE BROS., ON PORCE RIVER, COLOMBIA

*Mining engineer, 84 William St., New York.

To class 1 belong the gravels of the Cauca River above Valdivia; also the old gravels occupying a considerable area in the central part of the department to the east and north of the City of Medellin. This area, at one time perhaps continuous, is now divided by the Medellin River.

These old gravels are now found around the towns of Rio Negro to the east of Medellin and Santa Rosa, Anorí and Amalfi to the north. Their former extent can only be conjectured, but there can be no doubt of their great size. The town of Santa Rosa is built on a small mesa made up of these deposits, and the small rivulets flowing from the town after a heavy rain carry gold in paying quantities. These deposits are generally low-grade, but there are some areas that would pay to work if water could be obtained, although most of them lie at a higher elevation than the present streams.

By some these old beds have been attributed to glacial action, but there seems to be no good reason for this belief, as there are no signs of glacial action and this area apparently has no relation to the region to the south where glacial action may have taken place. In Santa Rosa where the deposits are most extensive, they are stratified over a large area, and large portions of this area are composed of very fine material alone. The commonly accepted local belief is that this area was formerly a lake bed, and that the detached areas were river deposits derived directly from the erosion of the surrounding country and formed in rivers occupying courses somewhat different from those of the present streams.

The deposits near Anorí and Amalfi, which are now being exploited on a considerable scale, occupy depressions back of the ridges bordering the Porce River on both sides. Some are being worked by driving a tunnel from the Porce Valley and sluicing the gravel through this tunnel. Some of these deposits cannot be reached in this way, and it is hard to see how they can be worked, since they occupy depressions in the mountains where dumping ground cannot be obtained and are too deep for dredging, being 160 ft. thick in places.

They apparently have their gold distributed from the surface down, as the natives have washed much of the gravel near the surface. It is claimed that these gravels run from $0.30 to $0.50 per yard. Some of the basins contain as much as 35,000,000 cu.yd. and others, not measured, much more. A cross-section through some of these deposits near Amalfi shows their structure and relation to the Porce River.

The old gravels of the Cauca Valley occupy the present valley of the Cauca above Valdivia, extending to the vicinity of Xerá. These beds are extensive and of great thickness (200 ft. or more) in places. They are poor, especially in the lower end of this area, but there are probably parts of the area that can be profitably dredged.

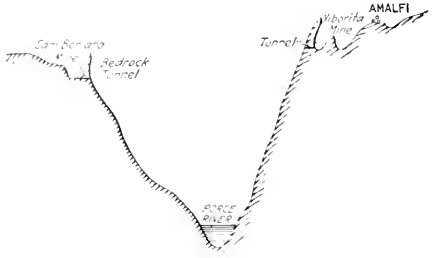
Origin of Source of Cauca Gold

The deposits of the Cauca have apparently derived their gold from a source distant from the present situation of the placers and entirely distinct from the area in the central part of the department. It is likely that the source of the Cauca gold must be sought in the country surrounding Manizales and the Quindio mountains to the south, before the eruptions of the Quaternary period buried that part of the country with the eruptives that are now found there. For this reason, the placers of class 2 on the lower Cauca have not been enriched by additions of gold from any other source.

The old placers in the other area were formed in the immediate vicinity of the source of the gold. This part of Antioquia is highly mineralized, having large areas with stringers and lenses of gold-bearing quartz so close together that they have formed residual deposits of sufficient importance to be worked on a large scale, where favorably situated in regard to water for hydraulicking. All of the small streams in this area carry appreciable quantities of gold, and it is the addition of this gold that has greatly increased the richness of the Nare and Porce Rivers in comparison to the Cauca.

Recent Placers Derived from Old Gravels

In class 2 are the mines of the Cauca below Valdivia and those of the Nare, Porce and Nechí Rivers. These mines on the Cauca are amenable to dredging, but no exact information concerning their value has been obtained except by the few companies that have drilled some areas there. Much time and money have been spent in drilling the lower parts of both the Cauca and Nechí Rivers. None of the companies seem to have taken into consideration the fact that gold is seldom found far from its source except in streams of considerable velocity. If there was any good reason for believing that the lower parts of these rivers had formerly had a greater gradient than at present, there would be some ground for seeking



ANCIENT PLACERS AND THE PRESENT PORCE CHANNEL

gold there, but as both rivers have a comparatively steep gradient down to Caceres on the Cauca and Zaragosa on the Nechí, it is most probable that the amount of gold found below these towns will diminish. Moreover, as the gold in these valleys has been derived from the reconcentration of the old deposits, it is inconceivable that the whole extent of this gravel could be enriched beyond its original content.

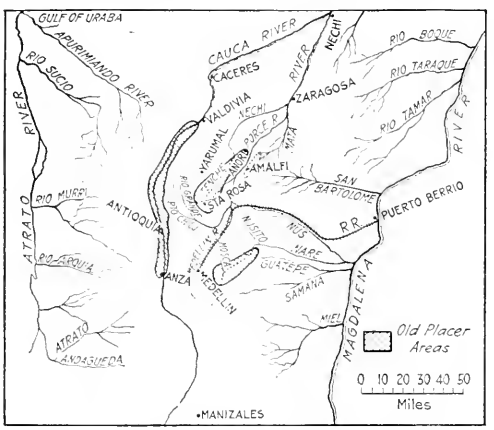
The fall in the Cauca River from Caceres (El. 205 m.) to Nechí, where the Nechi River joins it, is 50 m. in approximately 150 mi. Between Valdivia and Caceres, the Cauca receives numerous small tributaries that are gold bearing, and it is probable that these have played a part in enriching these deposits. They will also account for the variations found in the character of the gold at different points. Some of these streams furnish coarse gold derived from the quartz lenses in the schists which cover a large area there.

Porce and Nechi Rivers

The Porce and Nechi Rivers are treated as one since they both drain the Santa Rosa district, have their source there and join again a short distance above the town of Zaragosa, below which place they are called the Nechí. The Porce River is formed by the junction of the Medellin River and the Rio Grande. The Medellin River has

produced some gold in the past, but most of the gold of the Porce River has come through the Rio Grande. This river and its important tributary, the Rio Chico, are gold-bearing from their sources. Each has its source north of Santa Rosa and, after long circuitous courses, they come together south of Santa Rosa and flow north parallel with the Medellin River, finally joining it to form the Porce. The Rio Grande and Rio Chico rise at an elevation of 8,500 ft. and placers are found throughout the course of each wherever the gradient permitted them to form. These deposits have now been exhausted except in some places in the bed of the river. They were small but exceedingly rich. About 8 mi. above the mouth of the Rio Grande, at an elevation of 3,200 ft., begin the placers properly belonging to the Porce River.

Following the windings of the Porce River for a distance of approximately 25 mi. is to be found the richest placer ground in Antioquia. A conservative estimate of the amount of gravel in this area is 130,000,000 cu.yd. All of this gravel carries from $0.20 per yd. up, and the areas mined to the present time have averaged over $1 per yd. According to the indications in the mines worked,



PLACER DISTRICTS NEAR ANTIOQUIA, COLOMBIA

the richest part is in the present bed of the river. The ground in La Clara mine, which has been most extensively worked, has been better than this, but McGuire Brothers have not worked any more of the low-grade gravel than they could help. Neither have they mined more than a small portion of the river bed, and that near the banks. Preparations have been made this year, however, for the diversion of the river and mining the bed. Much poor ground has been mined in the search for the rich streaks. The average depth of gravel is 40 ft. In some places it is nearly 70 ft. deep. The bulk of the gold is found in narrow channels up to 25 ft. wide and within a few feet of bedrock. One peculiarity of these channels is that as bedrock rises they become poor; in other words, the richest spots are on bedrock sloping downstream. These gravels carry gold close to the surface and at a depth of 10 ft. generally carry $0.20 per yd. From this level there is little increase in value until a few feet above bedrock, and the existence of the rich channels is not indicated until they are reached. The bedrock over the entire area outside of the channels is generally rich enough to bring the average of the whole area to $0.50 per yd., exclusive of the contents of the rich streak. It is to be regretted that some accurate records of the contents of and costs of working these comparatively low-grade gravels have not been kept.

The operators of La Clara mine, which is the best equipped on the river, estimate that no ground running less than $0.50 per yd. can be handled at a profit. It would seem that this estimate is large, as it covers delays caused by working close to the river in pursuit of the best ground. Frequent periods of high water make work close to the river dangerous, and it is only successful in the dry seasons. The river can sometimes be crowded back by dumping the gravel elevated on the edge of the river and gradually forcing the river back. When successful the gravel mined has run several dollars per cubic yard, but the area mined has been small.

Rich Gravel in Gavino Mine

The Gavino mine just above La Clara was the richest mine worked on the river for its area, having produced over $200,000 from an area 300 ft. long by 200 ft. wide. About 75% of this production came from a narrow channel 15 ft. wide by 150 ft. long, the remainder of the ground mined not running over $1 per cu.yd. This mine was worked by natives, and the gravel was carried out by hand and washed in small, short sluices. A small elevator was used to pump out the water. The greatest depth to bedrock was 65 ft. Several years were spent in working this small amount of ground.

The reason against the use of dredges in this section of the river is the difficulty of moving them from one playa to another, as the playas are small, running from 2 acres, like the Gavino, up to 50 acres. They are generally separated by rapids. High water would also interfere with successful working. Otherwise the ground would seem to be favorable for dredging except where large boulders are encountered. Much of the gravel can be handled through an elevator with an 8-in. throat and the bedrock is a soft decomposed gneiss or granite. Power could be secured within short distances. Unless dredging is undertaken much of this area will never be worked, as it is impossible to secure water under sufficient head for elevators. Below here the Porce runs through a narrow deep valley until it approaches Zaragosa, although there are numerous deposits of gravel in this section that are large enough to work. These have the same characteristics as the deposits already described, and present the same difficulties, but they are more difficult of access.

In this part of its course, the Porce receives two important gold-bearing tributaries, the Guadalupe, which has produced much gold and has its source in the immediate vicinity of Santa Rosa, and the Mata River from the Amalfi district. The Guadalupe River has been worked in all its course, and washings are carried on every year in its bed as the gold contents of the bars are renewed each year. Most of this washing is done by women who make from 10c. up per day. Near the Porce, the Guadalupe makes a sheer descent of 1,000 ft. into the Porce Valley, and below this fall its course is comparatively level for several miles, until it flows into the Porce. This ground should be rich, but it has never been drilled and contains many large boulders. The Mata contains some large deposits and it has been claimed that they are of a grade that can be worked at a profit.

The Nechí River under the name of the Tenche rises a few miles northeast of Santa Rosa and flows north, receiving many gold-bearing tributaries from the towns of Angostura, Yarumal and Anorí. There has been much gold produced from this river in the past, and many of the mines have been extremely rich. I am not familiar with the lower part of this river, but I am told that there are deposits of gravel there of good size; they should be similar in contents to those of the Porce. It is below the junction of the Nechí and Porce Rivers that dredging operations have been undertaken profitably. Both dredges that have been installed there have been successful and the area that will be profitable appears to be big. Additional dredges are being installed. Most of the dredging ground will probably be found in the vicinity of Zaragosa, as drilling operations farther down near Nechí have not proved any good ground and the gradient of the river is too small to have transported much gold that distance.

Old Gravels in the Nare Valley

The Nare River also has a large part of its upper course in old gravel deposits, and next to the Porce is the most important source of gold in the department. Like the Porce it not only has received the benefit of the accumulated gold of the old placers, but it has been greatly enriched by numerous tributaries draining a highly mineralized country. Its most important tributaries are the Mosca, Conceptión and Nusito. Each of these streams has produced much gold in the past and formed large deposits at its mouth. These deposits have been worked out with the exception of that at the mouth of the Nusito.

In this part of the Nare River is found a deposit that is comparable in area and richness with that at the mouth of the Rio Grande. There is a great similarity in both the gold found in the Nare and Porce Rivers and in the distribution of the gold.

The Nare has the same rich narrow channels and about the same gold content in the rest of the playas. Here also the richest part of the deposits lies in the present river channel. The Nare has a wider valley than the Porce, and it is therefore more difficult to secure water with sufficient head for elevators. The river has a large production each year from bar workings, whenever low water permits. There has been little work done on this river in comparison with the Porce, but where bedrock has been reached good results have been obtained. The gravel has about the same average depth as that on the Porce River. The gold of the Nare and Porce is found in flattened grains ⅛ to ¼ in. diameter, but generally smaller. Its fineness runs from 820 to 840, and the gold from the Nare averages a little higher than that from the Porce. In the latter some platinum is occasionally found. This has come from the Santa Rosa district, where platinum has been found in some of the ore, according to Boussingault. Coarse gold is seldom found in either of the rivers, but is sometimes washed out of the banks of the Porce after a flood. Boulders are absent from the Nare gravels, except where dikes of hard rock are found cutting the gneiss and granite of the bedrock. The area at the mouth of the Nusito is probably more suitable for dredging than any area on the Porce. High water would be the only drawback.

Little drilling has been done on any of these mines, and it is doubtful if it has either proved or disproved the richness of these deposits, as closer drilling than is customary in a preliminary examination is necessary, or one of these channels would be missed and the whole drilling be without value. In fact, the operators of La Clara mine on the Porce place absolutely no confidence in drill results, but it would seem that close drilling would be of distinct advantage in locating these channels.

Placers of Recent Formation

In class 3—deposits having no connection with the old gravels—are included all the rest of the true alluvia of Antioquia, those of any importance being found on the San Bartolome, Nus, Samana, and Miel Rivers and the tributaries of the Atrato, which will not be considered on account of lack of knowledge concerning them.

The tributaries of the Samana and Miel have produced considerable gold in the past, but the deposits in the rivers themselves have never proved to be of much importance. These tributaries have their source in a country that is only slightly mineralized and characterized by an almost complete absence of gold-bearing stringers over any considerable areas. The one exception to this statement is the Guatepe River, but this stream flows into another river before it reaches the Samana, and it is doubtful if any of its gold has ever reached the latter river.

The Nus and the San Bartolome are the only two rivers of this class that are of any importance. The upper part of the course of each is through a country most favorable for the formation of placers, the Nus especially draining a district well known for its large residual deposits. The country drained by the San Bartolome is not so favorable, but it has the benefit of numerous tributaries larger than those of the Nus, and its gravel deposits are correspondingly larger and perhaps richer. The deposits of the Nus are shallow compared with the Porce and Nare, and the gold is more evenly distributed both vertically and horizontally. Water is generally available within reasonable distances and under sufficient head for elevators. These mines are worked by native methods, but with indifferent results. Not being as rich as the Porce or Nare, they attract little attention, although they should pay well with elevators. The Nus has few tributaries of any importance, the chief one being Las Animas, which has a good-looking deposit of gravel that pans well.

The San Bartolome has several important tributaries that have good deposits of gravel. Some of these have been highly productive, and others as good will doubtless be found. As in all of these streams, the only mines that have been worked have been those where water was easily obtained; and, with the exception of a few localities on the tributaries of the San Bartolome, it is difficult to obtain water with sufficient head. Dredging seems to be the only practicable method of working the mines on this river and some drilling of large areas to determine their value is now being done by Medellin men. The lower deposits of gravel will probably prove too poor to be worked, as those in all the other rivers have done; but the area in the vicinity of its tributaries will undoubtedly be worth developing.

There are numerous residual deposits scattered over the whole department, but the largest are found in the districts of Santa Rosa, Guarne on the Mosca River and in the Nus Valley. In these districts the deposits cover large areas and the aggregate quantity of gold produced

from them has been large. With the exception of those on the Nus, they are so situated that it is difficult to secure enough water to work them on a scale commensurate with their size. It is only during the wet season that water can be obtained, and after years of work the amount of ground washed has been insignificant.

A great many of the small quartz mills of the country are run on the ore left behind after sluicing these deposits. The small streams in the vicinity are steadily worked in the wet seasons and furnish a means of livelihood for thousands of people. Las Animas and Retiro mines at Providencia have maintained a steady output of gold for years and the creeks below their mills carry gold, but its fineness and the slime present have hindered all attempts to save the gold. In these mines the hills are sluiced away with water under no head, and the rock from the stringers and veins is collected and sent to the mill.

In a section 200 ft. wide, I have seen in the Retiro mine a dozen stringers of ore and two veins over 2 ft. wide. Not all of this ore carries gold enough to pay for milling, and only enough sluicing is done to keep the mills running. In the case of the Retiro mine, the sand from the creek below the sluices is collected and crushed again in a stamp mill through a coarse screen and a recovery running from $0.50 to $2 per ton is made. It is the steady addition of the gold resulting from the erosion of these residual deposits to that derived from the old gravels that has made the Nare and Porce Rivers much richer than the Cauca, whose original source of gold has been buried. The Cauca still has tributaries draining such sources of supply in the Quindio country, but if this gold ever reaches the Cauca River it is deposited in the upper parts.

Few Unexplored Areas in Antioquia

The only part of Antioquia where there is any chance of discovering new placers is on the tributaries of the Atrato, which region is comparatively unsettled on account of its climate. Even here it will be found difficult to locate mines, as most of the desirable ground has been taken up and would have to be purchased or leased. Practically the whole courses of the Porce, Nare, Nechí and Cauca have been titled, as well as the desirable deposits on the Nus and San Bartolome. There may be fractions of claims on these rivers that can be secured, owing to mistakes in the measurement of claims.

The small tributaries of these rivers have furnished the bulk of the placer gold produced in the department to date, but their production at present is small, most of the deposits of any importance having been worked out. It is generally a waste of time to examine any of the deposits on these small streams, even if they show no signs of having been worked previously. The old inhabitants of the department recall times when even rivers like the Porce carried so little water that work could be done in its bed, and while these larger streams with their deep bedrock could only have been worked to an insignificant extent, little gold has been left in the others. The work done in the rivers during the dry seasons has served to prospect them, and the native miners generally have a good knowledge of the situation of the richest ground.

All of the gravels on the lower Cauca, Nechí and San Bartolome are suitable for dredging and few of them can be worked in any other manner on account of the lack of water under sufficient head. The old gravel deposits of the Cauca River are generally too poor to be worked by any method, but there is one tract there covering an area of from 15 to 20 sq.mi. on which panning over a large part of this area has indicated a gold content running from $0.10 to $0.80 per cu.yd. There is sufficient water for dredging, and power could be obtained within reasonable distances.

The climate on all of these rivers is hot, and malaria is prevalent, but the fact that work is being steadily done there shows that the climate is not an insuperable obstacle. The mines on the upper Nare and Porce at an elevation of 3,000 ft. are afflicted to a less extent with malaria; the nights are cool and malaria can be avoided if ordinary precautions are taken.

There is no dredging ground on the Nus River, unless it be in its lower part, and I do not think there is gold enough present there for profitable operations. The dredging ground on the San Bartolome is somewhat difficult of access, and roads would have to be built for the introduction of machinery. This same condition is found on the Nare, but the best ground on the Nare is about 15 mi. from the railroad.

Abundant Water Power May Be Utilized to Pump Water for Hydraulicking

The most favorable tract on the Porce for dredging is the area at the mouth of the Rio Grande. This lies within a few miles of the railroad. These deposits so far have been worked only by hydraulic elevators, and this method will probably continue to be used. There is little water available and unless some of the smaller holdings can be consolidated to permit the construction of long ditch and pipe lines, they will remain idle for a long time. Ditch lines can be built cheaply but their maintenance is costly, on account of the nature of the ground, and the heavy rains.

Power can be developed cheaply from the river itself, and probably in the end these mines will be worked by means of heavy pumps and elevators. I see no reason why this method should not be successful, and undoubtedly it would require less capital than getting water on the mines through ditch lines.

All of the operators on the Porce and Nare have hopes of turning the flow through the ground worked out and thus being able to mine the bed of the river. If they succeed in doing this the yield will probably equal that of any ground ever mined in the department.

I would consider it a waste of time to investigate any mines that are not situated on the Cauca, Nare, Nechi, San Bartolome, Nus and Porce Rivers if one is looking for a large operation. Some of the tributaries of these streams offer good chances for the man with a small capital; but even there the best ground, situated where water could be obtained, has been worked. Regardless of new discoveries, the output of gold from Colombian placers will show a large increase in the next few years from the dredges near Zaragosa and the elevators now being installed on the Porce River.

The Deutsche Molybdänwerke at Teuschenthal near Halle on the Saale has been greatly enlarged and improved so that it will be able to supply the whole European steel industry with molybdenum metal and ferromolybdenum when peace is restored, according to "Zeitschrift für angewandte Chemie." The company owns mines producing an abundance of the raw material.

Geologic Conditions That May Confuse Oil Drillers

By Dorsey Hager*

Oil geology became a science only when the relation between underground and surface folding was clearly established; when it was found that surface folding reflected underground folding. This truth was arrived at by the plotting and the mapping of many well logs, and also by many observations taken in highly folded regions like California and Wyoming, where folding can be readily photographed and traced for depths of several thousand feet.

However, even though a geologist does find well-defined folds, there are a number of conditions under which the drill may fail to find oil, but which the geologist cannot foretell. A brief résumé of such conditions may lead to a clearer understanding of the geologist's limitations. The following factors all contribute to make oil-field work uncertain: (1) Faults; (2) unconformities—(a) angular, (b) erosional; (3) lensing—(a) due to thickening of beds in flat strata; (b) due to pinching out of sand; (4) hard spot or lack of porosity; (5) basalt intrusions; (6) water in anticline in place of oil; (7) shales at top of anticlines; (8) barren.

Hidden faults or breaks in the strata may make a region spotted. Where the strata have been broken, as in Fig. 1, wells Nos. 1 and 3 may carry oil, while Nos. 2 and 4 are barren. This faulted condition may not show at the surface, but drilling will in time prove its existence.

Angular unconformities (see Fig. 2) may result in a lack of production in a fold. Well No. 1 is barren; No. 2 is productive. Were No. 1 drilled first, the field would perhaps be abandoned. Were No. 2 drilled first, later developments at No. 1 would prove disastrous. Such a condition is the result of folding or tilting of the beds prior to the later deposition and folding.

In the erosional unconformity (Fig. 3) wells Nos. 1 and 4 are productive; Nos. 2 and 3 are barren. Such a condition is due to the erosion or washing of the earlier beds before the later beds were deposited upon them, leaving an island-like condition.

Lensing is the cause of uncertain conditions. Sands often change to shales, or *vice versa*. This may result in a humped condition, as shown in Fig. 4, in which the oil rises to the top of the lens or hump. Wells Nos. 1 and 3 may be practically dry, while No. 2 is a good well. Such a condition may account for oil in practically flat beds.

Fig. 5 shows the beds lying at an angle. The sand pinches out up the dip, resulting in an accumulation where there is no pronounced folding to break the normal dip. Wells 1 and 3 are barren. No. 2 is productive.

Fig. 6 shows the sand locally hard at the top of the fold. As a consequence well No. 2 is dry, though oil occurs on the slopes at Nos. 1 and 3. A similar condition may exist where the top of the structure carries gas and no oil. In Mexico dry spots are sometimes due to the occurrence of basalt intrusions. One drills into basalt as at well No. 2 and obtains dry holes, but in Nos. 1 and 3 oil is found.

Water may also occur at the top of the structure in place of oil. Shales may replace sands that one might expect on the axis of a structure, and one would find the fold barren. Again, there may be an excellent fold, but the age of the formation and its history are against its carrying petroleum. However, taking all adverse factors into consideration, one will find nine out of 10 folds in oil regions productive. Even though adverse conditions do exist, the tops of the folds are the best places to drill.

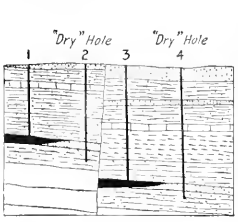


Fig. 1

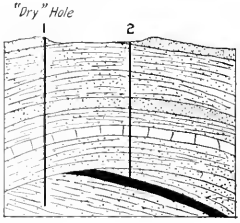


Fig. 2

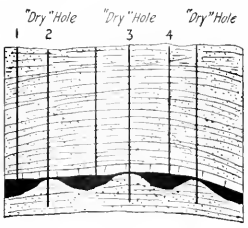


Fig. 3

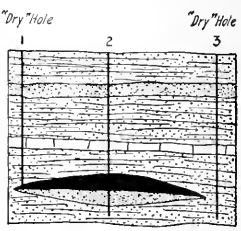


Fig. 4

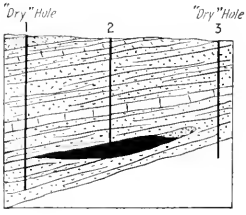


Fig. 5

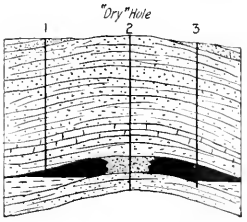


Fig. 6

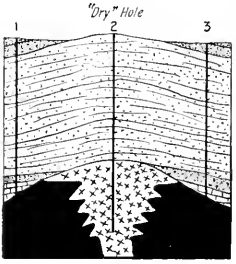


Fig. 7

FIGS. 1 TO 7. GEOLOGICAL CONDITIONS THAT UPSET THE OIL-WELL DRILLER

*Petroleum geologist and engineer, Tulsa, Okla.

Cryolite Imports Into the United States in 1914 amounted to 4,612 long tons, as compared with 2,559 long tons in 1913, according to the U. S. Geological Survey. No cryolite is produced in the United States, the entire supply used in this country being imported from Ivigtut and Eskimo Hamid on the southern coast of Greenland.

Use of Coal Tar in Flotation

By William A. Mueller*

SYNOPSIS—Experiments have shown that coal tar, while not usually a good flotation agent, serves as an excellent base for use with frothing oils, reducing the required quantity of the latter. Coal tars differ, and some are of no use, while others are applicable only to certain kinds of ore. Experimental results and practical operations are discussed.

In this discussion of the use of coal tar as an agent for mineral flotation I do not wish to advocate its universal use but merely to state a few facts and give a few results that I have secured experimenting with it as a flotation agent with a porphyritic copper ore of the Southwest. Furthermore, all references made to flotation in this discussion apply only to the flotation of copper-bearing sulphide ores. No attempt is made to discuss the action of any others at this time.

Character of Oils Used in Flotation

Every flotation plant finds an oil particularly suited to the ore being treated. There seems to be no one oil that will give satisfactory results in every case. Coal tar may, however, become a universal oil when employed as a base for making good working mixtures of oils. I feel that a great many of the expensive oils now in service could be reduced in quantity if combined with a large part of coal tar.

The principal oils utilized for flotation in this country for copper ores, up to a year ago, were wood-distillation products and, at one plant, cresol. The price of cresol, about 30c. per gallon, made its use costly (even though only 2 lb. of oil per ton of ore was needed) as compared with coal tar, which costs only about 5c. per gallon. Later, other coal-tar products less expensive than cresol came into notice, and finally coal tar itself, aided by some frothing agent such as pine oil. The latter, however, is also very expensive, and subsequent experiments showed that coal tar with from 10 to 25% creosote gave equally good results. Until these experiments coal tar was not considered as a flotation agent in this country, nor ever experimented with here, so far as I could find out, although mentioned in some English patents. The experiments referred to led to its adoption in one large mill, and many others are now experimenting with it and getting good results.

Tars Are Products of Gas Works

There is a great deal of difference in the behavior of the different tars, and those used in these experiments, while classed as coal tars, are really gas tars or the tars resulting from the manufacture of gas. They are byproducts and can be had reasonably cheap. In the case of tar No. 1 (Table 1) no special heat treatment was followed, as it was a product made in a small iron retort for test purposes only, before other tars could be secured. In this case the coal was heated in the retort until no more gases came off, the volatilized products were passed through a condensing system and the gas allowed to escape. The total condensed liquids, including the water, were collected and called tar No. 1. No. 2 was the same as No. 1, except that the water was removed by settling and decantation. The other tars used were crude products, as far as I could ascertain, and all were classed as byproducts of gas or coke plants in different parts of the country.

No attention was paid to the manner of making the tar, as a byproduct as inexpensive as possible was wanted; hence the heat treatment of the coal from which the tar is a product was not considered, nor were some of the other facts entering into the making of coal tar as a byproduct. Of course by special heat treatment and attention a coal tar can probably be made that will suit the purpose of flotation better than the material now employed; but whether the extra cost would warrant such procedure is doubtful, particularly when the gas and coke problems are considered. As a matter of comparison of the various tars, a distillation test was made on the samples at hand. The results were noted in Table 1.

TABLE 1. DISTILLATION PRODUCTS OF VARIOUS COAL TARS

Distillate	Tar No. 1	Tar No. 2	Tar No. 3	Tar No. 4	Tar No. 5	Tar No. 6	Tar No. 7
20°C.–110°C., light naphthas and water			1.2% mostly water. Oil, light brown and thick.	2.8% oil, light brown and thick	None	None	None
110°C. – 170°C., light oils.			1.2% oil; yellow color	0.4% yellow color, very gummy	0.4% oil; clear, pale, yellowish green	0.3% solid; reddish color	2.0% light yellow-colored wax.
170°C. – 210°C., second light oils.			1.2% oil; yellow color	0.2% light-brown, solid	1.1% yellow solid	0.2% light-yellow solid.	1.0% yellow solid
210°C. – 240°C., carbolic oils.			7.5% yellow clear liquid	6.8% white crystalline	9.1% yellow solid	2.0% light-yellow solid.	3.2% yellow solid
240°C. – 270°C., creosote oils.			7.4% reddish-yellow liquid.	4.8% white solid	8.4% yellow solid.	6.0% yellow solid	8.1% dark reddish-brown solid.
270°C. – 360°C., anthracene oils.			24.3% yellowish-brown liquid to red-brown solid.	11.1% yellow solid to reddish-brown solid	25.9% yellow-brown to light-brown solid.	20.3% yellow to brown solid	23.5% dark reddish-brown solid.

Tars Nos. 1 and 2 were in small quantities, hence no test was run on them. Tar No. 1 was the same product as Tar No. 2, except that the latter had the water removed. Both tars were made from the same coal as was used for Tar No. 3. The analyses would in all probability be the same for Tar No. 2 and Tar No. 3. Tar No. 1, however, would give a larger amount of the first fraction because of excess water. Where the fractions became solid no condenser could be used in distillation, hence there was probably some loss by volatization.

Character of the Ore Used in Experimenting

The ore, as has been said, was of a porphyritic nature, carrying about 1.60% copper, mostly chalcocite, with some chalcopyrite, and about 0.15% oxide.

At times this ore carries more clayey material than at others, and this fact makes a big difference in the results obtained, since it tends to lower the grade of con-

*Inspiration Consolidated Copper Co., Miami, Ariz.

centrates as well as to raise the copper contents of the tailings. The reason for this is not altogether clear, but it is reasonable to say that the clayey material coating the mineral particles keeps the oil from adhering to them, hence preventing its flotation as clean mineral.

The ore for each test is ground in an Abbé porcelain ball mill for the time necessary to reduce it to a fineness of less than 1.5% on a 48-mesh screen. The oil can be added either before or after grinding, but it seems to do better when added before and ground wet with about

ANALYSIS OF COPPER ORE

Silica	72.0%
Alumina	20.0%
Iron	3.0%
Copper	1.6%
Sulphur	2.0%
Lime + magnesia	0.7%

1 part ore to 1.3 parts water. Grinding with tar gives much better mixing and more intimate contact of tar and mineral than would otherwise be secured. If the tar is not thoroughly mixed with the ore, it will be found floating in globules on the pulp, and will not mix. Even agitation, unless very violent, will fail to break up the globules.

Method of Making the Flotation Tests

For the flotation a small two-compartment machine was used. One compartment comprised the agitation mechanism, which agitated pulp by means of a stirrer. This agitation compartment was connected with the other compartment (the spitzkasten) by a narrow slit near the bottom and a large opening near the middle. This enabled the aërated pulp to flow from the agitation into the next compartment, where no agitation took place. The froth rose to the surface and was skimmed off with a spoon or a spatula. The test was not complete until no more mineral-bearing froth was formed. The capacity of the machine was about 2,000 c.c.

For each experiment the time of flotation was noted, this being the period from the beginning of flotation until no more mineral-bearing froth formed in the machine. In all experiments the first product formed was called concentrate, and when this no longer came off, turpentine was added, and the next product was called middlings. This system corresponds to that followed when the ore goes through the Minerals-Separation type of machine, where concentrates are formed in the first few compartments, then turpentine added, and the later products taken off as middlings and retreated, either in the same machine or a similar one.

At the time of adding the turpentine the coal tar would often be brought to the surface in flaky particles which would sink later, but this made no difference, as the concentrates had already been taken off. The particles brought up appeared to be some of the insoluble portion of the tar, known as pitch, which does not have any apparent effect on the flotation when excessive. In some cases when tar was mixed with other oils the tar separated in the pulp before any flotation took place. This trouble, however, can be avoided by sufficiently grinding the pulp to the right consistency. The tar will be better mixed in a thick pulp than in a thin one. Whenever the tar separates there is a fault somewhere, the correction of which should prevent further trouble. A mixture wherein coal tar constitutes 80% of the whole now gives good results and separates very little.

Coal tar itself does not froth well. That is, the froth obtained from coal tar alone is very lean, although of good quality. For satisfactory results with coal tar alone the ore must be tied up in the machine for too long a period, and for this reason it is advisable to add a small amount of oil that has great frothing characteristics. Pine oil was the first to be employed for this purpose and has given satisfaction. The price of pine oil, however, is high and its use should be avoided when possible. Coal-tar products, such as cresol, creosote, etc., which formerly served alone, are now mixed with the coal tar to about 20%. The mixture thus obtained is excellent in both the pneumatic and agitation types of machine.

Coal tar alone gives low-grade tailings together with high-grade concentrates if the ore is treated long enough. Test B (Table 2) shows this. Here coal tar used alone, when floated for 45 min., gives concentrates assaying above 38% copper and tails 0.31% copper, of which 0.15% is oxide, thus leaving but 0.06% sulphide copper. In this case the concentrate plus the middling gave a product assaying 24%.

As a comparison with coal tar, the results of the same ore treated in exactly the same manner and under the same conditions (except cresol instead of coal tar) were used. Cresol was chosen only because it was the oil serving in the larger plant at the time the coal-tar experiments were made, and it was against this agent that coal tar was being tried out.

Of course all coal tars will not be found adapted to one ore, and there are probably some that are worthless for any ore. As the results show, some of the tars were useless, while others served admirably. Tars Nos. 1, 2 and 3 were from coals produced in the same field, the others being from coals of different fields, which fact may have some significance.

A tar may not give any results at all when used alone, but as soon as a very little of such an oil as pine oil is added, results are often obtained immediately. The amount of oil will vary according to the ore, grade of concentrates and tailings desired; 0.005% of it will work wonders on ore experimented upon. A large amount is beneficial to a certain point, when further addition is considered detrimental, as the grade of concentrates is lowered as the quantity of oil is increased. Of course the value of the tailings is lowered as well. It is a question of lost mineral against excess smelting charges on the concentrates.

Proportion of Tar Determined by Experiment

To produce good results both as regards concentrates and tailings, a certain amount of tar must be used, and this amount must be determined for each ore individually. More or less will be determined. For instance, Table 3 gives some idea of the proportion of tar to mineral that produces the best results. Other oils act in a similar manner.

In tests on three different kinds of tars we have, in Table 3, the comparisons of varying amounts of tar, the pine oil remaining a constant quantity with regard to its relation to ore. As the amount of tar increases in proportion to pine oil the amount of concentrate increases and the copper content of the tailing decreases. This may be on account of the proportion that coal tar bears to the mixture, or it may be because of the amount of oil resulting from increasing the amount of coal tar. In

every case the oils were introduced from a dropping-bottle and each drop meant about 0.005% of the weight of ore taken, so that as the mixture became richer in tar it also increased in bulk. To determine this fact the amount of coal tar was kept constant, while the quantity of pine oil was varied. This series of tests showed practically the same results as were secured by varying the tar; hence it must depend upon the amount of mixture employed. It seems to make no difference which we vary, so far as results are concerned, the prices of the products being the determining factors. The amount of oil required in every case is less than 0.1% of the ore, or a little less than 2 lb. per ton. These facts are confirmed in the commercial plant. More oil than this determined percentage leads to excess froth, which is hard to handle. Mixtures of coal tar with other frothing products have an effect similar to the pine-oil mixture. Along these lines there is a great amount of work being done, but until it is all ready for comparison there can be no comprehensive conclusions drawn.

TABLE 2 EFFECT OF VARIOUS TARS ON THE SAME ORE

Grams Concentrates	Time, Min.	Grams Middlings	Time, Min.	Copper in Concentrates, %	Copper in Concentrates and Middlings, %	Copper in Middlings and Tailings, %	Copper in Tailings, %	Tar No.	Test	Recovery Concentrate and Middlings, %	Recovery Concentrates, %	Remarks
32.0	60	12.0	15	29.3	24.2	0.40	0.22	1	A	88.7	78.2	Tar for concentrates, turpentine for middlings. Results are the average of three tests.
18.0	45	22.0	40	38.9	24.0	0.56	0.21	2	B	86.3	63.0	Tar for concentrates, turpentine for middlings. Results are from one test.
32.0	35	14.5	25	28.2	21.2	0.27	0.17	2	C	90.4	82.6	Tar: pine oil = 1 : 1 (mixture). Results are the average of two tests.
20.0	50	16.5	20	29.6	23.4	0.58	0.25	2	D	79.4	56.3	One drop (about 0.004%) turpentine added concentrates in addition to tailings. Results are the average of two tests.
11.0	40	18.0	15	21.2	26.6	1.15	0.43	3	E	68.3	20.7	Tar for concentrates, turpentine for middlings. Results are from one test.
28.5	15	25.5	18	30.0	18.1	0.38	0.22	3	F	86.0	75.8	Tar: pine oil = 1 : 1 (mixture). Results are the average of two tests.
8.5	50	24.5	25	22.0	23.9	1.18	0.38	4	G	73.7	34.5	Tar: pine oil = 1 : 1 (mixture). Half of mixture added before grinding; half after. Results are the average of two tests.
10.5	50	22.0	15	25.2	21.5	1.17	0.46	4	H	62.7	23.4	Tar: pine oil = 1 : 1 (mixture). All air added in mill. Results are the average of two tests.
13.5	50	23.0	25	28.6	21.1	1.00	0.48	5	I	67.2	33.7	Tar: pine oil = 1 : 1 (mixture) Half of mixture added before grinding, half after. Results are the average of two tests.
21.0	50	21.0	15	25.4	21.4	0.83	0.35	5	J	80.1	47.9	Tar: pine oil = 1 : 1 (mixture). All oil added in mill. Results are the average of three tests
12.0	20	45.5	20	33.2	15.3	0.98	0.34	6	K	77.4	35.4	Tar: pine oil = 1 : 1 (mixture). Half of mixture added before grinding; half after. Results are the average of two tests.
23.0	50	20.0	25	29.6	22.0	0.58	0.24	7	L	84.1	60.9	One drop (about 0.004%) turpentine added for concentrates in addition to tar Results are the average of three tests.
					Standard							
24.0	45	39.5	25	27.5	15.7	0.72	0.28	Cresol, No. 1	M	83.8	55.6	Cresol used in place of tar; turpentine used for middlings Results are the average of two tests
14.0	55	25.0	20	25.8	21.1	0.94	0.41	Cresol, No. 2	N	75.8	36.4	Cresol used in place of tar; turpentine used for middlings Results are the average of five tests.

Cresols used here are samples of two separate lots.

TABLE 3. EFFECT OF TAR VARIATION, PINE OIL REMAINING CONSTANT

Grams Concentrates	Time, Min.	Grams Middlings	Time, Min.	Copper in Concentrates, %	Copper in Concentrates and Middlings, %	Copper in Middlings and Tailings, %	Copper in Tailings, %	Tar No.	Test	Recovery Concentrate and Middlings, %	Recovery Concentrates, %	Remarks
7.0	15	28.0	15	32.2	19.6	1.15	0.55	3	A1	60.8	20.0	Pine oil (0.025%), tar (0.00%) of ore
17.0	15	23.0	15	35.4	22.6	0.65	0.25	3	A2	80.0	53.3	Pine oil (0.025%), tar (0.015%) of ore.
29.0	15	24.0	15	30.1	18.5	0.36	0.22	3	A3	86.8	77.2	Pine oil (0.025%), tar (0.030%) of ore.
34.0	15	19.0	15	27.6	18.9	0.30	0.22	3	A4	88.6	83.0	Pine oil (0.025%), tar (0.060%) of ore.
7.0	15	28.0	15	32.2	19.6	1.15	0.55	7	B1	60.8	20.0	Pine oil (0.025%), tar (0.00%) of ore.
10.0	50	30.0	15	22.1	21.5	1.25	0.38	7	B2	76.1	21.9	Pine oil (0.025%), tar (0.015%) of ore
15.0	50	21.0	15	27.6	23.4	0.88	0.31	7	B3	74.6	36.7	Pine oil (0.025%), tar (0.030%) of ore
19.0	?	29.0	?	29.9	19.7	0.76	0.25	7	B4	83.7	50.3	Pine oil (0.025%), tar (0.060%) of ore
5.0	50	12.0	15	15.5	22.0	1.41	1.03	6	C1	27.0	7.5	Pine oil (0.013%), tar (0.015%) of ore
9.0	50	24.0	15	21.6	23.3	1.25	0.49	6	C2	68.0	18.0	Pine oil (0.013%), tar (0.030%) of ore
16.0	?	35.0	?	20.7	16.8	1.00	0.30	6	C3	75.8	30.0	Pine oil (0.013%), tar (0.060%) of ore

TABLE 4 EFFECT OF PINE OIL VARIATION, TAR REMAINING CONSTANT

Grams Concentrates	Time, Min.	Grams Middlings	Time, Min	Copper in Concentrates, %	Copper in Concentrates and Middlings, %	Copper in Middlings and Tailings, %	Copper in Tailings, %	Tar No.	Test	Recovery Concentrate and Middlings, %	Recovery Concentrates, %	Remarks
11.0	40	18.0	15	21.2	26.6	1.15	0.43	3	D1	68.2	20.7	Tar (0.03%), pine oil (0.00 ore
18.0	25	23.0	15	31.2	22.2	0.66	0.19	3	D2	80.6	49.9	Tar (0.03%), pine oil (0.01 ore
28.0	15	27.0	20	29.9	17.7	0.40	0.22	3	D3	86.1	74.1	Tar (0.03%), pine oil (0.02) of ore
35.0	15	24.0	15	26.2	16.7	0.25	0.16	3	D4	87.2	81.1	Tar (0.03%), pine oil (0.0) of ore

Mohawk Mining Co.

The Mohawk Mining Co., Mohawk, Mich., for 1914 reports a profit of $132,053 from a production of 11,094,859 lb. of copper sold at 12.47c. per lb. Dividend payments amounted to $100,000, making a total disbursement of $3,275,000 in dividends to date. The company ended the year with a balance of quick assets amounting to $852,208. There were 665,852 tons of rock hoisted and 649,649 tons stamped. The production of concentrates amounted to 14,591,000 lb. The yield of the ore was 17.08 lb. per ton, or 0.854%. The total cost of producing copper was 8.58c. per lb., of which 0.35c. was for con-

struction and strike expense. The following table gives a record of the operations of this company for the last nine years:

Year	Tons stamped	Yield Lb Cu	Total Lb Copper Produced	Cost per Lb.	Profit	Dividends
1906	618,548	15 12	9,352,252	11.4c.	$763,302	$500,000
1907	640,777	15 77	10,107,266	11 6c.	398,405	900,000
1908	685,823	15 01	10,295,881	10 8c.	276,778	250,000
1909	819,019	13 73	11,248,474	11.2c.	223,691	300,000
1910	802,537	14 22	11,412,066	11 4c.	188,083	200,000
1911	802,548	15 07	12,091,056	10 4c.	269,506	175,000
1912	787,941	15 22	11,995,508	10 6c.	656,435	350,000
1913	866,458	15 76	5,778,235	13 2c.	123,839	500,000
1914	649,649	17 08	11,094,859	8 58c.	432,053	100,000

First Aid at Ray Consolidated

By J. T. More*

In keeping with the nation-wide impetus that is being given to first aid to the injured, the Ray Consolidated Copper Co., at Ray, Ariz., has instituted a regular course of training. This covers a period of six weeks, one lesson a week being given to each class. The course follows very closely that given by the United States Bureau of Mines. The first lesson covers a general discussion of first aid, its aim and scope; the bones of the body, illustrated with a skeleton; the circulation of the blood, arterial and venous bleeding, the location of "pressure points"; the respiratory system; the nerves; the muscles; "don't's" in first aid (under this head the men are impressed with what *not* to do—the rudiments of surgical cleanliness, don't wash or touch wounds); first-aid treatment for shock; the application of the triangular bandage. The second lesson covers strains, sprains and dislocations and the bandaging of breaks without splints, such as the lower jaw, shoulder-blade, collar-bone, ribs and pelvis. In the third lesson the splinting of broken bones is taken up and demonstrated. The fourth lesson is given up to the handling of injured persons; carries with stretchers—army and improvised; carries without stretchers. The fifth lesson covers artificial respiration, and the sixth is a general review. During the whole course the men actually perform first aid on a patient for supposed injuries. Upon finishing this course the men are given the Ray Consolidated Copper Co. diploma and a gold first-aid watch charm engraved with the owner's name.

Challenge Cup Stimulates Interest

The men are encouraged to organize first-aid teams, each to consist of a captain and five men. These teams compete in local contests for the "Ray" cup. This cup is held by the winning team and their names are engraved upon it. At the next contest it is again offered as award and so on until some one team succeeds in winning it three times, when it becomes the property of this team. The interest in these contests runs high and the competition is keen.

The first local contest was held May 5. Four teams entered. G. W. Sansbury, safety inspector of the United Verde Copper Co., Jerome, Ariz., acted as judge. Rules and discounts as outlined by the American Mine Safety Association were followed. No. 1 Team was composed of surface men, mostly machinists; No. 2 Team, miners representing No. 2 mine; No. 3 Team, Mexican miners from No. 3 mine; No. 4 Team, miners from No. 1 mine. The following is a list of the events:

One-Man Event—A man shoots in the face of a drift on going off shift. He is caught by powder smoke from the outside and is overcome. Falls and receives a severe laceration on the head. One man recover, carry 50 ft. and treat condition.

Two-Man Event—A miner is caught by a fall of rock. Two men working with him escape. They go back for the injured man and find that there are still dangerous slabs left in the back. Injuries sustained are as follows: Right ear scraped, right shoulder and right side of chest scraped with long shallow cuts and a simple fracture of the upper third of the right forearm. Two men recover patient and treat condition.

Three-Man Event—A mucker picks into powder in a muck pile in an openpit workings, exploding the powder. Injuries received are as follows: Face and both eyes filled with small rocks; right hand and wrist badly lacerated with severe bleeding; fifth and sixth ribs on the left side broken at the front and the right knee badly wrenched. Three men treat condition.

Team Event—A miner is working in a timbered stope. A rock falls from the back, breaking the flooring he is standing on and letting him drop two sets to a muck pile beneath. Injuries sustained are as follows: A fracture of the third, fourth and fifth ribs on the right side; a compound fracture of the lower third of the right thigh with severe bleeding; scalp wounds and the upper half of the right ear torn loose; small cuts about the right eye and a deep, short cut on the left thigh above the knee with severe bleeding; man unconscious but breathing. Team treat.

Mexican Team at a Disadvantage

The teams were given two minutes in which to discuss the problem at hand. No. 4 Team (R. T. Fees, captain; A. Anderson, D. Rebstock, J. A. McRae, H. C. Penney, E. R. Russell) won the contest with a score of 91.6%; No. 2 Team was a close second, No. 1 Team third and the Mexican Team fourth. There was but one man on the Mexican team with a thorough knowledge of English, and it was necessary for him to translate the problem and carry on the discussion in the two minutes. Under the circumstances this team did excellent work. In view of the fact that none of the teams had practiced more than three months, the showing made was very gratifying.

There were six teams entered in the second contest, held June 18. J. C. Roberts, mining engineer, United States Bureau of Mines, acted as judge. Due to the fact that it was impossible for a person to judge six teams at one time, the following method of procedure was adopted: The six teams were divided into two squads (*A* and *B*) of three teams each, this division being made upon a basis of time spent in practice; but two events were given, a two-man and full team; squad *A* performed first in the presence of squad *B*, then *B* worked a similar event in their presence; squad *B* then performed the full-team event first, squad *A* following with a similar problem; the highest team in the two events in each squad was given an elimination team event to decide the winner of the cup. These events were written in English and Spanish in an effort to overcome the handicap under which the Mexican team had worked in the first contest.

The *A* squad worked the following problem: Two-Man Event—Man caught by fall of rock. Scalp wound on top of head above right ear, severe bleeding. Compound

*Safety inspector, Ray Consolidated Copper Co., Ray, Ariz.

fracture of left forearm, midway between elbow and wrist, accompanied with severe bleeding. Fifth right rib broken, simple fracture. Patient is unconscious but breathing. Treat and carry 50 ft. without stretcher.

The *B* squad followed this with: Two-Man Event—Man caught by fall of rock. Left ear torn nearly off, bleeding. Compound fracture of right arm, midway between shoulder and elbow, severe bleeding. Bones of left hand crushed. Patient unconscious but breathing. Treat and carry 50 ft. without a stretcher.

Event for Full Team—*B* squad: Patient has cut fuse too short and blast occurs while he is going out. Air bad, candle will not burn. Patient is found 20 ft. from face of drift unconscious from bad air, not breathing. Back of head, ears, shoulders and back of arms badly burned. Compound fracture of right thigh just above knee. Treat and carry 50 ft. on stretcher.

Event for Full Team—*A* squad: Patient has cut fuse too short and blast occurs while lighting other shots. He is found near face of drift with the following injuries. Patient unconscious, not breathing. Severe burns on face, neck and arms (in front only). Simple fracture of right thigh, midway between knee and hip. Simple fracture of left leg, midway between knee and ankle. Air is bad in drift, candle will not burn. Treat and carry 50 ft. on stretcher.

Elimination Event—Man falls down 30-ft. winze. In bad air when found, unconscious (not breathing); candles will not burn. Suffers compound fractures of both thighs above knees. Right collar-bone broken. Treat and carry 50 ft. on improvised stretcher.

Close Scores by Leading Teams

The following will show the preliminary scores of the various teams: Squad *A*—Team No. 1 (No. 1 Mine, American), 92.2%; Team No. 2 (No. 2 mine, American), 93.2%; Team No. 3 (Surface), 83.0%. Squad *B*—Team No. 4 (No. 3 Mine Mexican), 89.0%; Team No. 5 (No. 2 Mine Mexican), 80.6%; Team No. 6 (Engineering), 92.4%.

The scores made on the elimination problem were: Squad *A*, Team No. 2 (No. 2 Mine American), 94.0%; Squad *B*, Team No. 6 (Engineering), 91.0%.

It will be noticed that Teams Nos. 1, 2 and 6 had scores almost identical although they did not all work on the same problems. No. 4 Team raised its score from 64.6% to 89.0% in six weeks' time, while No. 5 Team made a score of 80.6% at its first appearance on the field.

The men have shown their skill not only in contest work but also in actual service. By far the great majority of accidents, whether on the surface or underground, are given first-aid treatment before the patient is seen by the doctor. First-aid cabinets are installed in different sections of the mines and in centrally located points on the surface, and the 200-odd men, either wholly or partially trained, have at all times shown great willingness to help.

Costa Rica Now Imposes an Export Duty of 15% ad valorem on all gold bullion of Costa Rican origin. Each gold-mining establishment in the country must make a monthly report of production and must deposit with the Secretary of the Treasury bills of exchange sufficient to cover export duties, against which such duties will be charged. No exportation will be allowed until satisfactory deposits have been made.

Kowkash Gold District*

Kowkash station is 297 mi. west of Cochrane, Ont., on the National Transcontinental Ry. The recent gold discovery lies 9 mi. northwesterly from Kowkash station, near Howard Falls, on the Kawa-kash-kagama River.

The country is of low relief and consists of rocky hills up to 100 ft. or more in height, separated by large swamps, semi-muskegs and sand and gravel areas. The rocky hills are covered with a dense growth of small timber and moss and sometimes large loose boulders, which make prospecting somewhat difficult. The height of land at Redmond, 15 mi. west of Kowkash station, has an elevation of 1,122 ft. This northwest-and-southeast divide separates the waters of the Great Lakes from those of Hudson Bay.

History and Early Exploration of the Region

The gold discovery occurs on the river which the Indians call Kawa-kash-kagama, which signifies sparkling water. This name has been shortened to Kawashkagama by the Geographic Board. The National Transcontinental Ry. has further shortened the word by naming the station Kowkash, which the propectors have likewise done to the name of the river—hence the name of the new gold area.

The part of the Kowkash River near the gold find was examined by Dr. R. Bell and is described in the annual report of the Geological Survey of Canada for 1870-1; also by party No. 5 in a report entitled "Exploration of Northern Ontario," issued by the Ontario Department of Crown Lands, 1900, p. 156. In this report E. V. Neelands, geologist with party No. 5, blazed the way for the prospector when he stated "Huronian rocks, mainly chlorite and other soft green schists, occur on the Kawa-kash-kagama (Kowkash) River from about 4 mi. below the Wawong portage to the northern limit of exploration (Howard Falls). The most promising district is the country on the Kawa-kash-kagama River below the Wawong portage. Here Huronian exposures are numerous, mostly chlorite and other soft green schists. Several samples from small quartz veins in this district showed traces of gold, and it might be that careful prospecting in this district would be rewarded." W. J. Wilson and W. H. Collins' map. No. 964, published by the Geological Survey, Ottawa, which roughly outlines this Kowkash Keewatin area, is being much used by the prospectors at the present time.

E. W. King Dodds made his spectacular gold discovery on Aug. 21, 1915, when walking over the rocky hill below Howard Falls, which had been burned clean of moss and trees on the previous day. The news of the spectacular ore caused a rush of about 400 prospectors to the neighborhood, and about 75 to 100 claims were staked within three weeks.

General Geology of the Region

In the Kowkash area is a belt of Keewatin rocks 10 to 15 mi. wide and extending from the north end of O'Sullivan (or Sesekenaga) Lake in a southwest direction through Howard Falls and across the height of land at Redmond. This whole Keewatin area is worth prospecting for gold. For miles around this Keewatin belt are Laurentian granite and gneiss rocks.

*Abstract from a report by Percy Hopkins, Assistant Provincial Geologist of Ontario.

The Keewatin formation is largely massive, composed of fine-grained green chlorite and hornblende rocks, which are in places altered to schist. Some of the chlorite rock is altered diabase. Numerous exposures can be seen along the Kowkash River from 3 mi. below where Johnson Creek enters the Kowkash to within a mile of the driftwood portage. Altered basalts showing the pillow or ellipsoidal structure are common. They are well exposed from Howard Falls to beyond the Dodds gold showing, on the portage below Howard Falls and around O'Sullivan Lake. With the basalts are small agglomerate areas. Cutting these greenstones are numerous white-weathering quartz-porphyry dikes up to 30 ft. or more in width. They contain in a gray to green fine ground mass numerous white-quartz phenocrysts the size of peas.

Porphyry Resembles Porcupine Quartz Porphyry

The porphyry contains some quartz stringers, is schistose in places and resembles the quartz porphyry at Porcupine, Goodfish Lake and north of Schreiber. The main exposures seen extended for a mile eastward from Howard Falls and around O'Sullivan Lake. About 2 mi. below Howard Falls and one chain from the left bank is a large hill which has been recently burned. The south fringe of the exposure is a slate and conglomerate similar to the Timiskaming sediments in Porcupine, Kirkland Lake and Munro Township. The sedimentaries dip vertically and strike 25° north of east. The slate is very cherty. The pebbles of the conglomerate are drawn out and consist of chert, quartz porphyry, amygdaloidal basalt and gneiss. North of the sedimentaries is a large volume of massive pillow lava. Around the center portage between Abamasagi and O'Sullivan Lakes is a fine slate-like biotite and chlorite schist striking 35° east of north and dipping from 50 to 80° southeastward. This may be of sedimentary origin. At the last portage into O'Sullivan Lake is an actinolite rock, below which are numerous massive serpentine exposures. A gabbro and diabase, probably the youngest rock in the area, occurs about 300 yd. north of the Dodds gold find. Dikes a foot in width also cut the basalt on the Dodds claim. The direction of ice movement was 35 to 40° west of south.

Description of King Dodds' Discovery

Dodds' gold quartz vein, which is the only reported discovery up to the present, is ⅝ mi. below Howard Falls and 800 ft. north of the river. The vein strikes 8° south of east and appears to dip 75 or 80° to the north, thus conforming in strike and dip with the country rock. The vein, which is somewhat lenticular, is up to 4 or 5 in. in width and can be traced about 10 ft., ending in drift on either end. The quartz is glassy and largely free from sulphides. Spectacular gold was seen in place over an area about 5 in. long and 1 in. wide. This showing extended 5 in. along the hanging-wall side of the vein. Similar and richer specimens were reported to have been taken from the 4 or 5 ft. adjacent to the showing. On the hanging-wall side of the vein is a rusty schist band 6 in. wide and heavily mineralized with fine pyrite. The wall rock is pillow lava (basalt), which is altered to schist in places. A mineralized quartz-porphyry dike occurs about a chain southeast of the gold showing.

All the information on the area is being compiled by the Ontario Bureau of Mines, and a map will be published.

Engineering Congress Meetings in San Francisco

Editorial Correspondence

The mining industry is still the chief attraction in San Francisco and at the Panama-Pacific Exposition. The American Institute of Mining Engineers concluded its technical sessions on Sept. 18, and on Saturday visits were made to the deep gold mines at Grass Valley, the gold dredges at Oroville, the oil fields at Coalinga, with a yacht cruise on San Francisco Bay and a visit to the Selby smeltery. On Sept. 20 the American Mining Congress began its 18th annual session at the Civic Auditorium, closing on Sept. 22. The International Engineering Congress also met on Sept. 20, concluding on Sept. 25. The California Metal Producers' Association held its initial field meet for demonstration of first aid as taught by the Bureau of Mines, on Sept. 22. This will be the initial annual meet of California teams under the auspices of the Metal Producers' Association.

The third annual joint field meet of first-aid and mine-rescue teams under the auspices of the Bureau of Mines began on Sept. 23 and concluded on Sept. 24. During the two weeks there have been in attendance at the conventions and the demonstrations at the exposition a large number of mining men engaged in the various branches of the industry, from all parts of the United States and some foreign countries. Probably the number of mining men in San Francisco and visiting the exposition within this period is larger than has been assembled at any other point for a number of years.

Mineral Resources of Hunan

A report from United States Consul N. T. Johnson at Chingsha, China, after referring to the antimony mines of Hunan and stating that this business is again on a competitive basis, says that lead and zinc are being mined in the mountains near Sung Peh, on the Siang River, about 30 mi. south of Hengchow. A 3-mi. narrow-gage railway is used to carry the ore down to the river. The machinery is mainly of German origin, and it is understood that Carlowitz & Co. have invested about 600,000 taels in the mine and that they take most of its output. In the dressing plant 2,000 coolies are employed. Some of the mining is done in the old Chinese way; however, they are working four modern shafts, one being about 800 ft. deep. The mines, employing probably 5,000 men, are entirely under the management of two Cantonese, both trained in the coal mines at Ping Hsiang.

Saltpeter is found in Yung Hsunfu, Lung Shan, Sang Chih Shihmen and Tzu Li. Large quantities of firecrackers are manufactured in the neighborhoods of Siangtan, Changsha and Changteh, thereby creating a demand for this chemical.

Coal is found in the valley of the Siang and in the western part of the province about Shenchow and Yuanchow. That from the Tzu River, in the district about Paoking, finds its way down the river through Tungting Lake to Hankow.

Deposits of iron are worked by the natives at Chin-chou, near the southern border of the province. The mineral wealth of Hunan is just being tapped, and its possibilities are almost without limit.

American Institute of Metals

EDITORIAL CORRESPONDENCE

Among the interesting papers presented at the meeting of the American Institute of Metals, Atlantic City, on Sept. 29, was one treating of "The Effect of the Present European War on the Metal Industry," by T. F. Wettstein, of the United Lead Co., New York. In the discussion of this paper it was brought out that under normal conditions this country supplies its own demand of zinc, but leaves nothing much for export. The destruction of the Belgian and Silesian zinc industries then leaves a total of about 150,000 tons of the normal demand to be supplied for foreign nations. At the present time, because of its use in war, the demand for zinc is 10 times the normal amount. It was also brought out that the common grades of the metal have increased much more, comparatively, in price than the high-grade material. The premium on high-grade is normally up to about 40%, whereas at the present it is not over 30%. Some common grades of zinc are redistilled in order to secure a high-grade product, but redistillation does not affect the cadmium, which remains in the product. Cadmium runs up to 0.2, 0.3 and 0.4% in the redistilled material. The element is objectionable because it interferes with its utilization for many purposes.

A paper presented by Dr. S. Trood, of the United States Sherardizing Co., New Castle, Penn., on sherardizing methods, was one of wide interest, in that he described the necessity for the presence in the zinc thus used of a certain percentage of zinc oxide, not less than 8%, according to Doctor Trood; the service of the zinc oxide being to protect the zinc from melting and becoming a liquid and unmanageable mass under the required heat. Doctor Trood showed the possibility, owing to the presence of this oxide, of the passage of zinc from the solid to the gaseous state without passing through the liquid form. It was shown also that the continued re-use of zinc for sherardizing involved the accumulation in it of particles of iron, and these would rust upon exposure of the article to the air, forming an unsightly coating, although the protection to the iron of the article itself was no way impaired.

Papers on "Electric Furnace for Brass Melting" and "Substitutes and Alloys to Take the Place of Platinum" were not presented, and a paper on the "Alloys of Nickel, Chromium and Copper," by D. F. McFarland and O. E. Harder, of the University of Illinois, was read.

At the afternoon meeting an interesting paper on aluminum die casting was read by Charles Pack, of the Doehler Die Casting Co., Brooklyn, N. Y. The process of die casting was described, and the wearing effect upon the dies (for which a suitable metal is being sought) was discussed in detail. There was then read a paper upon the Manufacture and Use of Alumino-Vanadium, by William W. Clark, of the Seymour Manufacturing Co., Seymour, Conn.

D. V. Pannell, of the British Aluminium Co., Toronto, Ont., read a paper on "Recent Advances in the Manufacture and Uses of Aluminum." This process described the mechanical handling and working of aluminum, both as to drawing into wires and its use for other articles of commerce. In addition Mr. Pannell gave a thorough account of the requirements for welding aluminum, a process which is being practiced successfully by his company. A paper on "Aluminum-Bronze Alloys" was then read by W. M. Corse, of the Titanium Alloy Manufacturing Co., Niagara Falls, N. Y.

The papers listed for the Thursday meetings were as follows: "Development of an Acid-Resisting Alloy," by S. W. Parr, University of Illinois, Urbana, Ill.; "Methods of Analysis for Complex Alloys," by S. W. Parr, University of Illinois, Urbana, Ill.; "Effect of Zinc on Copper-Tin-Lead Alloys," by G. B. Clamer, Ajax Metal Co., Philadelphia; "The Advantages of a Standard Railway Journal," by Russell R. Clark, Pennsylvania R.R., Pittsburgh, Penn.; "Forging Manganese Bronze," by Jesse L. Jones, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn.; "The Failure of Structural Bronzes," by Dr. P. D. Merica, Bureau of Standards, Washington, D. C.; "Experiences with Brass in Civil Engineering Work," by A. D. Flinn, Board of Water Supply, New York; "Stellite," by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

Composition of Graywacke

Graywacke is a general term used in the field to designate certain obscurely bedded, in places much-altered, greenish rock, which ranges in texture from distinctly conglomeratic to aphanitic. Some of the finer-grained graywackes can with difficulty be distinguished from igneous rock. The result of field study led to the inference that the graywackes consist largely of igneous material worked over mechanically, but not greatly decomposed before deposition, and this inference is confirmed by microscopic study. Since their deposition, however, they have been in places greatly changed by shearing, brecciation and the development of secondary minerals. The degree of metamorphism necessary to convert a certain rock into a graywacke has not been determined or defined.

The United States Geological Survey[1] gives the following description of conglomeratic specimens of graywacke examined by it: The broken surface of the rock of one specimen, with the appearance of augite lamprophyre, showed bedding and pebbles. The slide showed the graywacke pebble to consist of fragments of augite, hornblende and feldspar in a dusty chloritic matrix. In some specimens the matrix is too fine-grained for determination. The material as a whole seems to be like that of broken-down, but not greatly altered, porphyry.

Another specimen, resembling basalt in appearance, was found to contain minute prisms of hornblende in a much finer-grained matrix; secondary hornblende and epidote were also found. Another specimen was described as dark greenish-gray, mottled with dark red, having a brecciated appearance. The microscope showed that the red patches were fragments of acid porphyries in which phenocrysts of feldspar were contained in a ground mass almost entirely calcite and chlorite. The matrix of the graywacke consisted of fragments of feldspar cemented by calcite and chlorite. Another specimen was a dark greenish rock, the only distinguishable structure being an irregular cleavage of hornblende and light aphanitic rounded or subangular patches. A weathered surface of this rock was light colored and chalky, with distinct fine-grained patches. Epidote and magnetite were abundant.

[1]Professional Paper 87, "Geology and Ore Deposits of Copper Mountain and Kasaan Peninsula, Alaska," 1915.

Details of Practical Mining

Shaft-Sinking with Jackhamers

By Leroy A. Palmer*

At the Black Oak mine in the "Soulsbyville granite" near the Mother Lode, jackhamers have replaced piston machines in shaft-sinking with a reduction of costs, air consumption, etc. Delay-action exploders have also been of assistance in sinking this shaft.

To the miner of the Mother Lode and the adjacent districts "Soulsbyville granite" conveys a meaning that cannot be amplified by a wordy description. Many of them know it from experience and all by reputation. It is the name given to the rock in the vicinity of Soulsbyville, Tuolumne Co., Calif., in what is known as the "East Belt," lying a few miles to the east of the Mother Lode proper. This rock is a typical gray granite, shading into grano-diorite and containing intrusions of diorite. It is extremely hard.

The Black Oak mine is situated a mile from Soulsbyville in this granite area and is operated through a shaft which has just reached the 1900 level, work on sinking the sump being now in progress.

The shaft was carried to the 1600 level with piston machines; then it was decided to try jackhamers. Inasmuch as a careful comparison of the work of the piston machines in sinking from the 1500 to the 1600 with that of the jackhamers in sinking from the 1600 to the 1700 was in favor of the latter, the work was continued with the lighter machines. The piston drill was a standard type of 3-in. machine.

Four men were used on a shift in each case—in the one, on two piston machines, and in the other, each with a jackhamer—and it was found that the daily progress was increased approximately 25% by using the jackhamers. No attempt has been made to formulate a comparison of the air used but it is known that the four jackhamers consume less than the two piston machines.

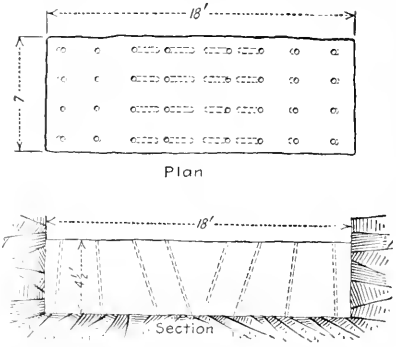
The shaft consists of two compartments and a manway, being 7x18 ft. overall and 5x15 ft. in the clear. It is on a very steep incline which averages from 65 to 70 deg. An ideal round, drilled to break 4½ ft., is shown in the illustration. It consists of 32 holes, two sets of cut-holes, eight to a set, and two sets of side rounds of the same number. The procedure is to put in the inner cut-holes, blast them and muck out before drilling the rest of the round. The outer cut-holes and the side rounds are then put down and if there is time, as is usually the case, another set of shallow cut-holes is drilled in the sump formed by shooting the first series of cuts. It has been found that this system of breaking the cut, then deepening the cut and shooting with the remainder of the round, has increased the progress of sinking about half a foot per round.

Drilling and mucking of the inner cut-holes is all done on one shift by four men. The next two shifts are given over to the muckers who clean out the shaft and get it ready for the drillers. The mucking shifts consist of two muckers and an engineer for the donkey hoist on each shift.

Of course the placing of the holes is varied to suit conditions as they are found in the shaft and it sometimes happens that as many as 35 holes are put down for the side rounds but the illustration shows a typical round. In all of the holes 60% dynamite is used.

The present arrangement of doing all drilling on one shift and mucking on the other two has been very satisfactory. It calls for a total of 10 men including an engineer on each of the two mucking shifts to hoist the broken rock from the bottom of the shaft to the 1600, where it is used for filling. The same headway has been made thereby as previously when there were four miners on each shift, drilling or mucking as occasion required.

The men are paid on a bonus system. The regular wages are $3.75 per day to one of the miners who acts as shaft



ARRANGEMENT OF HOLES IN BLACK OAK SHAFT

foreman, $3.50 to each of the other miners and the engineers, and $2.75 to the muckers. The miners each receive 25c. a day bonus for every month in which the shaft is sunk over 60 ft. and the muckers the same allowance for every day that they get the shaft cleaned out on time for the drillers to go to work.

During March, 1915, the shaft was sunk under the old arrangement of shifts, four miners on each shift drilling or mucking as the case might be. During this month the cost of sinking was $35.56 per ft. In April the shifts were rearranged, as noted, so that all drilling was done by miners on one shift and the shaft cleaned out by muckers on the following two shifts. For the first week under this arrangement of shifts the costs were brought down to $27.00 per ft. These are what the management refers to as "direct costs"; that is, cost directly chargeable to the shaft. They include timbering and hoisting from the 1900 to the 1600, but tramming on the 1600 is charged to stope filling. In view of the size of the shaft and the extremely hard rock in which it is sunk they can only be regarded as favorable.

*Mining engineer, 512 Custom House, San Francisco.

Several records have been kept of the progress in drilling with these machines. All measurements were taken during the regular progress of shaft-sinking and with one man doing all of the work in connection with his machine; in other words no attempt was being made to establish a record. Measurements taken in a very hard rib of grano-diorite in the south end of the shaft showed a drilling speed of from 1.09 to 2.13 in. per min. on holes from 2½ to 5 ft. in depth and at all angles from flat to nearly vertical; an average for four holes was 1.64 in. per min. Allowing 32 holes to a round, which is to break 4½ ft., it will be seen that with four machines there is ample time for shooting the center cut, mucking out, drilling the side rounds and shallow cut-holes. In this connection it should be borne in mind that the actual percentage of drilling time is greater with a machine of this type than with a heavier machine.

Of course it is understood that the efficiency of the jackhamer is not due to superior drilling speed but to the ease with which it is handled. Careful records made at the Buckeye-Belmont mine at Tonopah showed that the actual drilling time in sinking the shaft with piston machines was only 160 min. per 8-hr. shift. The men wasted no time but they spent two-thirds of the shift in getting ready to drill and then in getting ready to shoot. A certain percentage of this loss, such as connecting ventilating pipe, changing steel, loading, etc., will be practically constant under any conditions. But it will be found that the greater portion of the loss is chargeable to setting up, tearing down and shifting the machine from one set-up to another. All of this loss is avoided with the jackhamer, which weighs only 40 lb.; and when the shift is ready to shoot, each man simply takes his machine into the bucket with him and the whole lot is hoisted away.

At the Black Oak shaft, ventilation is accomplished by an 8-in. Sturtevant fan on the 1600 level and compressed air at 85 to 95 lb. by an Ingersoll-Rand two-stage compressor, 11x9-16 in., belted to a 150-hp. motor. Considerable water is found in the upper levels but the shaft is dry.

The Black Oak has also used the jackhamers to some extent for drifting. They were mounted on the shell of an old machine on a vertical bar. Two of them, with one man to each, made better progress with less air than two men with one 3-in. piston machine. Detailed records of these trials were not kept.

In connection with this shaft it is well to mention the use of delay-action exploders, to which the management is inclined to give much credit for the progress made, inasmuch as they have facilitated the firing of the shots. The "Ideal" delay-action exploder consists of a detonator, a time-fuse—whose length is chosen to suit the position of the hole—and an electric fuse-spitter to which is connected two copper wires. The detonator is placed in the cartridge in the usual manner and the copper wires attached to the fuses are connected in series, each end of the series being run to a wooden plug in a shallow hole at one end of the shaft. At these plugs connections are made with the two ends of an electric-light line brought down the shaft for this purpose. The exploder switch is in a locked box on the 1600 level, the key to the box being in the possession of the shaft foreman. There are no openings in the box for the wires leading down the shaft, so the door must be unlocked and opened before the wires are connected to their binding posts, and likewise they must be disconnected before the door can be closed. As a further precaution the switch is so arranged that the door cannot be closed unless the switch is open.

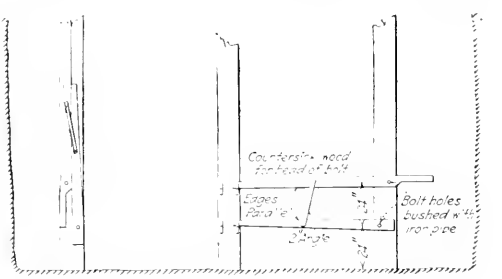
Thus the shaft men, after loading their holes and making the connections to the light line through the plugs, may leave the shaft leisurely. When the 1600 level is reached the shaft foreman goes to the switch box, opens it, connects the light-line wires to their binding posts and fires the round by closing the switch. Before he can close the door he must open the switch and disconnect the wires. Missed holes by this method are extremely rare; and it is certainly an improvement over spitting a round of holes with a candle or acetylene lamp, with the smoke so thick that one can hardly see, and then scrambling hurriedly into the bucket or up the ladder to reach a point of safety.

The writer acknowledges the courtesy of Roger Knox, superintendent, and J. H. Tate, engineer, of the Black Oak Mining and Development Co., in assisting in the collection of these notes.

Simple Folding Shaft Gate

By Fredlrick T. Teddy*

The simple shaft gate shown herewith has been in use for some time at the mines of the Tennessee Copper Co., Ducktown, Tenn. It has proved effective, as well as inexpensive in construction and maintenance. I suggested



A SIMPLE FORM OF SHAFT GATE

this gate as eliminating the undesirable features found in the usual gates that swing horizontally and others with counterweights that give more or less trouble.

The essential parts of this gate consist of two wooden rails and a short length of angle iron. The rails should be of hardwood, of 2x6-in. section, dressed on all sides and tapered to 3-in., one of the rails being longer, to provide a handle with which to raise the gate.

The gate is supported or hinged by means of lagscrews or bolts, and the bearing holes should be bushed with iron pipe. The diagonal tie iron should be a 2-in. angle section, and the spacing of the bolt holes in it must be the same as the straight-line distance between the supporting lagscrews. The corresponding holes in the bars must measure the same from the bushed bearings.

In erecting the gate it is preferable first to determine the position of the lagscrew or bolt for the top rail, and

*Mining engineer, Box 143, Ducktown, Tenn.

to swing the gate on it to the up position, bringing the lower bar parallel with the upper one, letting them incline backward a little. This fixes the position of the lower supporting screw. The gate may now be lowered and the brackets set in place.

Chart of Relative Values of Fuels*

In estimating the relative steaming values of fuels of different calorific values consideration must be given to the boiler and furnace efficiencies attainable. In any instance the equivalent evaporation in pounds of water evaporated from and at 212 deg. F. per pound of coal would be

B.t.u. per pound of fuel × *per cent. of efficiency* ÷ *latent heat of steam at 212 deg. F.*

The chart herewith has been prepared to save tedious calculations. Slanting straight lines represent the calorific value of fuel in thousands of B.t.u. per pound, each line being so drawn as to pass through points whose ordinates represent boiler and furnace efficiencies and whose abscissas represent the equivalent evaporation from and at 212 deg. F. per pound of coal.

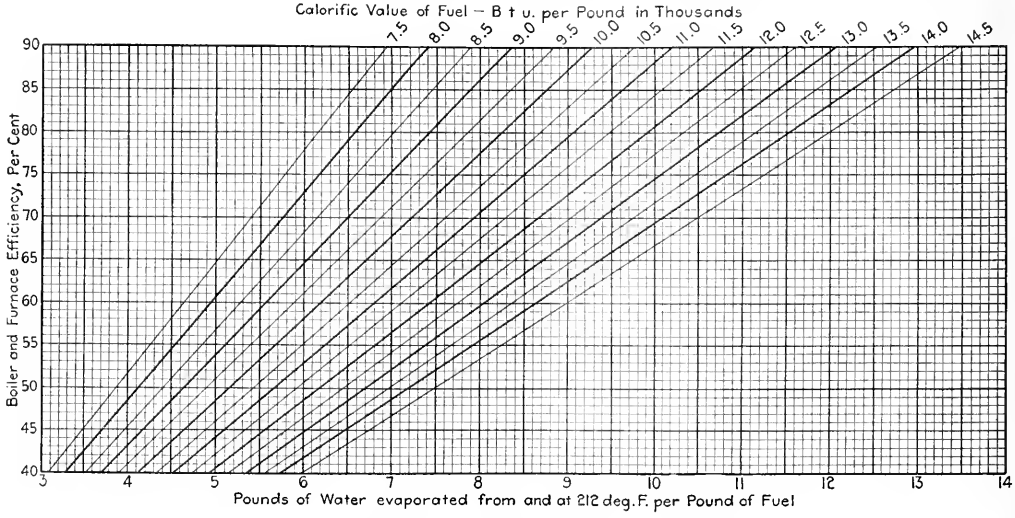


CHART FOR CALCULATING THE RELATIVE VALUES OF VARIOUS FUELS

To read the chart, start at the left-hand side at a given percentage of efficiency, as 70, and following along horizontally to the intersection with the inclined line representing the thousands of B.t.u. per pound of fuel, as 14, and then follow vertically downward to find the value 10.1 pounds of water evaporated from and at 212 deg. F. per pound of the coal, which for most practical purposes would serve the same purpose as the arithmetical solution,

$$\frac{14{,}000 + 0.70}{970.4} = 10.098$$

*By Richard A. Rover, in "Power" of Sept. 28, 1915.

Fuse Spitting with a Match

The following method of lighting a single black-powder time fuse is suggested by the United States Bureau of Mines as being more efficient than the old method of splitting the end of the fuse. The method is adopted when only one piece is to be lighted. It is not applicable when several pieces are to be lighted, as the time interval between ignitions would be too long.

A safety match is held against the powder core at the end of the fuse and the matchbox drawn across the match, causing the match and powder core to inflame immediately. It will be noted that this is just the reverse of the usual way of lighting a match—drawing the match across the box.

In case safety matches are not at hand, the ordinary household match can be used by placing one match against the powder core and then lighting another and quickly touching it to the first one.

It is believed that the method outlined, originated by W. C. Cope, of the explosives chemical laboratory of the bureau in Pittsburgh, as the result of experience obtained in the igniting of hundreds of pieces of black-powder fuse, will be helpful in quarrying and other outside work. It has the advantage of cheapness, as no fuse lighters are required.

Mullan Hand-Drilling Contest

The results of the double-hand drilling contest held at Mullan, Idaho, on Labor Day, were as follows:

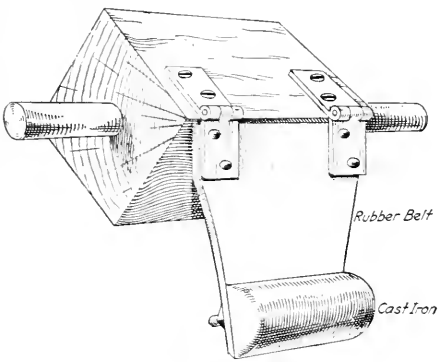
First place, Leaf and Kinsella, of the Tamarack-Custer mine, 30⅝ in.; second place, St. Germain and Stokes, of the Osborne, 28¼ in.; third place, Haff and Rosseman, of the Stewart mine, 27⅛ in.

The rock drilled in is granite. The first prize was $200. There are said to have been about 5,000 people in Mullan for the celebration.

Details of Milling and Smelting

A Simple Conveyor-Belt Cleaner

When ores are wet or when they are of a sticky, tenacious nature, they are likely to cause considerable annoyance by their tendency to cling to conveyor belts, refusing to be discharged at the proper point, but riding around on the belt in a continuous performance. A good many schemes have been tried in attempting to counteract this tendency—that is, to remove the ore from the belt as it passes the discharging point—but most of them have failed for one reason or another. Wire brushes have been tried, but they have a tendency to clog up and also to cut and destroy the conveyor belt. Scrapers are also dangerous, since they may occasionally catch in a small snag in the belt and are likely to ruin it utterly. At the Gold Hunter mill, near Mullan, Idaho, a contri-



THE CONVEYOR-BELT CLEANER

vance has been devised, however, which seems to have been entirely successful.

The appliance consists of a square wooden block with a hole through it, the block being mounted on a shaft and acting like a pulley. Fastened to one of the corners is a strap hinge with its free end bolted to a piece of rubber belt at the end of which is fastened a small half-circular iron casting. The idea is that this pulley revolves fast enough to keep the belt standing out from the pulley far enough to strike the conveyor belt at every revolution. The round casting face hits the conveyor belt a sharp rap, jarring loose whatever ore or clay may be sticking to it. Owing to the presence of the hinge, after striking the conveyor belt the piece of belting with its attached casting falls back against the square face of a pulley, avoiding all dragging or rubbing on the conveyor. Since the blow struck the belt is sharp and sudden and does not drag or wipe the belt, no damage results to it and there seems to be no objection whatever to its use. The appliance is mounted over the ore bin into which the conveyor belt discharges, thus insuring that all of the ore is delivered at the proper point.

Rotary Kilns for Desulphurizing and Agglomerating

Rotary kilns have been used for the preparation of iron ores for blast furnaces for a decade or more, but during the last few years they have been introduced also into copper metallurgy. The design and application of such kilns for the desulphurization and agglomeration of iron ores are discussed[1] by Samuel E. Doak, and while his remarks apply mainly to the treatment of pyrites cinder and other fine iron ores, they nevertheless contain a record of practice that might profitably be considered by the copper metallurgists.

In the case of lump or fine iron ores carrying not to exceed from 6 to 7% of sulphur, the desulphurization can be combined with agglomeration, provided the kiln is sufficiently large. The process is a simple roasting, with the addition, in the case of fine ores, of a nodulizing or agglomerating operation, performed near the discharge end of the kiln, at a higher temperature than is necessary for the desulphurization. If the kiln is not forced beyond its capacity, there is no difficulty in reducing the sulphur to less than 0.5% in the finished product. (In modern practice the sulphur content of the pyrites cinder is rarely as great as 6, and seldom lower than 1½%.)

As far as the desulphurizing action is concerned, the principal caution to be observed is not to allow the kiln to get too hot at the back end. To get a dead roast, the operation should be gradual and the heat should range from a barely perceptible dull red at the feed end to a bright yellow at the discharge end. When the ore is too hot in the center of the kiln, there seems to be a tendency to hinder desulphurization, probably on account of an almost imperceptible glazing of the particles, that renders them impervious.

For this reason it is important that the roasting should be complete before the nodulizing begins, since for the success of the latter the ore should be sufficiently pasty to ball up. This pastiness, however, should never be carried to a point where there is any flow of the cinder, and in fact should never be visible in the kiln. A bright-yellow heat is sufficient for the nodulizing, and it is well to keep the zone of agglomeration as near the discharge end of the kiln as possible, 15 ft. being sufficient length for the operation in any kiln not over 100 ft. long. For this reason a short flame is desirable. At present the rotary kiln owes what popularity it possesses to its nodulizing feature, in spite of the fact that it is a cheap and efficient roaster, and that it is much more successful as a roaster working on coarse than on fine ore.

The one great obstacle now in the way of continuous operation of rotary kilns, is the formation of rings caused by the cinder becoming hard enough to stick to the lining. The ring usually forms in the 15- or 20-ft. nearest the discharge end of the kiln and gets an

[1] "Bulletin of A. I. M. E.," September, 1915.

excessive amount of weight upon that end. Many devices have been tried to prevent the formation of the ring or to remove it without stopping the kiln, but none of them has been thoroughly successful. The best plan, according to Mr. Doak, is to shut down the kiln when the ring becomes too large, cool it off with water, and cut it out with bars and picks. The formation of the ring can be postponed by keeping the conditions of temperature, speed and feed from fluctuating. [Chains dragging in the kiln have also been used to prevent the formation of the ring.—EDITOR.]

Mechanical difficulties, so common when rotary kilns were first used for the treatment of iron ores, have been practically eliminated. The most important points to be observed to insure continuous operation are to make the kiln sufficiently strong (reinforcing it especially under the tires) and to keep the operating machinery well protected from dust. The tires should always be kept tight to the shell, since, if any play is allowed, the bolt holes will gradually become enlarged and the kiln will bear down hill so strongly that it will frequently break its thrust bearings. At least 1 in. of additional metal should be put around the shell under the tire. With the larger kilns, a 9-in. firebrick lining is used, while for kilns of 5 or 6 ft. diameter a 4½-in. brick is satisfactory.

The size and shape of the ore particles, the depth of bed, condition of lining and size of the kiln—all have an effect upon the speed or progression of the charge in the kiln. Any type of cinder can be treated satisfactorily in kilns from 80 to 100 ft. in length, turning at a speed of from 1 revolution in 60 sec. to 1 in 90. The greater length is safer in treating all fine high-sulphur cinders, since it greatly reduces the chances of a poor product through careless supervision.

CAPACITIES UNDER DIFFERENT CONDITIONS

The tonnage output of a kiln varies greatly with the kind of cinder charged. A kiln 60x5 ft. with 4½-in. lining will treat 1,500 tons a month of low-sulphur lump ore, while on high-sulphur fine it will with difficulty take care of 750 tons. A kiln 85x7 ft. will handle 3,000 tons of high-grade cinder per month and 1,500 tons of the poorest grade, while a kiln 100x8 ft. will treat from 4,500 to 2,500 tons, depending on the quality of cinder. A kiln 85x8 ft. could handle almost as much as the 100-ft. kiln, but at a greater fuel cost. In general the larger kiln will have the lower fuel cost, and the fine domestic ores will need less coal on account of their higher sulphur content. In a 60x5-ft. kiln the fuel consumption averaged for several months about 12% by weight of the roasted ore.

It has been the custom arbitrarily to connect a certain diameter with a certain length of kiln. A 60-ft. kiln is usually 5 ft. in diameter; 80- and 85-ft. kilns are 6 or 7 ft. in diameter, and a 100-ft. kiln is ordinarily 8 ft. in diameter; but it would frequently be more economical to proportion the kiln in a less haphazard way than by accepting the builder's standard design. The two determining factors should be the output desired and the quality of ore to be roasted. The output is dependent upon the dimensions of a cross section of the bed of ore that can be carried in the kiln, the speed of revolution and the slope of the kiln. The slope of the kiln can be left out of consideration, however, as good practice places it at ¾ in. per ft. Increased or decreased output can better be obtained by changing either of the other variables than by changing the slope of the kiln. Speed control is now a feature of the design of every kiln, so that this factor may be adjusted to the most satisfactory point after the kiln is in operation.

The question of output, then, so far as the kiln design is concerned, is determined by the width and depth of the ore bed. In general the latter can be increased with the length of the kiln, since the length of time it takes the ore to pass through the kiln will be greater as the kiln is longer, all other things being equal; but the increased capacity due to length will not be great, since without changing the diameter the ore bed cannot be increased to any considerable extent without harming the roasting process, for which a continual and complete stirring and overturning of the ore bed are necessary. Too great a depth of ore bed prevents this. It seems most reasonable to base the length of the kiln entirely upon the time necessary for desulphurization and agglomeration, and to control the output by the diameter.

OPERATING COST LARGELY RESULT OF LAYOUT

The cost of producing a ton of roasted ore, aside from the cost of the raw cinder, depends chiefly on labor. Two men on a shift should be able to take care of a well designed plant producing up to 100 tons in 24 hr., while in a poorly designed plant this number might easily reach 4 or 5. On a small kiln, 60x5 ft., the labor cost per ton on high-sulphur fine cinder averaged 40c. for several months, and with the same kiln using high-grade lump cinder this figure was reduced to 30c.; both figures, however, were excessive, not only on account of faulty design that made necessary 3 or 4 men on a shift, but also on account of a low output per man, because of the small size of the kiln. Repairs and supplies should not cost over 8c. per ton of roasted ore. The cost of operation of a rotary kiln will be determined almost entirely by the layout of the plant.

Hybinette Leaching Process for Copper Ores

In a recent patent (U. S. No. 1,122,359) covering the leaching of copper ores, N. V. Hybinette, of Christiania, Norway, states that sulphide copper is readily soluble in solutions containing 15 grams of ferric iron per liter, while it is insoluble in solutions containing under 10 grams per liter. At 15 or even 20 grams per liter the ferric compounds do not interfere so seriously as to necessitate using tanks with diaphragms. Mr. Hybinette, therefore, roasts the ore so that about 25% of the total copper is present as sulphide compounds insoluble in 5% HNO_3. A solution containing about 30 grams of total iron and 30 grams of copper as sulphates and about 60 grams of free sulphuric acid is provided. This solution continually circulates between the electrolytic cells and the leaching tanks. The cells are provided with lead anodes, but have no diaphragms. So long as the inflowing solution carries about 30 grams of copper per liter and the effluent about 20 grams, the ferric iron will be present in the proper amount. A portion of the solution is periodically withdrawn, completely precipitated, and discarded, so that the total iron may never rise above 35 grams per liter.

Company Reports

El Oro Mining and Railway Co., Ltd.

The directors of El Oro Mining and Railway Co., Ltd., report under date of July 24, 1915, that no accounts have been received from the mine for a long period, so that it is impossible to give the usual statement of the net realized profit for the year ended June 30. Owing to repeated occupation and evacuation of the town of El Oro, accompanied with more or less plundering each time, on Feb. 27 out of the normal population of 25,000 Mexicans, less than 100 remained. Consequently it was with difficulty that enough men were obtained to keep the mine pumps in operation. This, however, has been done, and the directors are advised that enough men have been available to keep the mine unwatered, to continue sinking the deep ventilating shaft and to maintain the various levels of the mine in good condition.

They are also informed that notwithstanding all disturbances no serious loss has been sustained and no material damage done to the mine and reduction works. On the other hand, the rolling stock of the railway has suffered somewhat and some looting has taken place among the houses of the company's staff, though this has not reached serious proportions. The directors say that they are unable to predict when operations at the mine will be resumed. At this time nothing of this nature can be contemplated. It is not, in their opinion, in the interest of the shareholders to order such resumption until they are fully satisfied that the works can be kept in operation without fear of further interruption.

Jumbo Extension

The Jumbo Extension Mining Co., Goldfield, Nev., for the year ended June 30, 1915, reports a profit of $339,373 from the treatment of 16,420 dry tons, averaging $45.76 gross value per ton. Of this tonnage 5,547 dry tons were milled, having an average gross value of $14.55 per ton; the loss in tailings was $8.53, and on concentrates 15c. per ton, making the net recovery $5.87 per ton on milling ore. Shipments to smelters aggregated 10,873 tons having a gross value of $61.58 per ton; smeltery losses were $4.71, making settlement on the basis of $56.87 per ton recovery. The average value realized on both grades of ore was $39.64 per ton, and all costs were $18.97 per ton, making the net realization from operations average $20.67 per ton. Costs consisted of the following charges: Mining, $3.12 per ton; development, $3.51; milling, including freight, royalties, and marketing concentrates, $1.05; freight and treatment on ore shipped, $7.29; freight and treatment on concentrates shipped, 24c.; general expenses, etc., $2.39; bullion taxes, 32c., and construction and equipment, $1.02 per ton.

The report states that the present exposures justify an estimate of 86,750 tons of ore in reserve. This estimate is made up of 19,500 tons of shipping ore, 35,750 tons of milling ore and 1,500 tons of mill ore on dumps. It is thought that the shipping ore should average about $11 by mine sample and the mill ore $7 by mine sample. The ore in the dump by mine sample runs $8.67 per ton. It is stated that the prospects for further development of ore are extremely good. The company had a cash balance of $120,533 on hand at the end of the year after paying $125,317 in dividends. The cash balance at the beginning of the year was $29,099. The company now has side-line agreements with the Booth, Goldfield Consolidated and Merger Mine companies. There are now 1,500,000 shares of stock issued.

Colorado Fuel and Iron Co.

The report of Colorado Fuel and Iron Co., owning coal and iron mines and lands in Colorado, New Mexico and Wyoming and steel works in Colorado, covers the year ended June 30, 1915. The fixed liabilities at the close of the year were $34,235,000 common stock, $2,000,000 preferred stock and $84,310,500 bonds. The only change from the previous year was a decrease of $83,000 in bonds.

The statement of production for two years past is as follows:

	1913–14	1914–15	Changes
Coal mined	2,428,992	2,329,069	D. 99,923
Coke made	535,274	520,261	D. 15,013
Limestone quarried	376,226	344,033	D. 32,193
Iron ore mined	614,039	441,026	D. 173,013
Pig iron made	268,883	286,661	D. 17,778
Finished iron and steel	352,929	324,600	D. 28,329

Of the coal mined in 1915, commercial sales took 816,228 tons; 561,775 tons were used at the company's plants; and 921,016 tons were used in making coke, showing a consumption of 1.77 tons to the ton of coke.

The earnings for the year were as follows:

	Earnings	Expenses	Net
Iron department	$10,885,451	$9,016,133	$1,869,318
Fuel department	5,692,589	5,796,848	*104,259
Total	$16,578,040	$14,812,981	$1,765,059
Total, 1914	17,803,025	16,729,255	1,073,770

*Deficit

Income from interest and other sources was $495,012, making a total of $2,261,101. The charges for interest and taxes were $2,319,121; sinking fund and miscellaneous, $122,146; equipment renewal, $80,000; insurance, personal injury and sociological work, $74,195; total, $2,595,762, leaving a deficit of $334,661 for the year.

President Welborn's report says:

The reduction in sales was due to a curtailment in the consumption of coal in all of that territory supplied from Colorado and to lighter purchases of steel by railroads. There is little promise of improvement in buying by railroads during the current fiscal year, and we do not anticipate a volume of rail business that will keep the rail mill operating to more than 50% of its capacity. The summer demand for coal has not been up to normal, and while some improvement is anticipated in the near future, it is not believed that the business will be such as to enable us to work all of our mines to their capacity, even during the winter months. During the period of reduced consumption of coal, extending now over two years, development of new coal properties in Colorado has

continued, with the result that the productive capacity of developed mines producing domestic coal in the state is at least twice the present demand and far in excess of the prospective demand for some years. Our coal properties have been kept in good physical condition and are able to respond to whatever demand may develop, though with the increase in the number of mines operated by others, our participation in the business offered will naturally be on a reduced basis.

A plan of coöperation between the company and its employees, providing for the adjustment of differences and the consideration of other matters of common interest, through representatives selected by the workmen, has been inaugurated at the coal mines. In its formative state this plan has proven to be mutually beneficial, and its further development is anticipated in the near future.

Continued attention has been given to matters affecting the working and living conditions of the employees. Additional safety devices have been installed, and constant vigilance is being exercised to prevent accidents. Many new houses of modern type have been built, and old houses repaired and repainted as needed. At most of the camps a large percentage of the houses have been fenced, inclosing ample yards, which many of the tenants have beautified with lawns and gardens; this work of fencing will be continued until, as far as practicable, all houses have been inclosed.

Tonopah Extension

The Tonopah Extension Mining Co., Tonopah, Nev., for the year ended Mar. 31, 1915, reports a profit of $596,891. Of this amount $283,026 was paid in dividends, $123,110 expended in additions to mill and mine plant and $190,755 added to the company's cash assets. There were mined and treated 11,882 dry tons of ore, containing 2,022,220 oz. of silver and 19,040 oz. of gold, or an average of 28.13 oz. of silver and 0.264 oz. of gold per ton. Of this metal content 1,790,031 oz. of silver and 17,584 oz. of gold were recovered. The receipts from the sale of this product totaled $1,285,508, with silver at 51.507c. per oz. and gold at $20.67 per oz. The following table gives the cost of production per ton of ore before crediting interest receipts and miscellaneous earnings:

Mining costs, including all development work	$5 191
Milling costs	3 753
Metal losses in milling	2.082
Marketing costs, express	.101
Marketing costs, refining	.349
Total cost	$11 476
Profit per ton	8 490
Gross value of ore per ton	$19.966

Development work amounted to 12,651 ft., making the total development in the mine to date 84,421 ft. The milling capacity was increased from 150 to 250 tons per day by the addition of 2 batteries of 5 stamps each, 2 tube mills with Dorr classifiers, 8 Wilfley tables, 2 Dorr thickeners, 5 agitators, and 9 zinc boxes.

Chief Consolidated

The report of the Chief Consolidated Mining Co., Eureka, Utah, for the half-year ended June 30, 1915, shows a net profit of $17,019 from operations after payment of all charges. A total of 11,865 dry tons of ore was shipped, which yielded $115,712 after payment of transportation, smelting and sampling charges. The average gross value of this ore per ton was $21.78; freight, smelting and sampling charges amounted to $10.65 per ton, and the net value per ton was $11.13. The metal contents of the ore consisted of 2,322,026 lb. of lead, 267,093 lb. of zinc, 112,011 oz. of silver and 2,669 oz. of gold. Development work for the period aggregated 2,629 ft., of which 1,902 ft. were drifts. The treasurer's report shows a balance of $211,953 on hand.

North Butte

The report of the North Butte Mining Co., Butte, Mont., for 1914 shows a production of 18,421,761 lb. of copper, 1,092,300 oz. of silver and 1,107 oz. of gold. These metals were produced from 337,372 dry tons of ore and 43 dry tons of precipitates. The following sales of metals were made during the year: 21,868,479 lb. of copper at 13.7436c. per lb.; 1,377,297 oz. of silver at 55.881c. per oz., and 1,107 oz. of gold at $20 per oz. During April and May a leaner grade of ore than had heretofore been mined was encountered, and following good mining practice, it was necessary to extract and treat this ore. This, together with labor troubles at Butte and the reduction of output at the beginning of the war, was the cause of a decrease in production as compared with 1913. The cost of producing copper was 11.505c., as shown by the following table:

COST PER POUND OF COPPER

	Cents
Mining and development	7.424
Construction	.016
Freight on ore	.224
Concentrating, smelting, freight on bullion, refining, selling, etc.	6.879
General miscellaneous expense and taxes	.257
Total	14.800
Less value of gold and silver and miscellaneous income	3.295
Net cost	11.505

The mine shipped 343,314 tons of wet ore and 71 tons of precipitates. The mine was operated 309 days, with an average of 767 men. An average of 1,111 tons was hoisted per day. The financial statements show that $558,215 was made as profit and that dividends aggregating $635,000 were paid.

Butte & Superior

The report of the Butte & Superior Copper Co., Butte, Mont., covering the quarter ended June 30, 1915, shows a profit of $2,107,152 compared with $1,163,156 earned during the first quarter of the year. The net value of the zinc concentrates at the mill was $2,509,229; net value of lead concentrates and residues at mill, $230,294, and miscellaneous income, $11,899—making the total net value $2,751,423. The operating costs were $644,270, leaving the profit as stated. These profits were calculated on spelter prices of 10.364c. per lb. for April, 12.106c. per lb. for May and 15.961c. per lb. for June, an average of 12.683c. for the quarter.

The mill treated 124,080 dry tons of ore, averaging 11.003% zinc and 8.067 oz. silver per ton. There were 35,840 tons of zinc concentrates produced, averaging 52.706% zinc, making 37,780,020 lb. of zinc in the concentrates. The average silver content in the concentrates was 22.714 oz. per ton. The mill recovery on the basis of total zinc recovered in the concentrates was 89.536%. The total cost per ton for mining and milling was $5.1924, made up of $3.3816 for mining and $1.8108 for milling. It is stated that new development work has blocked out new ore in an amount substantially equivalent to the amount mined. The company is now free from bonded indebtedness.

The Pioneer Consolidated Mines Co., Pioneer, Nev., reports that all is running smoothly at the mine and mill. Considerable new development work is being started and the mill will be operated 16 hr. a day. It is stated that the mine is in a position to produce an average grade of $10 mill ore.

Arizona Copper Miners' Strike

SYNOPSIS—The strike of operatives in the Clifton-Morenci district has developed into the usual exhibit of lawlessness. Three managers were arrested without any basis for real charges and through a process which was a travesty on law.

The strike of the employees in the mines and surface plants of the copper-mining companies in the Clifton-Morenci district of Arizona has progressed from a rather unpretentious beginning to a situation that at the present time is extremely serious. Becoming general on Sept. 12, the strikers tied up the mines and reduction plants of the district and violence has been unchecked. Agitators from the Western Federation of Miners have been largely instrumental in stirring up the men, while Mexican agitators have performed their share among those of their color.

According to the statement of Walter Douglas, general manager for Phelps, Dodge & Co., the strike was called on Sept. 11 by the Western Federation of Miners. "Bodies of men, principally Spanish and Mexicans, prevented the men that so desired from going to work. Pickets were immediately placed in mines, converters, power houses and smelters, and the companies' officers were refused permission to enter. The companies immediately withdrew all their watchmen and called upon the sheriff to protect their property. Only through direct orders from the state Corporation Commission to the sheriff was it possible to start up the electric plant to furnish light to the town, Morenci being in complete darkness for three nights.

"The strikers refused to permit mine pumps to be operated or drawn or to allow machinery to be cared for or belts taken off for their preservation. They even forbade the mules being fed or hoisted to the surface, until persuaded by the sheriff to allow them to be taken from the mines.

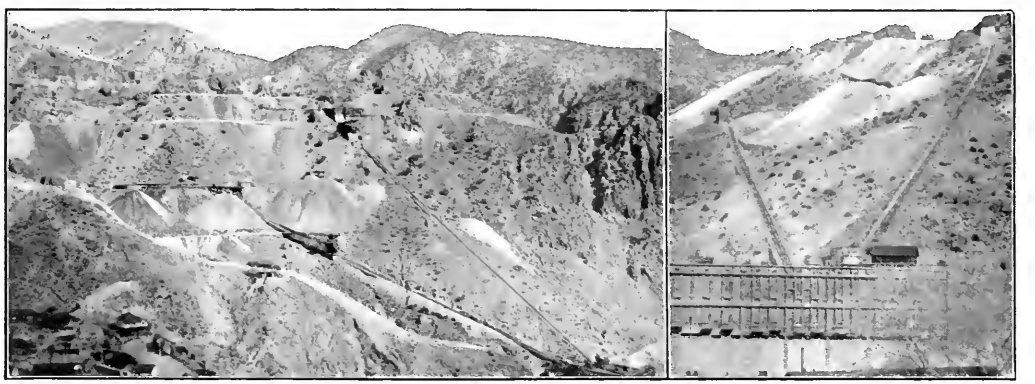
"The wage question is simply a pretext for the unionizing of a camp that in the past has never discriminated against any man on account of his affiliation. On the sliding scale introduced four months ago, labor of all classes has been receiving higher pay than ever before, nor has there been any grievance or complaint on this score.

"The Western Federation of Miners, aiming at political domination of the state, has introduced its agitators and organizers into the district, knowing that Mexican workmen are easily led and more easily intimidated, and has exercised its arbitrary and despotic methods to bring suffering and loss on a formerly happy and contented community.

"As regards the matter of wages, Americans, constituting about 30 per cent. of the employees and occupying positions of trust and skill, receive the same pay as in other mining camps of the Southwest, while miners and unskilled laborers are composed largely of Mexicans and Spaniards, whose wages exceed those paid for similar labor elsewhere.

"The Morenci-Clifton-Metcalf district comprises the highest-cost mines of the state, the copper of the largest producer costing nearly 13c. As the average price for copper for the last 10 years is less than 14c., it is obvious that they can hardly earn interest on their investments and equally obvious that it is commercially impossible to increase wages and continue operations."

In this connection it is interesting to note the accompanying table, which sets forth a comparison between the costs under the prices paid at the present time and the wage scale insisted upon by the Western Federation of Miners. It is to be remembered that the Western Federation of Miners bases its scale of wages on 13c. copper or lower. The present sliding scale is designed to prevail when copper is above 13c.



METCALF MINE OF ARIZONA COPPER CO., AT METCALF, ARIZ., SHOWING A PART OF THE DISTRICT WHERE STRIKE CONDITIONS NOW REIGN

DETROIT COPPER MINING CO. WAGE SCALE AND WESTERN FEDERATION OF MINERS' SCALE

Based on Wages Paid Last Half of July and First Half of August, 1915

	Detroit Copper Present, 13c. Cu	Western Fed. of Miners, 13c. Cu	Detroit Copper Present, 18c. Cu	Western Fed. of Miners, 18c. Cu
Mines	$58,462	$91,356	$67,091	$108,074
Concentrating	16,829	20,898	19,529	24,752
Smelting	7,944	10,057	9,092	11,897
Mechanical	7,749	8,925	8,[illegible]	10,558
Miscellaneous	4,518	4,876	4,943	5,052
Per month	$95,502	$136,112	$103,[illegible]	$160,303
Per year	$1,146,024	$1,633,344	$1,241,8[illegible]	$1,923,636
Difference per year	$487,320		$681,78[illegible]	
Difference between present 18c. rate and Western Federation of Miners' minimum per year				$318,492

According to these figures the difference per year for the entire district would be about $2,000,000.

The accompanying schedule shows the demands made by the Western Federation of Miners upon the copper companies operating in the district.

1. Reinstatement of all men discharged since Sept. 1, 1915.
2. Reinstatement of all men who went out on strike, with no discrimination because of membership in any society, association or organization, either now or at any other time.
3. Eight hours' pay per day.
4. Hospital board free to employees.
5. Wages asked for herein are based on 13c. copper or less.
6. Present sliding scale shall prevail when copper is above 13c.
7. Abolition of doctor's examination.

MINIMUM WAGE SCALE FOR CONCENTRATOR MEN

1. Construction department. Laborers, $2.50
2. Swampers in mill, screen men—wet and dry—sweepers in bins and crushing plant, $3.
3. Table operators, vanner operators, table repairmen, vanner repairmen, $3.50.
4. Sample men, $3.25.
5. General repairmen, $3.75. General repair helpers, $3.
6. Flotation machine operators, $3.50.

MINIMUM WAGE SCALE FOR SMELTER

Nothing Under $3 in the Mill

1. Skimmers, $4. Helpers, $3.25 Punchers, $3.25.
2. Electrical department: Cranemen, $4.25. Copper man, $3.
3. Slag engineers, $4.25. Copper weighers, $3.75.
4. Feeders, slag tappers, matte tappers, $3.50. Helpers, $3.25.
5. Repairman, $4.25. Helper, $3.25.
6. Converter punchers, $3.25. Crane swamper, $3.
7. Wheelbarrow men, $3. Slag-train brakeman, $3.
8. Other laborers, $2.50.

MINIMUM WAGE SCALE FOR MINES

Nothing Under $3 Underground

1. Miners, $3.50. Timbermen, $3.75. Shaft men, 50c. advance over scale.
2. Contract miners shall receive at least miners' wages.
3. Motormen, cagers, skip-tenders, $3.50.
4. Track men, $3.75. Tool nippers, $3.
5. Muckers, trammers, top-landers, and other laborers, $3.
6. Hoist men, single-drum, $4.25; double-drum, $4.50.
7. Pumpmen, $4. Tool sharpener, mine blacksmith, $4.
8. Samplers, $3.50. Surface laborers, $2.50.

MINIMUM WAGE SCALE FOR THE FOLLOWING CRAFTS

Machinists	Carpenters	Pipefitters
Boilermakers	Carmen	Power-house employees
Blacksmiths	Patternmakers	Electricians
Molders	Coppersmiths	Electrical operators

1. That $4.25 be the minimum wage for the following crafts.

Machinists	Coppersmiths	Carpenters
Boilermakers	Pipefitters	Electrical operators
Blacksmiths	Molders	

2 Boilermaker laying out the work to receive 5c. per hour more than the above scale.

MINIMUM WAGE SCALE FOR OTHER CRAFTS

Electricians, shift men	$4 75	Firemen	$3 50
Day electricians	4 25	Oilers	3 00
Electrician helpers	3 50	Patternmaker	5 00
Engineers	4 56	Car repairers	3 60
Switchboard operators	4 00	Wiper	2 50

3. A competent boiler-shop foreman.

MINIMUM WAGE RATING FOR HELPERS

Boilermaker helpers	$3 50	Machinist helpers	$3 50
Blacksmith helpers	3 50	Pipefitter helpers	3 50
Molder helpers	3 50	Car repairmen helpers	2 50

After considering these demands the companies, after consultation, decided to refuse them and the following letter was addressed to the strikers:

To the Committee representing the former employees of the Arizona Copper Co., Ltd., the Detroit Copper Mining Co. of Arizona, Shannon Copper Co.:

Gentlemen—In answer to your representations we beg to call your attention to the fact that these companies have seen their properties closed down and their operations tied up completely by a strike called by the Western Federation of Miners and this without any presentation of grievances. Our former employees have been persuaded by agitators of the Western Federation of Miners coming from outside of this district that the past pleasant relations and the present rate of wages should be radically changed.

In view of these facts and notwithstanding that the companies are convinced that a large number of their old employees desire to continue to work under the conditions formerly existing in this district, they realize that any attempt to recommence under such conditions would be to invite violence and intimidation. Therefore the managements of the Arizona Copper Co., Ltd., Detroit Copper Mining Co. and Shannon Copper Co. desire to notify the committees and the people of the Clifton-Morenci-Metcalf district that their mines and plants will remain idle indefinitely.

When it shall appear that conditions in this section warrant it and the companies are satisfied that the general sentiment of the community and their former employees is unanimously in favor of a resumption of operations on the basis of wages and conditions which have prevailed heretofore in this district, the companies reserve to themselves the right to decide whether or not they will again start up their plants.

Our attitude in this matter is based solely on the dominant influence of the Western Federation of Miners in this district at the present time, and when this influence is dissipated we may take a different view of the situation.

THE ARIZONA COPPER CO., LTD.,
By Norman Carmichael, General Manager.
THE DETROIT COPPER MINING CO. OF ARIZONA,
By M. H. McLean, General Manager.
SHANNON COPPER CO.,
By J. W. Bennie, General Manager.

After the receipt of this reply conditions continued to grow worse, violence being threatened on every hand by the strikers.

It is stated that Western Federation agitators had been trying to create a disturbance for some weeks prior to the calling of the strike, but with little success. To oppose these efforts, satisfied employees had circulated a petition announcing their satisfaction with conditions and asking that the camp be not unionized. Upon learning of this petition the Federation officials called the strike immediately, to forestall the submission of the petition which had already received about 600 signatures.

ACTIVITIES OF ARIZONA'S GOVERNOR

An interesting development was that after two days spent in Clifton and Morenci, taking testimony of mine managers and employees, Governor Hunt and Adjutant-General Harris left Thursday evening, Sept. 30, for Phoenix. The meeting was held late Thursday at Clifton, at which more than 300 persons were present. The announcement made by the governor afterward was: "I find conditions existing here that require adjustment. I feel that men who have charge of these great works will be amenable to reason, and I believe they will meet you on common ground. When I come back to this community and have to bring troops, the principal officers of the companies will be no different from the poorest Mexican they control. I hope all of you realize that I am going to have order if I have to call on every troop we have in Arizona. I do not want to come to this district except to bear the olive branch of peace, but if war comes you will have to abide by war. There never was a condition but that it could be improved, and I feel that employers and employees can get together, and if they cannot get together peacefully, they will have to get together some other way, because I am going to see you people get together some way, if I have to put every one of you in the bull pen."

After this remarkable effusion of frothy pother, the governor left the district, apparently assuming that he had settled the whole thing. The report is being circulated that the mine managers told the governor that as soon as the Western Federation organizers left the camp, there would be no difficulty in reaching an amicable agreement. There is no record, however, that the governor paid any attention to their remarks.

The change in conditions is shown clearly by the accompanying telegram, which was sent from Morenci Saturday evening: "Great demonstration in front of Norman Carmichael's office this morning. Master Mechanic Dawson was assaulted and made to march in front of mobs bareheaded. Dawson was very cool and was finally taken to jail by the sheriff. Mobs carried banners with violent inscriptions—'Down with the managers; they are too proud to be employees, but not too proud to lie to us;' 'We will fight before we starve;' etc. Strikers feel much stronger in their position since governor of Arizona's visit, which has had bad, very bad effects. Governor of Arizona's statement, which you have, was greatly tempered by newspaper reports, which beat him to it.

"We believe Norman Carmichael to be in great danger. On that account manager of Shannon Copper Co. proposes that managers leave district tonight. This will be done provided Carmichael can find opportunity to escape; demonstration in progress here now; about 2,500 men; banners more suggestive than those of this morning; am going to Clifton to insist that Norman Carmichael leave; will return to Morenci and arrange to leave myself a little later. There is not any mistake about danger to Norman Carmichael's life. Absolutely no protection for anyone."

(Signed) M. H. McLEAN.

The suggestion of the telegram, that the managers leave Clifton, was followed. They left on a blind locomotive and succeeded in reaching Lordsburg, N. M. Norman Carmichael, of the Arizona Copper Co., Milton McLean, of the Detroit Copper Co., and J. W. Bennie, of the Shannon Copper Co., were the three who escaped. Upon their arrival at Lordsburg they were immediately placed under arrest by Sheriff H. C. McGrath, Deputy Sheriff Joe Larrieu, of Clifton, swearing out a warrant charging them with being fugitives from justice. It was reported that Sheriff Cash, of Greenlee County, Ariz., was *en route* to Lordsburg, bearing a felony warrant. The managers expressed a desire to remain under the protection of the New Mexican authorities, fearing personal injuries at the hands of the strikers.

Mine Managers Reach El Paso

The warrant for the arrest of the three managers was sworn out by a Mexican laborer and the charge was inciting riot. A justice of the peace discharged them for lack of evidence.

The fleeing mine managers reached El Paso late Sunday and issued this statement:

"The incidents of the day and the temper of the strikers were such yesterday that the managers and disinterested observers were of the unanimous opinion that there would be bloodshed within 24 hr. if the managers did not withdraw themselves from the district; that their presence was a constant and increasing source of irritation to the strikers just as the presence of nonresident federation leaders was an irritation to the managers. Notwithstanding that the sheriff is carefully guarding the properties of the companies, the district is in the absolute and complete control of the Western Federation of Miners. Therefore there was nothing left for the managers to do and they could serve best their respective companies and the state by removing themselves from the district. Troops ought not to be needed now."

It is further stated from Phoenix, under date of Oct. 3, that Adjt.-Gen. C. W. Harris and 18 militiamen started at night for Clifton, to preserve peace in the strike of the miners there. The militiamen were ordered to Clifton by Governor Hunt on receipt of an appeal from Sheriff Cash, who said he feared the situation was beyond his control. Cash said the managers of the copper companies had abandoned the district and that the strikers were parading the streets and making demonstrations. He feared that serious trouble would result.

Thomas Simpson and Mike Penn, engineer and fireman respectively of the engine upon which Messrs. Carmichael, Bennie and McLean escaped from Clifton, were severely beaten by the mob upon their return from the trip. They escaped further punishment by getting away in a fast automobile.

A telegram received at New York on the morning of Oct. 6, from Milton McLean, manager for the Detroit Copper Co. is as follows: "Situation at Morenci steadily growing worse. Eight explosions of dynamite at Arizona Copper Co. mill last night. No damage reported. Terrifying town. 150 leaving tomorrow morning, 70 by order of men on strike and County authorities. The number steadily increasing. Western Federation of Miners leaders say explosions are work of company men. They will make their headquarters Hotel Morenci and say they will occupy my house. Arizona Copper Co. general office and drug store stoned. Stores promised protection which is doubtful."

New Jersey Iron Mines Prosper

Continued demands for munitions, according to the New York *Times*, have created a demand for products of the mines in Morris County, New Jersey, foremost among these being the Empire Steel and Iron Co. at Mount Hope and the Thomas Iron Co. at Richard Mine. The former is shipping about 17,000 tons of ore a month, and the latter about 6,000 tons. The Thomas Iron Co. has also purchased the stock on bank of the Hough Mining Co. at Wharton, and this is being shipped to the company's furnaces at Hellertown, Alburtis and Catasauqua, Penn.

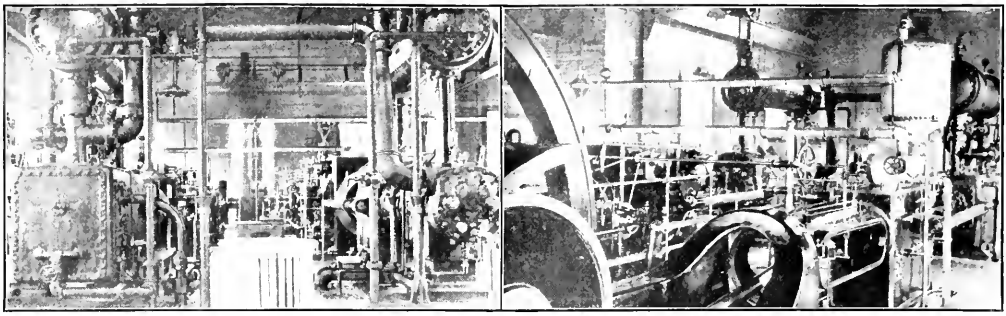
Much of the ore mined by the Empire Steel and Iron Co. at Mount Hope is being shipped to the Bethlehem Steel Co. Notices were posted on Oct. 1 at the office of the Thomas Iron Co., advising the employees of a 10% increase in wages. The average wage before this morning's announcement was: For drill runners, $2.20; for pump men, $2, and for laborers, $1.93 for an eight-hour day.

Clifton-Morenci Wages

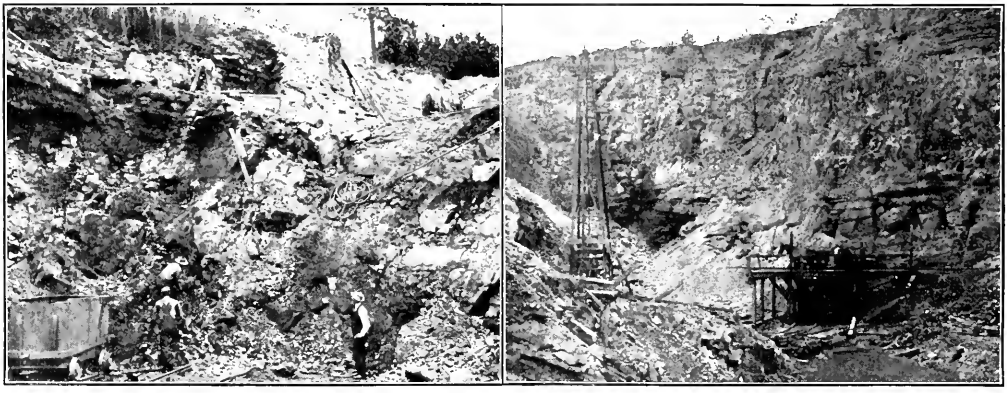
The Detroit Copper Mining Co. states that the wage scale as given in the *Journal* of Sept. 25, should be: For Mexican miners, $2.73 to $2.88 a day; American miners, from $3.30 to $3.78; Mexican timber-men, $2.88; the more skilled American timber-men, from $3.56 to $4.04 a day.

Boring for Petroleum is in progress at Kingston and Robe in South Australia, and the wells are now down about 1000 ft., with good prospects. G. D. Mendell, of Melbourne, is in charge of the operations. American drillers are working on the wells. Oil has been found in Papua and in several other islands on the north coast.

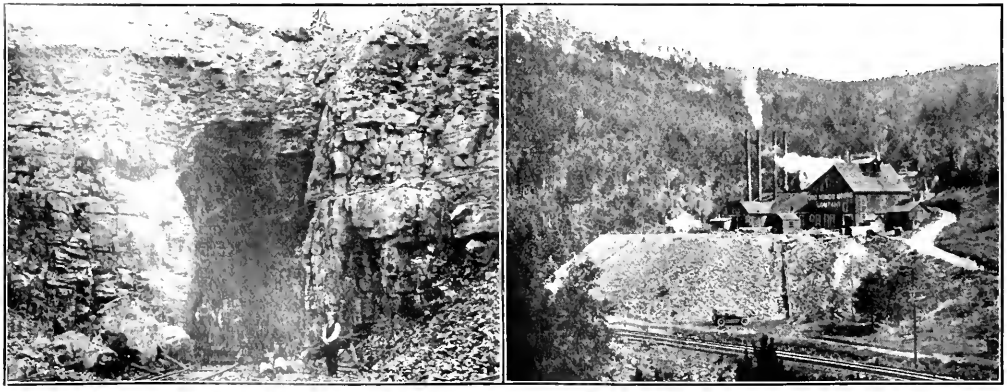
Photographs from the Field



THREE-STAGE 2000-LB. PRESSURE AIR COMPRESSOR AT THE ELLISON SHAFT OF THE HOMESTAKE MINING CO. AT LEAD, S. D.

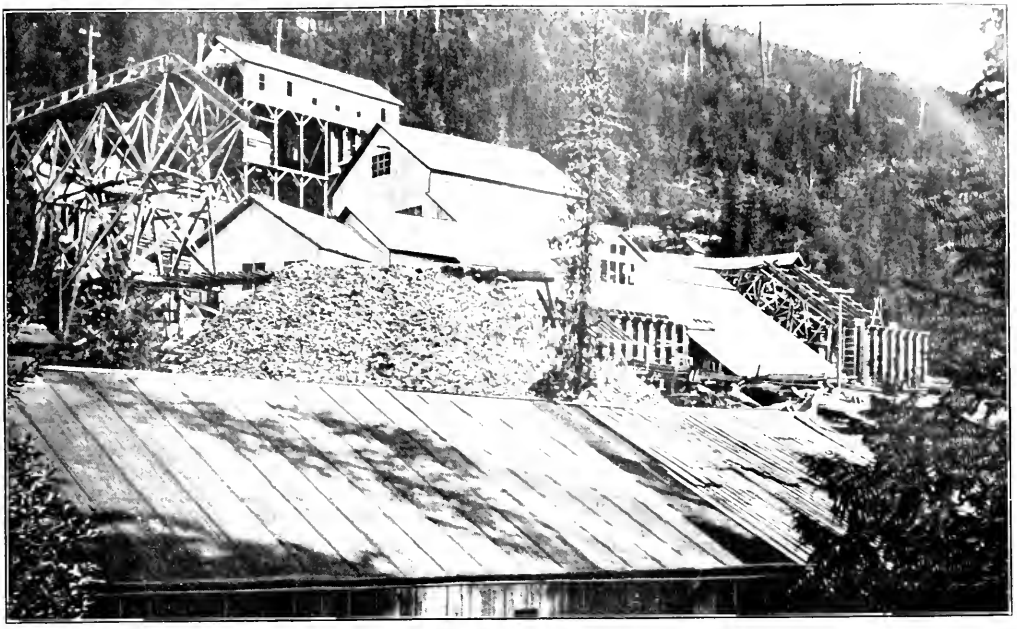


OPENCUT MINING AT WASP NO. 2, FLATIRON, S. D. ORE 18 TO FT. WIDE, 20 FT. THICK, AND ASSAYS $2 PER TON



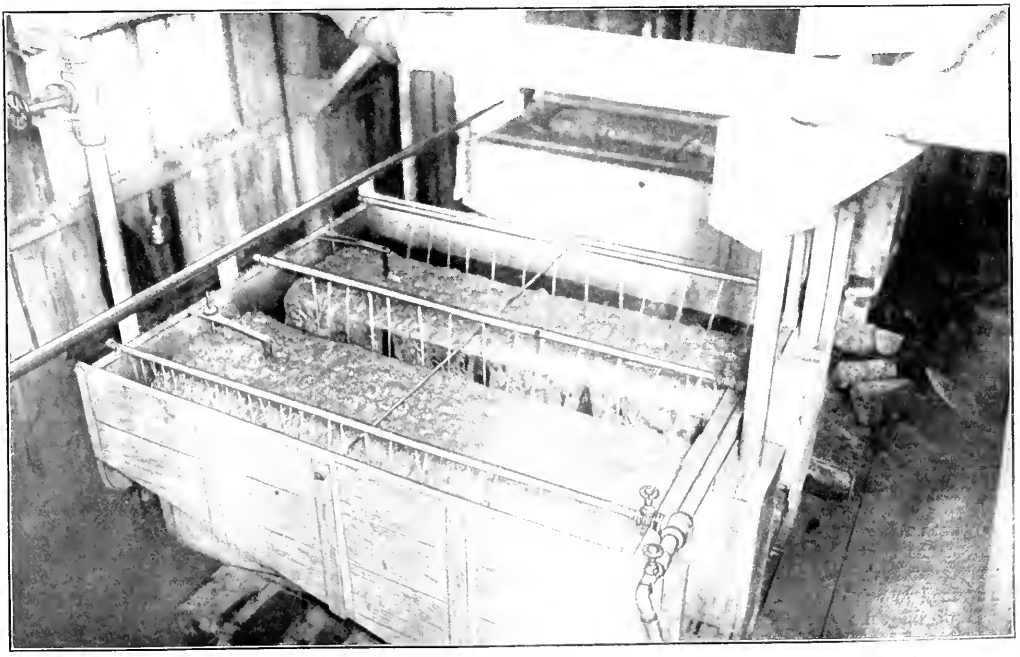
STARTING A 10X30-FT. STOPE AT WASP NO. 2

ORO HONDO SHAFT, 1700 FT. DEEP, NEAR LEAD, S. D.



INTERSTATE-CALLAHAN MILL, NINE-MILE CANYON, NEAR WALLACE, IDAHO

This property entered the producing stage at the time when the highest prices for zinc ruled, due to war orders. Consequently the company earned a great deal of money, its July dividend amounting to $575,000, followed by one in August of $920,000. Standard systems of jig and table concentration are used, followed by an interesting variety of flotation equipment.



CALLOW FLOTATION PROCESS INSTALLED AT THE ANACONDA'S REMODELED CONCENTR

Flotation promises to be of great service in treating copper ores, so much so that leaching is thought danger of extinction in such plants.

Editorials

Clifton-Morenci Strike

The strike at Clifton-Morenci, which at first was not regarded seriously—at least not here—has developed into an extraordinarily bitter labor trouble, and it exhibits features that are unusually alarming. In the disorder and rioting and attacks upon mine officials, there is a resemblance to the Lake Superior strike of 1913. A further point of similarity is to be found in the prompt appearance on the scene of that stormy petrel, Moyer, who is always on hand in such affairs.

The elements of this strike are evidently the usual demands for increased wages and recognition of the union, the latter having been dropped, however, early in the negotiations. The miners of Clifton-Morenci have heretofore been paid on the sliding scale, governed by the price for copper, that now prevails as a system in most of the copper-mining districts west of the Rocky Mountains. However, the scale at Clifton-Morenci has been lower than at the other copper-mining districts of Arizona. The reason for this has been the relative inferiority of the class of labor available, the mining population at Clifton-Morenci being to a large extent Mexican, partly immigrants and partly descendants of the Mexicans that were living in that region when it was acquired by the United States. A large portion of these Mexicans are, therefore, naturally citizens of the United States, not merely naturalized.

Now it is pretty well established in mining that the laborer gets what he earns. The most efficient labor is always the most economical, and the big companies secure it by offering wages that are attractive. Thus the highest wages are paid at Bisbee and Butte, and the companies operating there enjoy probably the most efficient class of labor. When the supply of miners is short they may be obliged to hire inferior men, but when demand slackens the inferior men are promptly weeded out.

Something of this sort is exhibited in the economic conditions of the Clifton-Morenci district. The labor there is generally inferior. Consequently the rates of wages are lower than elsewhere. This manifests itself in the cost of producing the copper. The three principal companies of Clifton-Morenci—the Detroit, Arizona and Shannon—rank on the whole as high-cost producers, relatively speaking. The managers have pointed out that if the demands of the men were granted, the companies would be unable to make any money if copper were at its normal level, although of course they would still make some money with copper at the present high level.

So much for the merits of the case. In the development of the strike there were early manifestations of disorder, and the several companies felt themselves constrained to put their property into the hands of the sheriff of the county, making the state responsible for its safety. Then the governor of Arizona appeared on the scene, endeavoring to play the part of mediator. His actions were silly and his talk was mere flubdub. Both contributed to make matters worse. Indeed, it might not be going too far to characterize the governor's talk as inflammatory. The policy of the responsible authorities of the state, especially the governor, was manifestly to play politics and win the vote of the Mexican population of Arizona and unionized labor generally. Finally the turbulence increased to such an extent and the hostilities to the three mining managers became so virulent that they actually stood in danger of their lives. They remained at their posts longer even than they should have done, especially Mr. Carmichael. His associates had hard work to drag him away, but finally they succeeded in doing so, and the three managers escaped on a locomotive, which was driven over the line to Lordsburg, N. M., at night, without lights—a perilous journey. Arrived at Lordsburg, the three managers were arrested by the sheriff of Grant County on a warrant sworn out by a Mexican at Clifton, charging them with being *fugitives from justice*.

Respecting Subway Timbering

B. B. Thayer declined to serve on the committee of engineers to advise the Public Service Commission about the safety of the New York subways under construction, and the commission is therefore going ahead with a committee of two, of whom neither is a mining engineer. This is a pity.

In the last number of the *Journal* the system of timbering used in the New York subways was illustrated, and comparison with the original form of square-setting used in mines was made, a method of mine-timbering reproduced from a Comstock print of the '70s being shown. It was not the purpose to advise that this system of mine timbering should necessarily be adopted in the subways, but rather to indicate the radical difference in ideas.

The fundamental principle of mine timbering is not to hold up rock by trying to carry the whole load, but instead thereof to keep it in place, to prevent it from slipping. It is rare in underground work that a large block of ground comes down unless it be brought down intentionally, as in the caving system of mining. The great danger in mining from what are called "falls of ground" is the dropping or sliding of blocks and slabs relatively small. This is met by keeping the timbering wedged up tightly to the face of the rock. In narrow veins the support may be simple stulls. In large, cavernous openings it may be timbers arranged in square sets.

Now timbering is not necessary in all cases. There are kinds of rock in which large chambers may be opened deep in the bowels of the earth without a stick of timber having to be put into them. There are others in which the only precaution is to cut out the roof in the form of an arch. But there are others which must be filled with a timber structure.

In the last case the timbers, usually 10x10 to 12x12 in. in size, are built up in the form of skeleton cubes, usually

about 6x6x6 ft. and rarely as much as 8x8x8 ft. In certain cases knee braces (angle braces) are added. The several members of a set come together in butt joints. Respecting the manner of making these joints there is an extensive literature. For the framing of the timbers for this purpose there are special machines, although the work can be done by hand, and formerly was always done so.

The result of such timbering is that the "stope," or cavernous opening, is filled with a multitude of relatively small cells, just as a child builds a structure of blocks, but the framework is always kept close to the rock faces and wedged in. If the ground is loose the outside of the structure is inclosed by horizontal lagging, usually of rough, round sticks laid closely. Upon the horizontal members of the framework, plank are laid to form floors on which the miners may work.

When an underground opening is timbered in this way one or several of the sets may accidentally be shot out or may be crushed in, but nothing very serious happens. The trouble is distinctly localized.

Let it be noted that in mining the purpose is to extract material at the minimum of cost and often some very close figuring is necessary. In many mines the item of timbering is a relatively large one, and it may be accepted as an axiom that no mining engineer does any more of it than he has to. In the construction of the New York subways, which cost four million dollars or so per mile, there is not the same necessity for close figuring in this respect.

We are not to be understood as recommending that the New York subways during construction ought to be timbered by the square-set method. Without any doubt a study of the problem would result in the development of a special method, which might be a modification of the square-set system. It may be said confidently, however, that simple square-setting would permit the excavation of the ground as well as the method heretofore used, while with respect to the reclaiming of timber for reuse as the work progressed square-setting would be more advantageous. Although further discussion of this subject is likely to be of only academic interest, there would be some entertainment for mining engineers, during the winter evenings that are coming, in devising plans for timbering subways in cities as they ought to be.

A summary of the report of the committee of two inspecting engineers was published on Oct. 5. It indicates that they have no real comprehension of the problems of supporting ground from the standpoint of the mining engineer.

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First-Aid Contests

The widespread interest in first-aid contests throughout the mining districts, not only of the coal fields of the East but also in the metal-mining regions west of the Rocky Mountains, is based no doubt upon the common desire of our people for a sport in which many may participate. The games of the East have never had any great vogue in the West. There is many a mining camp where there is not a level place big enough for a baseball diamond. One of the great sports of San Francisco in the '50s was running with the fire engine, and from there it was naturally transplanted to Virginia City and to the other great mining towns. As recently as the latter '80s the annual contest of fire-engine teams, coming from Aspen, Red Cliff, Gunnison, etc., was the great event of the year at Leadville, Colo. Drill contests never aroused the same interest. People want some sport that gives a chance for the development of teamwork. This is found in the first-aid work, which combines the opportunities for good teamplay with the interests and hazards of an obstacle race. It is a fine thing, for it is not only a subject of interest, but also it serves a highly useful purpose.

Waste of Hiring and Firing

The economic waste involved in the indiscriminate hiring and firing of employees has not been studied with care in respect to the mining industry, but a recent address on this subject confined to manufacturing lines forces some very startling conclusions. The figures given apply to 12 different establishments employing about 10,000 men, and the speaker estimated that the money lost in one year due to the problem of hiring and firing amounted to $831,030. He fixed the cost for the purely clerical work of hiring and recording discharge at 50c. per person.

Just how much parallelism there is between manufacturing and mining, in this regard, it is not necessary to discover for the purpose of emphasizing this point, so often overlooked. When a miner gets huffy and demands his time on the spot, the bother and inconvenience to the foreman and shift bosses and to the clerical force in the office are perfectly obvious, and are invariably resented in a psychological way, at least, and a money cost of the transaction might easily be figured, which does not come to mind when, for some equally trivial reason, the man may be handed his time.

Aside from the purely clerical cost of the hiring and the discharge, is the large economic waste involved in instructing a new man in his duties, if it be only to the extent of conducting him to his place of work and informing him where he will find the tools with which to work, and getting him acquainted with the system employed at that particular mine. If he is simply taken to the heading and turned loose on a drill, he is at a loss to know where his wrenches are, the air-pipe connection, the air valves and various other things, and he will lose a large amount of time ferreting out the knowledge he must have. While he is doing his best to acquire the information which should have been given him at the start, he may make some mistake that will get him an immediate discharge from an irascible foreman or superintendent. This is where the big item of waste in this problem comes in.

Next to the irascible superintendent, the new superintendent is the greatest offender in this regard. His strong point in his own mind when he first attains authority, is his willingness to exhibit the courage of his convictions by firing promptly any man who does not come up to the chalkmark of expectations. He calls it enforcing discipline. The inexperienced superintendent is wholly unaware of the long period his predecessor required to build up his organization, the paternal way in which he sometimes had to handle his men, and he has not yet learned that an efficient superintendent must know what not to see just as well as what he should see.

While he has probably never figured [illegible] cost in dollars and cents, the experienced handler of men, unless the cause is unmistakably flagrant, is rarely [illegible] on the trigger at discharging employees.

BY THE WAY

According to the *Evening Sun* a visitor filled out the form handed him by the office boy as follows:

Mr. Blank desires to see Mr. Marquis in regard to selling him stock in a false-teeth mine.

Well? We've seen stock in worse ones actually sold.

⁂

Sometimes ore representatives receive queer letters of instruction, of which the following is a sample:

i wil send to your smelting Co. a shiping of ore Nex week and a orden with it you to get your money out of it and you look out for the ore i let my Pardman look after the settle up of the last shiping and i thought everything was Punk.

JOE SMITH.

P. S. look out for the Nex week sure ore.

⁂

According to a Western journalist, Quong, the Chinese lawyer of Socorro, N. M., looking at $23,000 worth of Ernestine Mining Co.'s bullion stacked in front of the express office, computed in good pidgin English: "One high ball one bit, two high balls two bits. Good Godfley, one hundred eighty-four thousand high balls there!" and went musing down the street.

⁂

The Bureau of Mines has certainly justified itself if the newspaper report be correct that "embedded under 100 ft. of solid earth a silver vein more than a mile long and 7½ ft. wide, said to contain nearly $1,000,000 worth of pyrites silver ore, has been discovered on the United States Bureau of Mines site in Oakland, Penn., a suburb of Pittsburgh." However, we shall await further details before becoming excited.

⁂

Recent sales of Southern No. 2 foundry iron at $12.50 per ton, Birmingham, must be rather gratifying to two or three large speculators who bought quite freely of that grade at $9.50 some three months ago. The advance is not quite so spectacular as that of some of the "war babies" on Wall Street, but it is solid and seems likely to hold for a while. Makers who are delivering iron under the $9.50 contracts may take a different view of the situation.

⁂

Speaking of mining investments, we know of a young man who, desiring on occasion to make an impression on the mother of his best girl, borrowed from his numerous friends various quantities of stock in questionable mines to be returned forthwith. The array having been displayed with the telling effect intended, our friend was about to return his borrowed certificates when he became confused and was unable to tell which was which. He ingeniously overcame this difficulty by ingenuously asking each one how many shares he had borrowed from him, and then counting out to him the same number indiscriminately from his collection. The ingenuity of his decision and solution of his difficulty would seem to have been amply rewarded by the fact that he never had a single kick from any of the people with whom he had this stock transaction.

⁂

Speaking of the early days on the Comstock, Charles E. Van Loan describes interestingly in the *Saturday Evening Post* the exploits of the "bad men" of the period. But life in the '60s was not all violence and bloodshed; under the froth there was a solid citizenry. The miners—by far the largest single element in the camp—were a kindly people, and many of their customs might serve as models for any community. The entire city contributed liberally to the support of the widows and orphans, and when a man was hurt or killed in one of the numerous underground accidents it was the usual thing for every man working in the mine to chip in to the extent of one day's pay—four dollars. "If a man was sick," said one of the Comstock veterans to Mr. Van Loan, "the scene at his bedside was like a conference of the nations. Americans, Englishmen, Irishmen, Swedes, Germans, Mexicans, Bohunks—even the Chinamen—would drop in to see if there was anything they could do. They were the best and the biggest-hearted people in the world; nothing was too much trouble if a man needed help."

⁂

September Mining Dividends

Dividends disbursed in September, 1915, by 33 United States mining companies making public reports amount to $10,708,720, as compared with $3,280,058 in September, 1914. Industrial and holding companies allied to mining paid $6,900,586, as compared with $10,995,380, a year ago. Canadian and Mexican companies paid $784,380, as compared with $531,756 in September, 1914.

The totals for the first nine months of the year are as follows: Mining companies, $51,399,883, as against $45,690,640 in 1914; metallurgical and holding companies, $61,726,344, as against $68,603,024 in 1914; Canadian and Mexican mines, $6,082,120, as against $12,602,124 in 1914. The drop in the payments by industrials is entirely due to the passed dividends on U. S. Steel common.

United States Mining Companies	Situation	Per Share	Total
Argonaut, g	Calif	$0 06	$20,000
Brunswick, g	Calif.	06	23,717
Bunker Hill & Sullivan, l s	Ida.	25	81,750
Bunker Hill Con., g	Calif.	02½	5,000
Butte & Superior, z	Mont.	5 75	1,564,637
Calumet & Hecla, c	Mich.	15 00	1,500,000
Calumet & Arizona, c	Ariz.	1 00	617,385
Chino, c	N. M.	75	652,455
Champion, c	Mich.	2 00	200,000
Federal M. & S., l s pfd	Idaho	1 00	119,861
Golden Cycle, g	Colo.	.02	30,000
Hecla, l s	Idaho	.07	70,000
Homestake, g	S. D.	.65	163,254
Jumbo Ex., g s	Nev.	07½	72,876
Magma, c	Ariz.	.50	120,000
Nevada Con., c	Nev.	37½	749,796
North Star, g	Calif.	.20	50,000
Old Dominion, M. & S., c	Ariz.	1.50	243,000
Oriflie	Calif.	.12	78,270
Plymouth Con., g	Calif.	.24	58,520
Quincy, c	Mich.	2.00	220,000
Ray, c	Ariz.	.37½	547,035
St. Joseph, l	Mo.	.25	352,350
Seven Troughs Coalition, g s	Nev.	.02½	36,076
Stewart, s l	Idaho	.10	125,826
Success, z	Idaho	.06	90,000
Superior & Pittsburgh, c	Ariz.	.38	569,922
United Globe, c	Ariz.	9.00	207,000
Utah, c	Utah	1.00	1,624,490
Utah Con., c	Utah	.50	150,000
Wasp No. 2, g	S. D.	.01	5,000
Yellow Pine, Lz.c.s.	Nev.	.10	160,000
Yukon, g	Alaska	.07½	262,500

Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Sm. and Ref. Co., com	U.S.	$1.00	$100,000
Am. Sm. and Ref. Co., pfd	Mex.	1.75	875,000
General Development	U.S., Mex.	1.50	44,982
Inland Steel	Ind.	2.00	157,672
International Nickel, com	U. S	5.00	1,901,575
La Belle, pfd.	U. S.	1.00	99,154
National Lead, com	U. S.	.75	154,916
National Lead, pfd	U. S.	1.75	426,433
Old Dominion of Maine, c	Ariz.	1.50	393,354
Pittsburgh Steel, pfd	Penn.	1.75	112,500
Phelps, Dodge & Co.	U.S., Mex.	5.50	2,475,000
St. Mary's Mineral Land, c	Mich.	1.00	160,000

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Caribou-Cobalt, s	Ont.	$0.09	$90,000
Dome, g	Ont.	.50	250,000
Hedley, g	B. C.	.50	60,000
Hollinger, g	Ont.	.20	120,000
Kerr Lake, s	Ont.	.25	150,000
Lucky Tiger, s g	Mex.	.09	64,380
Standard Silver-Lead, s l	B.C.	02½	50,000

NEW PATENTS

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

ALLOYS—A New or Improved Process for the Preparation of Alloys Containing Copper and Lead. L. Sempell, Duisburg, Germany. (Brit. No. 28,492 of 1913.)

ALLOYS—Process for the Production of Alloys of High Melting Point Having Ductile Properties. Wolfram Lampen Akt., Augsburg, Germany. (Brit. No. 29,980 of 1913.)

BRIQUETTES—Machine for Making Briquettes. Ellsworth B. A. Zwoyer and Rolland A. Zwoyer, Perth Amboy, N. J., assignors to Zwoyer Fuel Co. (U. S. No. 1,152,468; Sept. 7, 1915.)

CEMENT—Method of Burning Portland Cement Clinker. Thomas A. Edison, Llewellyn Park, Orange, N. J. (U. S. No. 1,152,613; Sept. 7, 1915.)

COKE—Apparatus for Utilizing the Heat of Coke Cakes. Carl Semmler, Wiesbaden, Germany. (U. S. No. 1,153,453; Sept. 14, 1915.)

CONCENTRATING TABLES, Head Motion for. William Armor Stedman, Wonder, Nev. (U. S. No. 1,153,723; Sept. 14, 1915.)

CONCENTRATOR TABLES—Protective Covering for Concentrator Tables and Method of Applying the Same. Everest A. Baylis, Madera, Mexico, assignor to J. A. McMahon, El Paso, Tex. (U. S. No. 13,981; reissue Sept. 20, 1915.)

CONVERTER for Treating Matte. William H. Howard, Garfield, Utah. (U. S. No. 1,153,921; Sept. 20, 1915.)

CONVEYORS—Improvements in or Relating to Coal and the Like Conveyors. S. A. Ward, Sheffield, England. (Brit. No. 23,084 of 1914.)

CONVEYORS—Improvements of Jig Conveyors. H. Flottmann & Co., Herne, Westphalia, Germany. (Brit. No. 10,184 of 1914.)

COPPER—Improvements in and Relating to the Extraction of Copper. E. R. Weidlein, Pittsburgh, Penn. (Brit. No. 10,500 of 1914.)

CRUSHING—Ball Mill. Frank E. Marcy, Salt Lake City, Utah. U. S. No. 1,153,239; Sept. 14, 1915.)

CRUSHING—Lining for Pebble or Ball Mills. Hans A. Hansen and Joseph M. Schmueser, Smuggler, Colo. (U. S. No. 1,153,844; Sept. 14, 1915.)

CRUSHING—Screen Grate for Ball Mills. Frank E. Marcy, Salt Lake City, Utah. (U. S. No. 1,153,238; Sept. 14, 1915.)

CYANOGEN COMPOUNDS—An Improved Process for the Production of Cyanogen Compounds and a Furnace for Carrying the Same into Effect. A. R. Lindblad, Ludvika, Sweden. (Brit. No. 22,852 of 1914.)

DREDGES—Clam-Shell Dredger-Bucket Buffer. Peter Peterson, San Francisco, Calif. (U. S. No. 1,153,950; Sept. 20, 1915.)

DREDGES—Power Spud for Dredges. Earl W. Dotten, Aitkin, Minn. (U. S. No. 1,154,492; Sept. 20, 1915.)

DRILL CHUCK. William Farquharson, Greenock, Scotland. (U. S. No. 1,154,209; Sept. 20, 1915.)

DRILLING MACHINES—Improvements in Coal and Rock-Boring Machines. A. Berner, Nuremberg, Germany. (Brit. No. 18,404 of 1914.)

DRILLS—Improvements in Hydraulic Rock and the Like Drills. J. Hanson, Penrhyndendraeth, North Wales. (Brit. No. 17,689 of 1914.)

DRILLS—Rotating Device for Rock Drills. Charles Otis Palmer, Cleveland, Ohio. (U. S. No. 1,153,700; Sept. 14, 1915.)

ELECTRODE FURNACES—Improvements in Electrode Furnaces which Have an Arrangement for Automatically Mixing Up the Charge. E. Krupp Akt., Essen, Germany. (Brit. No. 742 of 1914.)

FLOTATION—Improvements in Separation of Mixed Sulphide Ores. Minerals Separation, Ltd., London, England. (Brit. No. 8746 of 1915.)

FOUNDRY—Apparatus for Drying Sand. James C. Davis, Hinsdale, Fred C. Henke, St. Louis, and William H. Hawley, Granite City, Ill., assignors to American Steel Foundries, New York, N. Y. (U. S. No. 1,151,667; Aug. 31, 1915.)

FURNACE-CHARGING APPARATUS. William F. Clark, Coraopolis, Penn. (U. S. No. 1,153,605; Sept. 14, 1915.)

IRON AND STEEL INGOTS, Improvements in Treating. B. Talbot, Middlesborough, England. (Brit. No. 2639 of 1915.)

JIGS—Discharging Means for Jigs. Samuel V. Tench, Lansford, Penn. (U. S. No. 1,153,527; Sept. 14, 1915.)

KILNS—Improved Lining for Rotary Kilns or Furnaces. Dynamidon G. M. B. H., Mannheim-Waldhof, Germany. (Brit. No. 11,824 of 1914.)

KILNS—Improvements in and Relating to Rotary Kilns for Burning Cement, Ores and Like Material. G. Polisius, Dessau, Germany. (Brit. No. 17,146 of 1914.)

LAMP—Miner's Safety Lamp. Martin Albrecht, Frankfort-on-the-Main, Germany. (U. S. No. 1,153,003; Sept. 7, 1915.)

METAL COATING—Apparatus for Melting and Spraying Fusible Substances. Franz Herkenrath, Zurich, Switzerland, assignor, by mesne assignments, to Metals Coating Co. of America, Boston, Mass. (U. S. No. 1,151,586; Aug. 31, 1915.)

METAL COATING—Galvanizing Bath. Nicholas King Turnbull, Manchester, England. (U. S. No. 1,151,629; Aug. 31, 1915.)

NODULIZING—Method of Treating Ores. Louis C. Drefahl, Cleveland, Ohio, assignor to the Grasselli Chemical Co., Cleveland, Ohio. (U. S. No. 1,153,203; Sept. 14, 1915.)

OIL-BURNING SMELTING FURNACE. Oliver P. Moore, Spokane, Wash. (U. S. No. 1,153,561; Sept. 14, 1915.)

PEAT—Method of Removing Water from Peat. Thomas Rigby, Dumfries, Scotland, assignor to Wetcarbonizing Ltd., London, England. (U. S. No. 1,151,825; Aug. 31, 1915.)

PHOSPHORUS—Process of Producing Sulphides of Phosphorus. Francis C. Frary, Minneapolis, Minn. (U. S. No. 1,153,051; Sept. 7, 1915.)

PNEUMATIC TOOL. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,152,624; Sept. 7, 1915.)

PUMP—Balanced Centrifugal Pump. Ferdinand W. Krogh, San Francisco, Calif. (U. S. No. 1,153,321; Sept. 14, 1915.)

REGENERATIVE FURNACES—Improvements in and Relating to Reversing Regenerative Furnaces. L. L. Knox, Pittsburgh, Penn. (Brit. No. 17,584 of 1914.)

ROASTING—Improvements Relating to the Roasting of Sulphide Ores and Similar Metallurgical Products. W. Baudeus, Charlottenberg, Germany. (Brit. No. 29,042 of 1913.)

SAMPLING—Automatic Sampling Device. Robert Hamilton, Birmingham, Ala. (U. S. No. 151,682; Aug. 31, 1915.)

SCRAP—Apparatus for Recovering Metal Scrap. George E. Wisener, Steubenville, Ohio. (U. S. No. 1,152,867; Sept. 7, 1915.)

SCREEN for Ores and Coal and Other Material. Edward S. McKinlay, Steamboat Springs, Colo. (U. S. No. 1,153,804; Sept. 14, 1915.)

SCREEN—Pulsating Screen. Edgar B. Symons, Chicago, Ill. (U. S. No. 1,151,976; Aug. 31, 1915.)

SEPARATION—Apparatus for Separating Minerals and Like Materials. Friedrich Arthur Maximilian Schiechel, Frankfort-on-the-Main, Germany. (U. S. No. 1,151,722; Aug. 31, 1915.)

SEPARATOR—Fine Coal and Ore Separator. John Marriott Draper, Manchester, England. (U. S. No. 1,151,448; Aug. 24, 1915.)

SEPARATOR—Ore Separator. Charles H. Brown and Charles C. Parker, Eureka, Utah. (U. S. No. 1,152,351; Aug. 31, 1915.)

SKIP DUMP. Charles L. Lawton, Hancock, Mich. (U. S. No. 1,151,955; Aug. 31, 1915.)

SLIMES—A Process for the Treatment of Slimes and Colloidal Masses and for the Recovery of the Metalliferous Contents of Ores, Tailings, Middlings and Concentrates. A. A. Lockwood, Surrey, England. (Brit. No. 174 of 1915.)

SLIMES—Apparatus for Thickening Slimes. William Armor Stedman, Wonder, Nev. (U. S. No. 1,153,722; Sept. 14, 1915.)

SLIMES—Improvements in and Relating to the Filtration and Treatment of Ore Slimes. C. Butters, Oakland, Calif. (Brit. No. 9921 of 1914.)

STAMP MILLING—Cam for Stamp Batteries. Arthur B. Foote, Grass Valley, Calif. (U. S. No. 1,152,161; Aug. 31, 1915.)

STEEL—Improvements in or Relating to the Production of High-Grade Steel and Slag Rich in Soluble Phosphates. Deutsche-Luxemburgische Berg Werks- und Hütten Akt., Bochum, Germany. (Brit. No. 27,885 of 1913.)

STEEL—Improvements in Reversible Regenerative Furnaces for Use in the Manufacture of Steel and the Like. J. S. Atkinson, Ditton Coke-Oven Machinery Co., Ltd., and K. Huessener. (Brit. No. 27,678 of 1913.)

SULPHATES—Process of Extracting Sulphurous Acid and Oxides from Sulphates. A. Bambach, Cologne, Germany. (Brit. No. 3,174 of 1914.)

SULPHIDES—Process for Treating Metallic Sulphides or Sulphide Ores. N. M. Hooton, Burton-on-Trent, England. (Brit. No. 18,007 of 1914.)

SULPHUR MINING. Herman Frasch, New York, N. Y., assignor, by mesne assignments, to Union Sulphur Co., Jersey City, N. J. (U. S. No. 1,152,499; Sept. 7, 1915.)

SULPHURIC ACID—Improvements in the Manufacture of Sulphuric Acid. Fr. Curtius & Co., Duisburg, Germany. (Brit. No. 28,550 of 1913.)

TEMPERING—Method and Apparatus for Tempering Metals. Julius A. Dyblie, Joliet, Ill. (U. S. No. 1,151,675; Aug. 31, 1915.)

TUNGSTEN—Method of Treating Tungsten Ores. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., Niagara Falls, N. Y. (U. S. No. 1,153,594; Sept. 14, 1915.)

WASHER—Magnetic Ore Washer. Edward W. Davis, Minneapolis, Minn. (U. S. No. 1,153,037; Sept. 7, 1915.)

WASTE HEAT—Recovering the Waste Heat of Smelters and Kindred Plants. Carl Semmler, Wiesbaden, Germany. (U. S. No. 1,151,831; Aug. 31, 1915.)

WELDING—Electric Welding Machine. Friederich Müller, Hartford, Conn., assignor to Pratt & Whitney Co., Hartford, Conn. (U. S. No. 1,151,706; Aug. 31, 1915.)

WELDING—Method of Welding. Jean Hubert Louis De Bats, Zelienople, Penn. (U. S. No. 1,152,610; Sept. 7, 1915.)

ZINC—Arrangement for Preventing the Formation of Smoke in the Production of Zinc. Alexander Roitzheim, Duisburg-Ruhrort, Germany. (U. S. No. 1,152,050; Aug. 31, 1915.)

ZINC—Improved Process for the Manufacture of Metallic Zinc or Zinc Oxide. H. W. Baron de Stuckle, Dieuze, Alsace-Lorraine, Germany. (Brit. No. 28,188 of 1913.)

ZINC—Improved Process for the Manufacture of Receivers for Zinc Furnaces and the Like. Tellus Akt. f. Bergbau und Hüttenindustries, Frankfurt a. M., Germany. (Brit. No. 17,557 of 1914.)

ZINC—Reduction of Metallic Oxides and the Like. Frank William Highfield, Caversham, England. (U. S. No. 1,153,786; Sept. 14, 1915.)

ZIRCONIUM ALLOY and Process of Producing the Same. John Louis Brown, Baltimore, Md., assignor to Edward R. Cooper, Baltimore, Md. (U. S. No. 1,151,160; Aug. 24, 1915.)

PERSONALS

F. W. Harbord is now chief metallurgist to the British Ministry of Munitions.

F. R. Weekes will be in Darwin, Calif., for the next two months on professional business.

Robert M. Keeney has taken a position with the Standard Chemical Co., Canonsburg, Penn.

Edward L. Brayton, president Pelton Water Wheel Co., San Francisco, was in New York last week.

R. B. Lamb, formerly of Toronto, has moved his office temporarily to Room 1615, 27 Cedar St., New York.

L. V. Emanuel is now with the River Smelting & Refining Co., Florence, Colo. H. H. Utley is manager of the company.

Andrew C. Lawson, professor of geology, has been appointed dean of the College of Mining, University of California.

George H. Garrey is in Goldfield, Nev., to make a geological study of conditions in the property of the Goldfield Merger Mines Co. there.

R. O. Hocking has accepted a position as inspector of mining operations with the Meriden Iron Co., Hibbing, Minn., on the Mesabi Range.

Charles Perkins, purchasing agent of the Russian government, who is also an oil expert, recently visited the oil fields in South Alberta, Canada.

Montrose L. Lee sailed from Rio de Janeiro, Brazil, on Sept. 8 on his way to Bordeaux, France. He will spend two or three months in Europe, principally in Spain and France.

Homer D. Williams, now general superintendent of the Duquesne Works, will be president of the Carnegie Steel Co. in place of Alva C. Dinkey, who goes to the new Midvale company.

E. P. Earle and David Fasken, directors, and R. B. Watson, engineer, of the Nipissing Mines Co., have gone to inspect a gold discovery recently made north of Le Pas, Manitoba, which is reported to be remarkably rich.

Charles Sagert has been made superintendent of the open-hearth steel plant of the Brier Hill Steel Co., Youngstown, Ohio, to succeed Edward Bailey, who has gone with the Algoma Steel Co. at Sault Ste. Marie, Ontario.

Alva C. Dinkey, for a number of years president of the Carnegie Steel Co., has resigned and has been chosen president of the Midvale Steel Co. as reorganized. William E. Corey, who was chosen president last week, becomes chairman of the board.

B. B. Thayer, who was invited to sit on the Board of Engineers to investigate the conditions in the New York subway after the accident, declined, saying that his duties as member of the new Naval Advisory Board prevents his taking up the work.

Harry Huntington Miller, manager of the Compañia Anonima Minera lo Increible, has returned from a recent trip to Caracas and New York, and is again in charge of operations at the company's mines in El Callao district, Yuruary, Venezuela.

Dr. James Douglas, of New York, has made a donation of $150,000 to McGill University, Montreal, for the erection of a students' residence. Dr. Douglas has been offered the position of Chancellor of Queen's University, Kingston, Ont., and it is understood that he will accept it.

Russell A. Cowles has resigned his position with the American Brass Co. and has been elected a director and vice-president of the Buffalo Copper and Brass Rolling Mill, operating a brass and copper rolling plant at Buffalo, N. Y. Mr. Cowles has also been elected recently president of the Metals Trading Corporation.

Joseph W. Richards, professor of metallurgy at Lehigh University, South Bethlehem, Penn., was the guest of the Lehigh Intermountain Alumni Association at a luncheon at the University Club, Salt Lake City, Sept. 27. Professor Richards stopped over in S. It Lake on his way east from San Francisco. Nine alumni were present.

B. L. Miller, professor of Geology of Lehigh University, and Jos. T. Singewald, Jr., of Johns Hopkins, are making an extended tour, covering a period of 10 months through South America examining mines and deposits. Their trip includes a visit to the iron mines of Tofo, operated by the Bethlehem Chile Iron Mines Co., situated in the province of Coquimbo, Chile.

OBITUARY

John G. Bright died in Pittsburgh, Sept. 23, aged 79 years. He had lived in or near Pittsburgh for 61 years. He was for many years connected with the iron industry and assisted in the establishment of the first tinplate plant in Ohio.

William L. Hurd died at his country residence, near Valencia, Sept. 26, aged 68 years. He was born at Port Lavaca, Tex., and educated at Brown University, Providence, R. I. For 12 years he was with the National Tube Works Co. at McKeesport. He then connected himself with the Continental Tube Co., and later held a leading position with the Duquesne Tube Works Co. In 1897 he engaged in the iron and steel commission business at Pittsburgh with Hugh H. Davis, as Hurd, Davis & Co., and in 1899 organized and became president of the Monongahela Tube Co., which position he filled at the time of his death.

John W. Bookwalter, whose name was quite prominent in the steel trade about 25 years ago, died Sept. 27 at San Remo, Italy, aged 77 years. While engaged in the manufacture of the Leffel turbine water wheel at Springfield, Ohio, in 1888, he introduced from France the Robert-Bessemer process, installing a converter in the plant of the Bookwalter Casting Co., established for the manufacture of steel castings. The converter of this type attained considerable popularity, and it was introduced into quite a number of steel foundries in various parts of the country. For the past 15 years Mr. Bookwalter has spent most of his time in Europe.

SOCIETIES

American Institute of Mining Engineers—The first annual meeting of the Utah Section was held Oct. 4, at Salt Lake City. The order of procedure was as follows: Dinner (informal) and election of officers. Paper, "Notes on Flotation," by J. M. Callow. Paper, "Underground Mining at Utah Copper Mine," by T. S. Carnahan. Moving pictures of copper mining, milling and smelting. The officers chosen were: C. W. Whitley, chairman; Walter Fitch, vice-chairman; Ernest Gayford, secretary and treasurer.

Utah Society of Engineers—Following the summer intermission, this society has resumed its regular meetings, which are held monthly, every third Friday. The papers for four successive meetings—including the first, of Sept. 17—are as follows. "Engineering and Architecture," by H. D. Bowman, engineer of building construction; "Irrigation Pumping," by W. H. Trask, irrigation engineer, Utah Power & Light Co.; Nov. 19, "Coal-Dust Firing," by F. M. Seddon, superintendent of the Portland Cement Co.; "The Possibilities of Smoke Prevention by the Use of Powdered Coal," by W. H. Kelsey, smoke inspector; Dec. 17, "The East Cañon Creek Dam," from the construction standpoint, by A. F. Parker; from the designers' standpoint, by C. J. Ullrich. The meetings are held at the Consolidated Music Hall. Recently a stereopticon was purchased by the society.

American Mining Congress—The report of the Utah committee on freight and ore treatment rates, read at the American Mining Congress in San Francisco, recommends a getting closer together of operators and smelter men; that there be closer cooperation between ore shippers and the railroad companies in disputes relative to freight rates. Before the report was submitted efforts had been made to ascertain definitely if any ore shipper had not received proper treatment at the hands of either smelters or railroad companies; and mine operators throughout Utah were requested to report any grievances to the Utah Chapter of the American Mining Congress. No replies of any kind were received by the committee. Efforts are being made to show the railroad companies that a reduction in rates upon low-grade ores would result in an opening up of ores of higher grade, which would give the railroads the advantage and opportunity of charging higher rates, which the ore could stand. The Tintic district of Utah is referred to in illustration. The committee recommends that assayers be instructed to refer small producers to smelters for the actual market value of ores, based on smelting rates, instead of on the gross value of the metals, based on hand samples as given by the assayers. The committee was composed of I. Pett, H. S. Joseph, George H. Dern, W. M. Ferry, and Arthur Thomas.

Columbia University—Courses leading to the degree of Chemical Engineer have been offered in the Department of

Chemistry of Columbia University for the past 10 years but, in recognition of the rapidly increasing importance of those industries based upon the applications of chemistry, and the consequent demand for men specially trained in the fundamental engineering practices as applied to the problems of industrial chemistry, the trustees of Columbia University have established a separate Department of Chemical Engineering upon the same plane of importance in the graduate engineering school as mining, civil, electrical and mechanical engineering. The head of the new department will be M. C. Whitaker, who has been professor of chemical engineering at Columbia University for the past five years. The new chemical-engineering laboratories which were recently installed, where the students are taught to use engineering methods and engineering appliances in the study and development of chemical industry, will be provided with still further equipment during the present summer. These laboratories are equipped with apparatus to illustrate the various fundamental operations of chemical and electro-chemical processes, and the student learns by actual contact to apply fundamental scientific principles to industrial problems. Here research may be conducted on such a scale as to establish the dependable engineering data necessary for intelligent and accurate process design.

INDUSTRIAL NEWS

The Asbestos Protected Metal Co., of Pittsburgh, Penn., announces the removal of its Detroit office to 2011 Dime Bank Building.

William Jay Turner has been appointed general counsel of the Lehigh Coal and Navigation Co., effective Oct. 1, 1915, vice Samuel Dickson, deceased.

The American Steel Foundries has installed a six-ton electric furnace of the Heroult design at its Indiana Harbor, Ind., plant for the manufacture of extra-quality steel castings.

The American Steel and Wire Co. has been awarded a grand prize by the Panama-Pacific International Exposition for the superiority of its products and the high character of its exhibit.

W. E. Hardy, for the last 11 years connected with the Diamond Rubber Co. and the B. F. Goodrich Co., has been appointed sales manager of the Boston Belting Co., Boston, Mass., manufacturers of mechanical rubber goods.

The Bucyrus Co. announces the appointment of the Union Construction Co., 604 Mission St., San Francisco, Calif., as its agent for the sale of placer dredges in western United States, western Canada and Alaska.

The Hardinge Conical Mill Co. has received an order from the Nevada Consolidated Copper Co. for two 8-ft. Hardinge mills, to be used with iron balls, also an order from the Dome Mines Co., Ltd., of South Porcupine, Ont., Canada, for two 8-ft. ball mills. These ball mills are to take the place of stamps now in use at the Dome company's plant.

Frederick T. Snyder, president of the Snyder Electric Furnace Co., 53 W. Jackson Blvd., Chicago, Ill., will deliver a paper before the October meeting of the American Chemical Society in Pittsburgh, describing an electric furnace for carrying out industrial operations at temperatures above 2,000° C., with a holding capacity of 10 cu.ft. of charge.

Bausch & Lomb Surveying Instruments received the Grand Prix at the Panama-Pacific Exposition for "general design and excellence of quality." Among the features of these instruments which secured for them the highest award are: recalculated lens system with maximum apertures; interior focusing; water-proof construction; tarnish-proof graduations and the tubular tungsten magnetic needle.

The Nordberg Mfg. Co., Milwaukee, Wis., announces that it has recently received orders for electric hoists from the following mining companies: Anaconda Copper Mining Co., Canadian Copper Co., Mond Nickel Co., Ray Consolidated Copper Co., United Verde Extension Mining Co., Consolidated Arizona Smelting Co., Magma Copper Co., Cerro de Pasco Mining Co. and Morococha Mining Co.

New Heroult electric furnaces have been contracted for as follows: The Latrobe Electric Steel Co., Latrobe, Penn., will add a 3-ton furnace to its equipment. It is operating a 6-ton Heroult furnace for producing special and tool steels. The Belle City Malleable Iron Co., Racine, Wis., is to install a 3-ton furnace in its steel castings department to make steel castings. It is now using the crucible process. The Buchanan Electric Steel Co., Buchanan, Mich., will add a 2-ton furnace. It is now operating a 3-ton Heroult furnace. The Buckeye Steel Castings Co., Columbus, Ohio, has contracted for a 6-ton furnace.

A new publication has just been issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, which should be of a high degree of interest to all who are giving attention to the problem of the extension of our trade abroad. It is entitled "Financial Developments in South American Countries," and reviews in about 10 pages of a clear and forcible style the situation as regards the currency, the money market, the principal banks, and the general condition of business in Argentina, Bolivia, Brazil, Chile, Peru, and Uruguay, during the last two or three years. Especial emphasis is placed on the results of the European war and the measures taken by the various governments, financial institutions, and commercial communities to meet the situation thus created. The author of this publication is William H. Lough, vice-president of the Alexander Hamilton Institute, who has recently made a trip through the countries treated. It is to be had from the superintendent of documents, Government Printing Office, Washington, D. C., for the price of 5 cents.

TRADE CATALOGS

The Connersville Blower Co., Connersville, Ind. Catalog No. 17. Gas Pumps, Exhausters. 64 pp., illus., 8x12 inches.

Tate, Jones & Co., Inc., Pittsburgh, Penn. Circular No. 148, October, 1915. Shells and Shell Furnaces. 8 pp., illus., 11x8½ inches.

Alberger Pump and Condenser Co., 140 Cedar St., New York. Bulletin No. 20. Hammond Water Meters. 24 pages, illus., 6x9 inches.

A. D. Granger Co., 90 West St., New York. Bulletin No. 2. Oswego Internally Fired Water-Tube Boilers. 16 pp., illus., 8x10½ inches.

The Denver Engineering Works Co., Denver, Colo. Bulletin No. 1064, "Dewco" Sample Grinder. 4 pp., 8½x11 inches, illus. Bulletin No. 1073. Richards Pulsator Riffle. 8 pp., illus., 8½x11 inches.

Link-Belt Co., 39th St. and Stewart Ave., Chicago, Ill. General Catalog No. 110. Elevating and Conveying Machinery, Power Transmission Machinery, Crushers, Etc. 576 pages, illus., 6½x9½ inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1096, Direct Current Motors and Generators. 16 pages, illus., 8x10½ in. Bulletin No. 1412-A. Crushing Rolls. 32 pages, illus., 8x10½ in. Bulletin No. 1625. Hydro-electric Plant of the Cerro de Pasco Mining Co. 16 pages, illus., 8x10½ inches.

International High Speed Steel Co., 99 Nassau St., New York, N. Y. Catalog Mining and Rock Drill Steel. Hollow and Solid. 56 pp., illus.; 6x4¾ inches.

While this is primarily a catalog of tool steels, including drill steel, there is a great deal of information in the general subject of annealing and tempering that makes it a small "tool-steel handbook." Every user of tool steel ought to have it.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., OCTOBER 1, 1915.

of The Engineering and Mining Journal, published weekly at New York, N. Y., required by the act of August 24, 1912.

Editor, Walter Renton Ingalls, 10th Ave. at 36th St., New York, N. Y.

Managing Editor, Donald M. Liddell, 10th Ave. at 36th St., New York, N. Y.

Business Manager, L. E. Ives, 10th Ave. at 36th St., New York, N. Y.

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The balance of the stock issued (less than 1% each) is owned by 70 employees, 4 ex-employees, and 13 others who are wives, daughters or relatives of employees.

Known bondholders, mortgagees, and other security holders holding 1 per cent. or more of total amount of bonds, mortgages or other securities. Mortgage on building held by Dime Savings Bank, Brooklyn, N. Y.

C. W. Dibble, Vice-President.
HILL PUBLISHING COMPANY

Sworn to and subscribed before me this 30th day of September, 1915.

RICHARD L. MURPHY,
Notary Public
(My commission expires March 30, 1917.)

Editorial Correspondence

SAN FRANCISCO—Sept. 29

The Mine in the Mines and Metallurgy Building at the Panama-Pacific Exposition has from the opening day attracted a large number of visitors, particularly at the hour when the mine rescue work is demonstrated. The numerous underground features in gold, copper and coal mining and the various installations of mining machinery, most of which are operated for demonstration, afford to the lay visitor an opportunity to form a fairly good idea of what an actual underground mine is like. It was believed that this exhibit would attract only the lay visitor but the records show that not only a large number of mining engineers, but engineers and managers in high position have also availed themselves of the opportunity of observation and study. Young mining engineers and students found many features of practical mining detail here demonstrated much to their edification. The surface equipment of The Mine is not so complete in suggestion as it might have been, but the Bureau of Mines was obliged to work with such facilities and appropriation as were available. The wooden headframe is a fairly good one, but it is by no means a model. In fact there should have been a steel headframe instead and there might have been, had the builders been alive to the opportunity offered by this exhibit. There are few steel headframes in use at California mines, and this state is not alone in this lack of advancement. There are many small operators in the Pacific Coast mining regions who have never seen a steel headframe, who would have been glad to see an example in the Mines and Metallurgy Building at the Exposition. Another disadvantage in the surface suggestions is that while there are plentiful examples of coal there are no metal-bearing ores displayed, so that the visitor unacquainted with the situation underground forms an idea that he is going into a coal mine only. That is the fault of mining men who failed to provide a display of ores. But beyond this the exhibit as a whole is very creditable and of value to the mining industry as well as of interest to those who go merely to see what a mine looks like. The moving pictures of mining and metallurgical methods are also a feature that can be enjoyed by the lay visitor and studied with profit by the miner.

DENVER—Oct. 1

Nederland, only a small mining camp in the Rockies, has become famous through the prevailing and unusual market prices for tungsten ores. This is the chief settlement in the Boulder County tungsten belt and is teeming with activity. There is not a vacant house and hotel space is at a premium. Two lines of auto stages run daily between Nederland and Boulder, while the Denver, Boulder & Western Ry.—the Switzerland Trail—carries more pasengers than ever before if we except tourist travel. Miners are even giving renewed attention to a portion of northern Gilpin County (immediately south of the Boulder County line) where they recall having noticed a heavy black unidentified mineral in their early-day prospecting for gold.

W. S. Van Sant, general manager of the Copeland Ore Sampling Co., Victor, disappeared a week ago and thereby caused considerable gossip in the district. He is remembered as having driven away from Victor in his auto with a party of friends but his whereabouts is a mystery. Van Sant's predecessor was G. E. Copeland, then proprietor of the establishment, who was accidentally shot, a few years ago, in the Brown Palace Hotel, Denver, by Frank H. Henwood. Last winter, at the time of the first carload shipment of very rich ore from the famous Cresson "vug," the press of the country carried reproductions of the famous check issued in payment for this ore by the Copeland company, bearing Van Sant's signature.

SALT LAKE CITY—Sept. 30

A Greater Interest in Unlisted Stocks is being shown in the trading on the Salt Lake Stock and Mining Exchange. The total weekly business transacted in unlisted stocks during the past 3 weeks was: For the week ended Sept. 11, 204,739 shares, valued at $48,854; for the week ended Sept. 18, 211,550 shares, valued at $57,852; and for the week ended Sept. 25, 414,845 shares, valued at $100,037.

A New Dividend Payer has been added to Utah mines in the Cardiff, situated near the head of Big Cottonwood, which has just declared the initial dividend of 25c. a share, payable Oct. 1. Dividend aggregated $125,000 on the 500,000 shares issued. Shipments of 160 tons of ore a day, valued at between $4,000 and $5,000, are being made, but the average output is around 125 tons daily. The Cardiff opened ore last October, and has developed an orebody 225 ft. long by 20 ft. wide by 200 ft. on the dip.

Shipments from Alta now amount to three and four cars daily, or about 120 tons of ore, which is sent out over the Salt Lake & Alta R.R. The South Hecla is shipping 80 tons, including shipments by leasers; the Michigan-Utah, Wasatch Mines, and Alta Consolidated are also shipping. There has been some talk recently of building a narrow-gage cog railroad from Wasatch to Alta over the former narrow-gage grade a distance of 8 mi. Of greater immediate interest, however, is the possibility of an aërial tramway, which is being seriously considered. Two plans are under consideration: One for a tramway 8 mi. long from Wasatch to Alta, and the other for a tramway, about 4½ mi. long from Alta to a short distance below Tanners' Flat. The Salt Lake & Alta R.R. has a switchback at the granite quarries at Wasatch, and the railroad could be extended with a moderate grade to the latter point. Surveys for this have already been made, and the plan is found to be feasible at a moderate cost. This 4½-mi. tramway and extension of the railroad appears to meet with greater favor. It is estimated that such a tramway could be built at a cost, not exceeding $60,000 to $80,000. The season is rather far advanced for construction work, although the lower part of the cañon will probably be free from snow up to November or December. The plans under consideration call for the best material obtainable, and a good substantial tramway.

SEATTLE—Sept. 29

Nome Placer Mining Season, lasting usually about 100 days, was cut short this year for nearly the entire month of August on account of a long dry spell. This has not affected the average production which has been maintained by the district since 1898, with the exception of three years when the annual output went to nearly $6,000,000, due to the strike on the third beach line which is 4 mi. long. Many individual miners are operating placers this year on the tundra, the work extending over a strip of territory 10 mi. long and 4 mi. wide. The placer mining season is now closed permitting of an accurate estimate of the year's yield which is placed at close to $3,450,000.

Development Proves Permanency of Valdez Mines. Many events which loom big in the mining industry of Valdez have transpired recently. The big tram of the Granby mine has been started up and in a short time 300 men will be employed in the copper mine four miles from there. The Granite mine has struck a 4-ft. lead on the 600-ft. level and the output of the property will be more than doubled, with cheaper cost of handling the ore. The lead was struck on the Three-In-One property near Shoup Bay, and the future of the claims seems assured. The Fidalgo-Alaska copper claims on Shoup Bay have been turned to a syndicate of Spokane, Wash., mining men. The Valdez Mining Co. will let a contract soon for the extension of their lower tunnel. While the Granite mine has been a big producer for months, the striking of the lead in the 600-ft. tunnel adds greatly to the value of the property, insuring ore for many years, and allowing for more economical working of the claims. Operations on this group are being pushed rapidly by Superintendent W. R. Millard. The Granby mines are in charge of Superintendent Smith who has a large crew at work, and will continue development and the work of putting the properties on a shipping basis. The wharf and bunkers have been completed and the first ore sent down to the smeltery. Enough ore has been blocked out to last for several years. Jeff Devinney and M. F. Hendricksen are the principles in the bonding of the Three-In-One properties. E. D. Reiter, who is in charge of the work at the Fidalgo-Alaska claims, is making arrangements for the purchase of considerable additional equipment. A new wharf and bunkers are now under way. Many other claims are working. The Rutherford & Ramsay mine is being worked night and day, with the output heavy, and will continue working until the end of the season. H. Ellis has a crew on the Cliff mine and

a new lead has been uncovered and ore is now being crushed at the mill. The Dickey property on Landlock Bay and the McIntosh copper claims on Fidalgo Bay are producing steadily.

Sluicing Nome Tundra from the present beach line to the foot of Anvil Mountain, a distance of more than 10 mi. is the latest plan of interests in Nome backed by the Pioneer Mining Co. of which Jafet Lindeberg, discoverer of Nome, is the president. It is planned to strip each one of the seven beach lines so far uncovered and practically sluice them into Bering Sea. Arrangements are now being made for the carrying out of what will be the largest hydraulicking job ever undertaken in Alaska. Large reservoirs will be constructed in the Grand Central Basin on the east side of Anvil Mountain through which the water will be carried by tunnel to penstocks on the mountain which will give it a head of 340 ft. From here a ditch will be constructed from 20 to 100 ft. deep running to the seashore, part of this emptying into the present Miocene ditch, now one of the largest in the country, having a capacity of several thousand inches. This ditch picks up the water at the head of Nome River and delivers it to Anvil Creek. Below the tundra from Snake River to Hastings Creek, a distance of about 12 mi., and from the present seaboard back to the foothills, a distance of about 4 mi., the ground is seamed with auriferous sands. In many places these sands are not sufficiently rich to warrant their operation by the ordinary methods and in other places where they are fabulously rich, they cannot be worked by ordinary methods because of the inflow of water. All, however, are amenable to profitable operation by hydraulicking, and the big waterway will be used to obtain the gold that is now unobtainable. One of the ancient beach deposits which was discovered in 1904 yielded many millions of dollars, but a large portion of the streak has never been operated because it is impossible to shut off the flow of water. By cutting a bedrock ditch through the tundra to the sea, a task made possible by the conversion of the Grand Central waters, the overflow from which will be turned into Nome River, all of this ground will be drained. The Pioneer Mining Co., which is conceded the biggest placer mining company in Alaska, will start active work the first part of next season and will work a crew of about 300 men on the ditch and the necessary reservoirs.

KELLOGG, IDA.—Sept. 27

The Old English Board of Directors of the Northport Smelting and Refining Co. resigned in a body on Sept. 23. The new board elected immediately at Wallace is composed of E. K. Knight, Jerome J. Day, Eugene R. Day, Edward Boyce, and F. M. Rothrock. Jerome J. Day was elected president and Eugene R. Day secretary-treasurer, thus linking the management very closely with the Tamarack-Custer and Hercules mines and recalling a previous report that the $600,000 surplus of the Tamarack-Custer would be used by the new owners to finance the reconstruction of the smeltery. The work of overhauling plant is proceeding rapidly, 150 men being employed. A new flume is being built to supply water to the town of Northport and the works. New lead furnaces of 600 tons daily capacity are planned. Two largest of old copper furnaces, capacity 150 tons each, are being repaired. The equipment has been ordered from the Traylor Engineering Co. The Northport smeltery besides treating the Hercules and Tamarack-Custer ores will do a custom business, as is indicated by the installation of copper furnaces. Although it is hoped to have part of plant ready in 60 days, at least four or five months will be required to finish rebuilding.

Mines on the North Fork of the Coeur d'Alene River are making steady progress, and an effort is being made to secure daily train service to the junction at Enaville in place of the tri-weekly service now maintained by the O.-W. R & N. The Empire Copper Mining Co., operating the Horst-Powell mine on the Little North Fork, is shipping three cars of copper ore a week. Development work extending over several years has disclosed a large orebody that can be shipped. A wagon road has recently been built from the mine to the mouth of Little North Fork at a cost of $10,000 and it is believed that the railway will soon extend a branch up the creek to the mine. Ore from both the Tuscumbia and the Idora is concentrated at the Idora mill and the concentrate is hauled 9 mi. to the railway at the mouth of Beaver Creek. The Tuscumbia is shipping eight cars of lead concentrate a month and the Idora two. Charles Conn, lessee on the Terrible Edith, last week shipped two cars of zinc ore and expects to send out a car a week hereafter. The Chicago-London company, which has the Black Horse mill under lease, is temporarily closed down on account of a shortage of water. They have until recently shipped four cars of zinc concentrate a month and expect to do better when milling is resumed. Shipments from this district will be greatly increased when the Ray-Jefferson completes its 250-ton mill at the forks of Beaver and Carbon creeks. It is rumored that the O.-W. R. & N. railway will build a branch to the mill.

HOUGHTON—Oct. 5

Production of Copper from Michigan Mines will run over 24,000,000 lb. for September, keeping close to the sustained high figures of last six months. Calumet & Hecla may run a little more than last month because the regrinding plants are again in full swing. Copper Range continues at its record-breaking output for 1915, running the highest percentage of copper ever secured from the Champion mine and far above any other mine in the district. Champion is making better than 50 lb. copper to the ton; Baltic and Trimountain close to 30. Total rock output from these mines is not so large, all rock being handled at two stamp mills, practically, but the selection is careful and close. Quincy's deeper levels are showing higher copper returns. South Kearsarge is furnishing the richest and largest tonnage from the Osceola Consolidated and the rock tonnage from the various mines of this corporation is limited only by mill capacity, everything working to the limit. Wolverine may show a slight increase for September; Isle Royale likely will run up to 900,000 lb. and Allouez's output will be at least 875,000 lb. for the month. It is considered the best of the Calumet & Hecla subsidiary investments at the present time. Franklin is increasing shipments steadily now, running average of 450 tons of rock daily and there is an improvement in the average of copper content. Franklin's conglomerate is running 20 lb. to the ton. Shipments are about 1,100 tons daily. More Calumet & Hecla shafts will go on three shifts this week. On Oct. 10 No. 13 and No. 16, on the Osceola lode, Calumet & Hecla, will go on three shifts. There has been a notable increase in the shipments of silver to the mint from the Calumet & Hecla. The figures will prove interesting if the increase in silver continues in 1916 as it has this year.

HIBBING, MINN.—Oct. 2

Upwards of 130,000 Tons Per Day being shipped from Hibbing district, of which Hull-Rust and Mahoning pits jointly contribute one-half. Figured into 50-ton cars, this daily tonnage means 2,600 carloads. At that, operations are somewhat curtailed because of lack of vessel capacity at docks. Next week's shipments will exceed above figures if weather conditions permit.

BRAINERD, MINN.—Oct. 2

Much Activity on the Cuyuna Range is manifest in the district, but the greater part of this is being exercised in an endeavor to uncover known tonnage; but little exploratory drill work is under way. Inside the village limits of Ironton, in Sec 3, 46-29, a prospect shaft is going down on the June Lake property. The Adbar Development Co. is sinking a plank-lined operating shaft 4 mi. east of Brainerd, not far distant from the Wilcox. The Adams shaft, at Orelands, is being unwatered. At the Mahnomen and Hill Crest pits, stripping is being rushed. The small concentrator at the Cuyuna-Sultana is in operation and some shipments have been made. The Croft shaft at Crosby is cutting a station.

TORONTO—Sept. 27

An Extensive Deposit of Zinc Ore is reported to have been discovered by Denis Callahan, a Haileybury, Ont., prospector, near Burbridge Lake in the Upper Gatineau district of Quebec. John D. Macfarlane, mining engineer, has gone to inspect the discovery and bring out samples.

An Important Gold Discovery on the west side of the Pinewood River, 10 mi. from Athapapuska Lake, in northern Manitoba, by Don Messiers and Ralph Hammel, two former Cobalt prospectors, is reported to the Manitoba government. The prospectors are stated to have uncovered a rich lode of sulphide ore assaying $25 to the ton. The veins are said to be 2,000 ft. long and of remarkable width.

In the Kowkash Gold Field a number of new discoveries are reported, indicating that the gold belt is at least 25 mi. in length. Gold has been found near Redmond Station on the National Transcontinental Ry., 12 mi. west of Kowkash Station, and discoveries have also been made at a point about 5 mi. northeast from the original find, and near the shores of O'Sullivan's Lake an additional 5 mi. further on in the same direction. Free gold has been found along Gold Creek 2 mi. southwest of the King Dodds claims. Development is being pushed by the Syndicate which holds the option on the latter and some promising veins have been uncovered. The surrounding claims are being worked and many quartz veins and stringers have been exposed. A rich discovery of silver is reported at Collins near Armstrong on the National Transcontinental about 100 mi. from Kowkash. The government is preparing a map and report on the Kowkash country.

The Mining News

ALASKA

KENNECOTT COPPER (Kennecott)—Mine production for four months ended Sept. 30 was 31,000,000 lb., or at the rate of more than 90,000,000 lb. a year. Production in September was approximately 9,000,000 lb. Alaska Steamship Co. has bought two steamers, which will be used to carry Kennecott's ore now being shipped to Tacoma and Garfield plants of American Smelting and Refining Co.; Tacoma plant unable to handle mine's entire output. Some of the ore is being sent to Perth Amboy for smelting.

CALIFORNIA

Amador County

KEYSTONE (Sutter Creek)—Eighty men are employed and 40 stamps are dropping on good ore. C. R. Downs is manager.

PINE GROVE (Pine Grove)—Shoot of ore 4 to 6 ft. wide reported. Development of property is in progress. Russell Robinson is superintendent.

PLYMOUTH CONSOLIDATED (Plymouth)—Company report for August shows 10,800 tons of ore milled yielding total value of $53,236 or average of $4.93 per ton. Operating expense $29,158; development $1,906, total $31,104, leaving surplus of $22,132. James E. Park is superintendent.

Butte County

GOLDEN BANK-GOLDEN QUEEN (Forbestown)—Extraction and milling of ore has been resumed under lease by Charles W. Reese. Lease carries purchase option on which payment must be made in October. Property is largest of old producers in Forbestown and was reopened about four years ago by M. J. Cooney after being idle for about 18 years. Large amount of development was done and property examined by large investors and would probably have been sold but for advent of European war. Reconstructed 20-stamp mill is driven by water power, as mills were in the early days in Forbestown district. Should this property be sold and operated on proper scale an electric power plant will be necessary. If this property is reopened and operated reopening of entire district will follow.

Calaveras County

ROUGH DIAMOND (Angels Camp)—This gravel mine has been developed to bed rock, to depth of 61 ft. Gravel is dark blue and prospects from 5c. to 15c. per pan. An incline is being sunk to follow bedrock into channel believed to be old Murphy's channel.

Eldorado County

MOREY (Placerville)—Property is being worked by Elwood Morey. A 5-stamp mill which is one of oldest in state and is said to have been running almost continuously for 45 years. Ore is high-grade.

BLACK SAND discovered in the bed of Hanktown Creek within limits of Placerville recently gave return of $110.90 from 97 lb. of sand. It is believed there is large deposit of high-grade black sand in creek.

MOUNT PLEASANT (Placerville)—This old mine near Grizzly Flats is being unwatered with view of resuming development in lower levels, lowest being at 1,100-ft. depth. Assessment of 5c. per share has been levied on the capital stock, delinquent Oct 7. Mine was good producer years ago but was never worked extensively below 600 level.

W. S. DAY (Placerville)—A purchase bond has been taken by Nipissing Mining Co. at price reported to be $100,000. Reported that prospecting will be done with diamond drill. Ore is generally good-grade, running as high as $20 per ton. If development warrants purchase and operation it is probable that concentration will be introduced. H. E. Bush is superintendent.

MIOCENE OIL (Maricopa)—Gusher was brought in on 4, 11-23 recently and when it became evident that big producer was about to be finished, work was stopped and preparations made to bring well under control. Company has thus avoided large immediate production without tankage. Oil sand was entered at depth of 1,704 ft. Well is situated on Pat Welch lease.

Mariposa County

HART (Madera)—High-grade ore reported to have been disclosed in 2-ft. ledge extending for 30 ft. Ore contains copper as well as gold. Sample shipped to Selby. Property is owned by S. D. Hart.

Mono County

STANDARD (Bodie)—Work of treating old dumps is said to be preliminary to resumption of development of this and other mines in Bodie district.

Monterey County

PATRIQUIN (Parkfield)—Mine is producing about 1½ tons of ore per day. Recovery of about 60 flasks of quicksilver per month is reported.

Nevada County

THOMAS (Colfax)—Irving F. Smith and associates, of Oakland, have taken over the property and will begin development immediately.

EMPIRE AND GOLDEN CENTER threatened litigation reported settled out of court. It is also reported that negotiations have been resumed for settlement of Empire-North Star controversy out of court.

WALKESHAW (North Bloomfield)—In driving new drift Nels Jepsen and Theodore Larsen opened up large volume of water from which they escaped by being warned of approach by seepage through drill holes. They were compelled to run distance of 1,000 ft.

CARTER (Nevada City)—Reported that Haggin and Hearst interests have made an inspection of these claims at Missouri Bar on South Yuba River. Large ledge recently disclosed which produced good ore. Development will proceed under superintendency of Stuart Rawlings.

UNION HILL (Nevada City)—Fourth battery of mill in commission, making total of 20 stamps dropping on ore. Most of the ore comes from 700 level and 770 intermediate level, averaging about $7.50 per ton. Monthly output of bullion $12,000 to $15,000. Small amount of tungsten.

Plumas County

HENRY TAUNT AND J. P. BUTRE, operating gravel claims on Squirrel Creek, recently cleaned up $900 in coarse gold, one of pieces weighing about 9 oz. This district has produced large amount of coarse gold, recent slug valued at $700.

San Luis Obispo County

AVILA REFINERY has been removed to Casmalia in northern part of Santa Barbara County where it will be used in manufacture of asphalt from heavy grade of oil produced in that field which had been abandoned by fuel-oil producers.

COLORADO

Boulder County

WHITE RAVEN (Ward)—In sinking shaft below 240-ft. level body of rich silver and bismuth ore has been opened, at what appears to be convergence of two oreshoots which have been opened in higher levels.

BOULDER TUNGSTEN (Nederland)—Work on Clark tunnel is well under way and timbering of loose ground near portal is in progress. Machine drills will be used as soon as new compressor plant has been installed. Foundations for compressor and mine buildings have been laid and buildings are under construction. Portal of the tunnel is located below the Nederland dam of the Colorado Power Co. and line of tunnel is directed in northwesterly course which will intersect veins at depth of 1,000 ft. below the surface. F. H. Nye is superintendent.

Clear Creek County

WYOMING VALLEY TUNNEL (Idaho Springs)—The company plans to resume active development work. New 8-drill air compressor is to be installed.

VINDICATOR TUNNEL (Idaho Springs)—The 6-ft. vein in Tom Tuck property has been opened for distance of 250 ft. Arrangements are in progress to provide capital for extensive development, and to cover cost of machinery to complete equipment of old Gold Hill mill, which is to be remodeled to treat ore from tunnel.

Lake County

LEADVILLE DISTRICT MILL (Leadville)—Zinc tails from old Adams mill in Strayhorse gulch are being hauled by Horrigan Bros. and are treated by flotation in this reconstructed mill now operated by Pingree Mining and Milling Co. Estimates place dump tonnage at 10,000.

San Juan County

CARLSON (Silverton)—Main adit on sulphide vein has opened large body of soft sulphide ore, much of which is high grade and can be shipped crude.

KITTIMAC (Eureka)—Manager Walter, of Denver, and Superintendent Card have decided to install flotation in the mill in addition to Huff electrostatic process.

HAMLET (Middleton)—Remodeled mill is now in operation. Ore is trammed from mine 200 ft. through snow shed to mill storage bins. Ore is broken in Blake crusher and passed to two sets of rolls and revolving screens; then treated on roughing table to eliminate part of gangue and passed to Hardinge mill. Pulp goes to classifier and thence to four sets of Wilfley tables. Slime is pumped to Callow tank for dewatering and thence to 6-cell flotation machine. E. A. Ritter is consulting engineer.

Summit County

NO. 2 BOAT OF THE TONOPAH PLACERS CO. exposed four different veins in the bed of Swan River recently and prospectors have staked out claims along the extensions up Muggins Gulch.

Teller County

WAR EAGLE (Altman)—After lying idle for 10 years, this mine in highest part of district is being reopened by Charles Dougherty. It produced high-grade liberally in former operations.

MORNING GLORY (Anaconda)—New leasing concern is pushing development on 225 level after installing electric hoist and laying compressed-air pipeline from Doctor-Jack Pot power plant.

TORNADO (Cripple Creek)—Development will soon be resumed in this Raven Hill property belonging to Elkton estate. Surface equipment is being installed and shaft will be repaired and placed in working order.

IDAHO

Shoshone County

GUELPH (Wallace)—Caledonia compressor, motor and hoist have been purchased for this company and connections are being made with power mains

INTERSTATE-CALLAHAN (Wallace)—For 26 days ending Sept. 5, this company shipped 4,600 tons of concentrate and crude ore, averaging about 19% zinc.

OOM PAUL (Burke)—Company will use 500-ft. Echo tunnel as start for 1,000-ft. crosscut adit. New buildings, including bunkhouse, mess-house, and compressor-house, have been completed.

NORTHERN LIGHT (Pine Creek)—Crosscut and drift from bottom of 200-ft. shaft has exposed vein 6 ft. in width, nearly all of which is commercial ore, with 15 in. of shipping ore along foot wall. Ore is both lead and zinc, former predominating.

OOM PAUL (Burke)—Crosscut 1,000 ft. in length is now being driven to cut vein 1,000 ft. below old shaft workings on opposite side of mountain. New and permanent buildings have been completed and company is well equipped to make rapid progress. Crosscut will run through ground of Echo Mining Co. and will cut vein on that property at great depth.

EMPIRE COPPER (Little North Fork)—Empire Copper Mining Co., which owns property formerly known as the Horst-Howell, is shipping three cars of copper ore per week, hauling by wagon five miles to railroad Company spent $10,000 building wagon road, which is built on railroad grade, and it is believed that O.-W. R. & N. company will extend branch to mine next year.

LITTLE PITTSBURG (Pine Creek)—Gus Smith has just bonded Little Pittsburgh group of claims to J. D. and Watson Beebe, who have incorporated Colonial Mining Co. for purpose of development. Ledge is open at depth 400 ft. by crosscut and drift of 25 ft. has exposed 14 ft. of zinc ore that averages 25%; 7 ft. of which averages 45%. Compressor has been ordered and electric power line is being extended to property.

FRISCO (Gem)—Mine closed down three weeks to install new crusher, rolls and other machinery in mill. Owned by Federal company. Working zinc ore left in mine years ago by former owners when zinc was of little value. Extensive experiments operating during past year or more said to be successful. Mill processes include concentration, magnetic separation and flotation. New body of lead and zinc recently struck on 2,200 level.

SNOWSTORM (Mullan)—Mine exhausted ore reserves and suspended operations several months ago, having surplus of $160,000 in treasury. Reliably reported today that surplus will be used to take over Banner lead property near Troy, Mont., which has been under development for several years by Leo Greenough, manager of Snowstorm. Fred McCormick, formerly superintendent of Snowstorm, has gone to Troy to take charge of property

NATIONAL (Mullan)—Crosscut from bottom of 200-ft winze sunk from inner end of the old working adit has entered vein 35 ft., opening highest-grade copper ore ever found in mine. There is no indication of hanging wall, but no further crosscutting will be done till new pumps have been installed to handle increased flow of water expected when hanging wall is reached. The 500-ton mill will soon be ready to operate and there is said to be sufficient ore broken in stopes to keep it running at capacity for several months.

CALEDONIA (Kellogg)—Connection between upper workings and Keating tunnel has opened orebodies at considerably greater depth and is said to have assured sufficient ore to maintain dividends at present rate of 3c. a share, or $78,150 a month, for at least five years. Four feet of lead-silver ore assaying higher than any considerable body heretofore discovered in mine has been opened by new level 70 ft. above Keating tunnel. Where raise cut vein a foot of first-class copper ore was found, and this is said to have widened to several feet of milling ore, with stringers of shipping ore.

INDEPENDENCE-GETTYSBURG (Mullan)—Independence-Gettysburg group of claims, adjoining Morning mine of Federal company, was recently taken over by Independence Lead Mines Corporation, of which Maurice W. Bacon, general manager for Stewart Mining Co., is president. More than 4,000 ft of development has been done. Fifteen men are employed, stripping apex of supposed extension of Morning vein, driving on Independence at depth of 600 ft. and on Gettysburg at 150 ft. It is rumored that eastern capitalists are negotiating for two-thirds of 1,000,000 shares issued, on basis of 25c. per share.

MICHIGAN

Copper

AHMEEK (Ahmeek)—Has foundations in for new shaft rockhouse at No. 2. This will not interfere with hoisting but will give greater capacity when completed.

SOUTH LAKE (Houghton)—South Lake's suspension of rock shipments is due simply to desire to accumulate dozen cars at time to facilitate railway transportation from Copper Range to Hancock and Calumet roads.

HOUGHTON (Houghton)—Has resumed hoisting rock and shipping to Winona mill. Winze will be sunk from 10th to 12th level. Best showing is south of 6th level. Practically all copper rock is coming from that point now.

CALUMET & HECLA (Calumet)—Two-men machines are entirely out of use excepting in some pillar work. While the "one-man" drill was made an issue in strike two years ago no man would go back to old drill now. Calumet & Hecla now has on payrolls over 10,000 men

WHITE PINE (ONTONGAN)—Last Friday made its record showing for a single day since operations started. The mill turned out 40 bbl. of mineral, each barrel weighing 1,300 lb. of mineral or 52,000 lb. per day. Assuming that mineral shows a refined return of 70%, an assumption warranted by facts, product for one day's operation is shown to be 36,000 lb. refined copper. Mill was not then operating to complete capacity.

Iron

SALISBURY (Ishpeming)—Long drift to new orebody to south has been completed. Raising is now in progress. Exact size of deposit is unknown as only one drill showed ore.

FORBES (Iron River)—New blacksmith and machine shop to be erected soon. Present structures are entirely inadequate. Electric hoist, pump and underground haulage to be installed.

NORTH LAKE (Ishpeming)—Contract has been let for power house at new Section 6 mine of North Lake group. First cut has been made in pit. Stripping should be finished early in year. Ore will be mulled. Deposit contains about 250,000 tons

VOLUNTEER (Palmer)—Mine was reopened this week. Had been closed more than year but pumps had been kept going. New shaft has been raised. Drilling disclosed fine, new deposit. About 150 men will be employed when mine gets going well. Shipping also started this week.

JONES & LAUGHLIN (Ishpeming)—Small pit at Iron Mountain Lake has been opened again. Some work done here four years ago. About 12,000 tons will be shipped. Some exploratory work will also be done. Work on new underground property, short distance away, will probably be resumed in November. More drilling will be done on this property.

LAKE ANGELINE (Ishpeming)—Cleveland-Cliffs Iron Co. making surface survey of this property, which was bought at auction from Pittsburg & Lake Angeline Iron Co., Sept. 15. Old workings will be scrammed. Development campaign will be planned shortly. Believed there is ore to be found there. Machinery is almost worthless. Lucien Eaton, superintendent of Ishpeming district, will have charge.

PENN IRON (Vulcan)—Hydro-electric shovel has been loading ore from stockpiles for some time and is giving excellent satisfaction. It operates very smoothly and is said to be a big improvement over straight electric shovels. There is not wear and tear on motors when maximum load is on, as is case with electric machines. Patents have been secured by Frank Armstrong, designer.

MINNESOTA

Duluth

MINNESOTA STEEL (Duluth)—Officials state that plant will be in readiness to start on schedule time, Nov. 1. After month's firing with fuel oil, coke ovens are nearly ready. Although no ore shipments are yet arriving, upward of 300 cars of limestone and coal are being received daily. Blast furnace and hot-blast stove linings now being dried, as well as openhearth furnaces. Company recently contracted for erection of $50,000 hospital and $40,000 store building. Hospital will be 4-story structure, and store building will be 187x187 ft., two stories. Both will be of concrete blocks.

Mesabi Range

MORTON (Hibbing)—A new shaft has been completed.

ALEXANDRIA (Chisholm)—Arthur Iron Mining Co., employing 40 men on shift, now down 52 ft.

HILL ANNEX (Calumet)—About 300 ft. of trestle collapsed Sept. 25, carrying down ten cars. No fatalities.

THORNE (Buhl)—This new underground mine of Steel Corporation made its first shipment Sept. 23.

SUSQUEHANNA (Hibbing)—New shaft completed and drifting started. This main drift runs directly under openpit.

QUINN-HARRISON (Nashwauk)—Much rock being encountered in stripping operations. Eight shovels working.

LEETONIA (Hibbing)—Oliver Iron Mining Co. has completed new shaft and is now preparing to drift under Carson Lake.

MAHONING (Hibbing)—On Oct. 1 mine passed the 1,800,000-ton mark for season. Either Mahoning or Hull pit will be season's biggest shipper.

VICTORIA (Virginia)—Republic Iron & Steel Co. has started diamond-drill operations on property, immediately east of Norman mine

TIOGA (Chisholm)—Contract for furnishing light and power to this new operation of Shenango Furnace Co. has been awarded to Chisholm Electric Co. Latter company is building an addition to its plant for this purpose.

OLIVER IRON MINING (Chisholm)—Is shipping complete outfit for exploratory shaft sinking from its Sec. 27 shaft at Chisholm to Schulsburg, Wis., at which point shaft will be put down in zinc district. At Sec. 27 mine temporary equipment has been superseded by permanent installation.

HAWKINS (Nashwauk)—Company has notified all its surface lessees to remove their buildings by Nov. 1 as the company plans stripping west bank. This will bring openpit within few feet of town's principal business street, Central Ave. Overburden at point is 40 ft. deep.

Missouri—Kansas—Oklahoma

ATHLETIC MINING (Duenweg, Mo.)—To enlarge mill to 350 tons capacity. Larger compressor also to be installed. After contemplated improvements plant will be largest and most complete in district.

HANFORD MINING (Joplin, Mo.)—Is sinking new shaft east of its plant in Jackson Hollow, southwest of Joplin. Has made several improvements in plant recently and is now making about 60 tons of ore weekly.

GRAY CAT MINING (Galena, Kan.)—Started up last week after shut down of month, installing new steam hoist and making some repairs on mill. Made two cars of [illegible] assayed 61%, sold for $80 on 60% base.

JAMES MURPHY LAND (Galena, Kan.)—Mine practically flooded by heavy rains; hundred of miners out of work. Large concrete flume in Short Creek which crosses this land, insufficient to carry water off, arrangement being made to [illegible] install two Texas Wonder pumps, expect to have [illegible] out in about six weeks.

MONTANA

Jefferson County

KING SALOMON (Clancy)—This property, located in Clancy district, has been taken over by Monarch Mining and Smelting Co., with ample capital for financing property, which is one of old producers of district. Large amount of ore is blocked out in 400-ft. level for stoping. On 600-ft. level ore will be tapped by drift and crosscut. Mine is equipped with modern machinery good for depth of 1,200 ft. Regular shipments will begin shortly.

Silver Bow County

TUOLUMNE (Butte)—Strike of rich copper glance running as high as 40% copper was made Sept. 28 on 2,600-ft. level about 50 ft. from station.

NETTIE (Butte)—Pumping capacity at this mine, one of Anaconda company's properties in western section of Butte district, has been increased to take care of entire flow of water from underground workings, which is at present between 1,400 and 1,500 gal. per minute

BUTTE-DULUTH (Butte)—On Sept. 29 Judge George M. Bourquin of the United States district court rendered a decision that the Butte-Duluth mining company of Butte is not bankrupt. Although company admitted that it was unable to meet its obligations as they matured, it did not admit that its liabilities exceeded assets.

BUTTE & LONDON (Butte)—Shaft sinking at this property has met with set-back through trouble with installation of new electric pump on 1,100-ft. level to take care of flow of water in mine. In meantime shaft is kept clear of water by use of pump on 800-ft. level and by supplementing with tank-skips whenever water makes any gains.

DAVIS-DALY (Butte)—Hesperus vein, opened on new 2,500-ft. level of Colorado mine, has been drifted on 150 ft. and ore is holding out well. Vein averages 12 ft. in width, and the commercial ore, which contains a good sprinkling of copper glance, is about 5½ ft. wide. Smelter returns showing an average copper content of 5½ per cent.

NORTH BUTTE (Butte)—Encouraged by steady increase in surplus, company is making preparations for development of some of its new properties purchased in Butte district in past two years. Regular quarterly dividend of 50c. was ordered paid, but there will be no advance of dividend rate as surplus will be kept for proposed improvements and developing of new properties. It is understood that cost of producing copper by North Butte has dropped below 10c. a pound. With new shaft in operation monthly output should increase to at least 2,250,000 lb. of copper, raising production to 27,000,000 lb. per annum.

NEVADA

Clark County

SULTAN (Goodsprings)—Henry Robbins, owner of this property, has announced his intention to erect 50-ton dry-concentrating plant at mine. Mill is to treat mixed lead and zinc carbonates, of which there is considerable tonnage blocked out in mine. Experiments are also to be made on concentration of low-grade zinc carbonates.

MOBILE (Goodsprings)—Now shipping about 250 tons of zinc-carbonate ore monthly. Owners have taken option on Doran & Zenzen property on Big Devil Mountain. Force of men are to be put to work at once. Property has considerable tonnage of ore exposed, carrying lead and silver. It is probable that mill will be erected in near future.

Douglas County

BUCKSKIN NATIONAL (Buckskin)—Has 5,000 tons ore on dumps. Will build mill as soon as sufficient depth is attained in mine to determine permanent character of ore.

Esmeralda County

DIAMONDFIELD BLACK BUTTE (Diamondfield)—The Howard Marine lease on 110-ft. level has cut rich ore. Face of drift said to average $240 per ton in gold and silver.

GOLDFIELD CONS. (Goldfield)—During August total production was 32,100 tons from which net realization was $106,624. During month lessees produced 992 tons of total gross value $23,085.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Reported that on south 1,200 level strike of 14 in. of $10,000 ore has been made. Is thought to be same streak which was 8 in. wide and assayed $5,300 on both 1,200 and 1,300 levels.

ROCHESTER MINES (Rochester)—Big Friedman tunnel is progressing at rate of 15 ft. a day and is now in 920 ft. Low-grade vein matter is being encountered. Ore zone expected to be encountered at depth of from 1,000 to 1,200 ft. according to original estimates when figuring dip of veins at 400 level. Tunnel will hit ledges at depth of 1,200 ft.

Mineral County

BELLEVILLE TAILINGS ASSOCIATION (Belleville)—This association composed of Goldfield mining men has been working on tailings from ores of Candelaria milled in early days of camp, since July of last year, laying off only during winter months. Plant cost $25,000 and has treated to date 20,000 tons of tailings. There remains at least 150,000 tons averaging around $5 to be treated. Force consists of 18 men and the plant treats about 115 tons daily. C. Beedle is manager.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 25 was 9,629 tons, valued at $199,282 compared to 9,861 tons week previous. Producers were: Tonopah Belmont, 2,833 tons; Tonopah Mining, 2,850; Tonopah Extension, 1,850; West End, 839; Jim Butler, 1,050; miscellaneous leasers, 207 tons.

TONOPAH BELMONT (Tonopah)—Combined statement of Development and Milling companies for quarter ended Aug. 31, shows receipts from ore and bullion $586,480; mining, milling, and administration expenses, $371,867. Total net income, including miscellaneous, for three months, $226,864.

Storey County

MEXICAN (Virginia)—South drift No. 3 on 2,500 level in porphyry and quartz. Mill treated Mexican and Union wedge rock.

BELCHER-CROWN POINT (Gold Hill)—Water at incline lowered 45 ft. and held at 170 ft. below the 1,500 level. Saved 20 cars of mill rock. Jacket mill received 977 tons of dump rock and shipped one bar of bullion.

CON. VIRGINIA AND OPHIR (Virginia)—Air and water pipe placed for a distance of 186 ft. below 2,500 level. Ophir continued raising to third floor in vein. Ophir saved 309 cars of ore from all work and milled 250 tons.

White Pine County

GIROUX CON. (Kimberley)—Col. E. A. Wall, of Salt Lake City, has filed petition at Reno, Nev., asking for receiver for Giroux Consolidated. He alleges conspiracy on part of Thomas F. Cole and others to depreciate value of property and asks for accounting. Restraining order issued. Hearing set for Nov. 10 at Carson City.

NORTH DAKOTA

LIGNITE OPERATORS of Burlington, N. D., have lodged complaint with state railway commission against the short haul rates recently promulgated. Date of hearing not yet set.

SOUTH DAKOTA

Lawrence County

HIDDEN TREASURE (Deadwood)—Crosscutting easterly and westerly on 200 level is revealing highly mineralized formations. Some native copper has been found.

MOGUL (Terry)—New De La Vergne engine has been put in commission, raising capacity of plant to 200 tons daily. Custom ore is treated for $1.50 per ton; settlement is made upon 75% of gold assay.

UTAH

Beaver County

CONSIDERABLE MINING AND DEVELOPMENT is being done in the vicinity of Milford. The Moscow, Cedar-Talisman, Lady Bryan, of the Utah Mining, Milling and Transportation Co., and Majestic mines are producing; and the Leonora, Paloma, and others are developing ore. It is reported that the Horn Silver dumps at Frisco will probably be turned over to a leasing company. The dumps contain over 200,000 tons, and some of the material carries about 7% lead, 6% zinc, and 6 oz. silver. The mill at the South Utah at Newhouse, which will treat the Cactus dumps by flotation is expected to start up in the near future.

Juab County

TINTIC ORE SHIPMENTS for week ended Sept. 25 totaled 130 carloads estimated at 6,500 tons, valued at $163,000, compared with 121 carloads week previous.

Summit County

PARK CITY ORE PRODUCTION for week ended Sept. 25 totaled 2,634 tons valued at $105,000, compared with 1,727 tons week previous. There were 5 shippers.

Tooele County

INTERNATIONAL SMELTING (Tooele)—A. J. Bruneau, representing 25 Tooele Valley farmers, has filed suit in United States Court at Salt Lake City against International Smelting Co. for specific performance of contracts to purchase lands near smelter. Suit involves $265,000 and $39,000 attorney fees. Contracts were made prior to building of smeltery and were to be exercised should damage by smelter smoke be proven.

CANADA

British Columbia

GRANBY CONSOLIDATED (Grand Forks)—Has taken bond on Gloucester group of claims in Gloucester camp, about 55 mi. from Grand Forks, and about 30 mi. from end of Kettle Valley R.R., to complete which an extension of time was granted by Government.

Ontario

BEAVER (Cobalt)—Diamond-drilling to depth of 1,700 ft. has proved occurrence of rich ore below present workings, and shaft is being sunk rapidly.

CHAMBERS FERLAND (Cobalt)—Has found vein carrying high-grade ore on 275-ft. level. Extension of this vein in Nipissing has been profitable producer.

SMITH-LEBINE CLAIMS (Sesekinika Lake)—Have been purchased by Montreal syndicate, headed by A. M. Bilsky. They have an area of 120 acres on which 18 veins have been uncovered.

DOMINION REDUCTION (Cobalt)—Has taken option on Brennan property at Goodfish Lake, and has also taken more options in Munro Township, where it already owns rich Dobie-Leyson property.

NIPISSING (Cobalt)—Has dropped its option on claims in Munro Township, near the Dobie-Leyson. Company has an option on property in California. Financial statement shows cash on hand $655,403 and ore and bullion on hand and in transit, $731,572.

MEXICO

Pachuca

SANTA GERTRUDIS (Pachuca)—Ore crushed during August amounted to 13,338 tons; estimated profit, £5,280.

AFRICA

Transvaal

GOLD OUTPUT IN AUGUST is reported at 778,763 oz. fine, which is 8,208 oz. more than in July, and 66,845 oz. more than in August, 1914. For the eight months ended Aug. 31 the total production was 5,530,165 oz. in 1914, and 5,957,167 oz., or $123,134,642, in 1915; an increase of 427,002 oz. this year. The number of negro laborers employed at the end of August was 206,809, an increase of 7,412 over July.

The Market Report

Metal Markets

NEW YORK—Oct. 6

There was not much change in the metal markets last week, save in the case of copper where some pressure to sell began to be exhibited. Lead was a little weaker in tone. The peculiar condition in spelter continued.

Replying to an inquirer, "regular terms" in the sale of copper mean that the seller delivers the copper to the buyer, paying the freight on it, and allows him 30 days after his receipt of the copper in which to make payment, or if he chooses to pay cash the bill is discounted at the rate of ½%. To arrive at the difference between a sale upon these terms and a cash sale, f.o.b. refinery, which is regarded as being f.o.b. New York, the interest on the value of the copper while in transit is commonly reckoned. This is a matter of 10 days. When copper sells at 18¼c., regular terms, the equivalent net price is therefore about 18.03c., there being 0.09125c. discount, 0.1c. freight, and 0.0304c. loss of interest, a total of 0.22c. The freight rate is naturally a variable, being less to some near-by factories and more to some of the more remote ones. About 10c. per 100 lb. is regarded as being an average transportation cost.

Copper, Tin, Lead and Zinc

Copper—Some of the principal producers who had made liberal sales at 18c., regular terms, raised their asking price to 18¼c., but the market never became established at that figure. At the beginning of our week of record several sales of one million pound lots were made to domestic consumers at 17⅞c., regular terms, at least two agencies participating in this business. At the same time producers made sales of considerable tonnages for export at prices netting above 18c. Later, foreign business was done in considerable volume at higher prices, but, at the same time, foreign business was taken at lower prices. With respect to this business much depended upon the points for which sales were made and the conditions otherwise. Some producers were fortunate in having copper already available on the other side, and others were fortunate in having contracted for freight room in advance. In the meanwhile the domestic market became rather dull and the producers of electrolytic copper began to feel keenly the competition of the Lake producers. The latter realized high premiums several months ago and have had dreams of getting them again, but apparently giving up such hopes, they have lately been offering Lake upon the same terms as electrolytic. Even so, they found the going not quite easy. During the time when Lake was so scarce, the producers of electrolytic took some trouble to find a foothold for their product in quarters where previously it had not been used. Now, when the Lake producers are trying to get back their old customers they are told in some cases, so it is said, that electrolytic copper is liked better. At the close of the week copper was offered in many quarters at 18c., regular terms, and in some quarters at 17⅞c., with intimations that even the latter price might be shaded.

The volume of business transacted during the week was moderately large. Sales to domestic consumers were probably in excess of 10,000,000 lb., and foreign business was probably larger than that.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19½@20c. per lb. at mill. The chief maker does not quote base price.

Tin—The market was dull up to Oct. 5, when rumors began to be circulated that the government of the Federated Malay States was going to put an export duty on tin. This news, which was first published in a New York daily paper, became the subject of cable inquiries to Europe which led dealers over there to surmise that something was in the air, and considerable excitement ensued. On Oct. 5 tin opened in this market at 32c. and closed at 32½c. On Oct. 6 there was a sharp rise in the London price, which was reflected by an advance in the price here.

Lead—At the opening of the week some lead realized a premium, but this could not be maintained in view of the free offerings by several large interests at the old price. Meanwhile the market in St. Louis became a little weaker. There was a good deal of inquiry for large tonnages of lead but these were freely met.

Spelter—The only change in conditions from our last report was the doing of considerable business for such deliveries as October-March, November-March, etc. Such business was done at about 11¾@12c. The total volume of business was rather large, and it was almost entirely for export, domestic consumers apparently having no interest in the market. A relatively trifling amount of business for early deliveries was done, the price for October being about 13¾c., for November, 13¾@13½c., for December, 13@13¼c. Sales were made for the first quarter of 1916 at 10½@11½c.

Zinc Sheets—Business has been active, sales good but with no material change in quotations. The base price for carload lots is $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
Sept Oct	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			17 80		4 50		12 75
30	4 7188	49⅛	@ 18 00	32½	@ 4 55	4 42½	@ 13 75
			17 70			4 37½	12 00
1	4 7225	49¼	@ 17 90	32¼	4 50	@ 4 42½	@ 13.75
			17 70			4 37½	11 75
2	4 7200	49⅛	@ 17 80	32¼	4 50	@ 4 40	@ 13 75
			17 70				11 75
4	4 7150	49⅛	@ 17 80	32	4 50	4 37½	@ 13 75
			17 65				11 75
5	4 6850	49⅛	@ 17 75	32¼	4 50	4 37½	@ 13 75
			17 65				11.75
6	4 7000	49⅝	@ 17 75	32¾	4 50	4 37½	@ 13.75

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 15c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
Sept Oct	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
30	23⅜	72	73	87½	18 43	151¼	152½	23¾	5 02	65	13 70
1	23⅜	73	73⅛	87½	18 44	150	151¼	24¼	5 08	67¼	14 22
2	23⅜										
4	23⅜	72⅞	73⅛	88	18 53	149¾	150¾	23¾	4 98	67½	14 19
5	23⅜	72⅞	73⅜	88	18 45	148¾	149¾	23 7/16	4 92	69	14 35
6	23⅜	71	72	88	18 47	151¼	152¼	23¼	4 91	69	14 30

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is quoted in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the London delivery, subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound, the following approximate ratios are given, reckoning exchange at 4.80: £10 = 4.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Various items, £1 = 0.21½c.

Other Metals

NEW YORK—Oct. 6

Aluminum—The demand continues good and the scarcity of metal for spot and early deliveries has been accentuated. Sales are reported as high as 49@51c. per lb. for No. 1 ingots. No quotations on futures are being made.

Antimony—A fair business has been done and there is a good lot of inquiries. Reports of large demand for war orders are current, but not especially credited. Ordinary brands, chiefly Chinese, bring 28@29c. per lb., New York; while 45@46c. per lb. is asked for Cookson's.

Nickel—Quotations for ordinary forms nominally are 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—Stocks are reported rather low, and the market is active and stronger. New York quotations are $90 per flask of 75 lb. for large lots, $91@92 for smaller orders. San Francisco reports by telegraph a brisk market, with sales early in the week at $85, the price hardening to $87.50@90 at the close. London price is unchanged at £16 per flask, with no discount from second hands.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium** metal, 75c. per lb., New York.—**Cobalt** metal, 97% pure, is sold at $2 per lb.—**Magnesium**, pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots, $4.50@5 for retail quantities.—**Tellurium** is quoted at 8os. per lb. in London.

Gold, Silver and Platinum

NEW YORK—Oct. 6

Gold sales from the United States Assay Office in New York in September were $3,020,719, being $498,497 less than in August. For the nine months ended Sept. 30, the total sales were $48,409,521 in 1914, and $24,420,943 in 1915; a decrease of $23,988,578 this year.

Gold Imports in Great Britain eight months ended Aug. 31 were £6,934,244, exports, £6,679,991, excess of imports, £254,253. The receipts are apparently very much less than in 1914 owing to the arrangements by which gold in the Transvaal and Australia is held in those countries.

Platinum—The market is entirely in the air owing to the scarcity of supplies. Dealers are reluctant to quote, even to regular customers. On a nominal base of $50 per oz. sales have been made up to $58 and even $60. Quotations may be put at $57@60 per oz. for refined platinum, and $61@65 per oz. for hard metal.

Silver has been steady in London, and the amounts on the market have been absorbed at slightly advancing prices. There is no news, however, to indicate any material advance.

Silver Imports in Great Britain eight months ended Aug. 31 were valued at £6,479,285, exports, £5,426,759, excess of imports, £1,052,526, which compares with an excess of exports of £1,130,571 last year.

METAL EXPORTS AND IMPORTS

Imports and exports of minor metals in the United States, seven months ended July 31, in pounds, except platinum, which is in ounces:

	Imports		Exports	
	1914	1915	1914	1915
Nickel	24,000,060	20,057,243	17,845,959	18,463,253
Antimony	8,775,391	11,509,034	3,675	662,492
Aluminum	9,087,575	5,842,129	18,939	40,102
Quicksilver			9,141	128,837
Platinum	38,715	12,779	143	9

Nickel and antimony include contents of ore, matte, etc. Exports of aluminum manufactures not included above, were valued at $533,927 in 1914, and $2,124 this year. Exports include reexports of foreign material. Imports of quicksilver not reported separately.

Exports and imports of the Principal Metals, other than iron and steel, in the United States, seven months ended July 31:

	Exports		Imports	
	1914	1915	1914	1915
Copper, long tons	266,063	180,145	93,056	73,741
Tin, long tons	455	472	27,198	38,005
Lead, short tons	11,009	79,846	13,576	29,671
Zinc, short tons	1,014	77,928	560	549

Exports include reexports of foreign material. Copper includes contents of ore and matte. Imports of zinc ore in 1915 were 69,854 tons, estimated to contain 29,049 tons metallic zinc. Exports of domestic zinc ore were 605 tons.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Oct. 2

The open market base price paid this week for 60% zinc ore advanced from $72 to $76.50 per ton. Ore taken under contract sold up to $85 per ton. Medium grades sold in the open market at $68@72 base. One lot of 150 tons assaying 50% zinc and carrying 8% carbonate sold at $45 per ton. The base price paid for 80% lead ore was $50 per ton.

SHIPMENTS, WEEK ENDED OCT. 2

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,694,440	238,460	473,880
Year	148,206,040	4,781,620	20,494,190

Shipped during week to separating plants, 4,311,280 lb. zinc ore.

JOPLIN, MO.—Oct. 2

Blende, high price, $90, base, per ton of 60% zinc, premium ore, $87.50, medium grades, $85@85; lower, $84@80; calamine base, $60@56 cut lots and ton lots, $55@50; average, all grades of zinc, $79.62. Lead, high price, $56.10; base, $55@50 per ton 80% metal content, average, all grades of lead, $50.62 per ton.

SHIPMENTS WEEK ENDED OCT. 2

	Blende	Calamine	Lead	Values
Totals this week	12,299,300	711,100	2,380,240	$578,220
Totals this year	433,005,410	33,645,780	67,721,880	$19,033,410

Blende value, the week, $198,690; 40 weeks, $16,488,510.

Calamine value, the week, $19,290; 40 weeks, $767,060.

Lead value, the week, $60,240; 40 weeks, $1,777,840.

Nearly 60 in. of rain this year is the government record for Joplin. Other portions of the district have experienced several heavy rains that did not visit Joplin. There has been no rain of importance since Tuesday, when a 3-in. fall visited the district east of Joplin, but was very light here. The water is very heavy in the mines, but the present outlook is more favorable for settled clear weather than any prospect this fall. All ore outside Granby has been sold, the shipment representing over 1,000 tons in excess of the production, while large quantities of ore were being contracted for future delivery today and tonight.

Iron Trade Review

NEW YORK—Oct. 6

The iron and steel trades show increasing activity and a stronger position. This is not due altogether to export business, since domestic orders are growing in volume. Structural-steel orders are coming in more freely, as building and bridge business seems to improve, the railroads are ordering more cars, and there is a considerable volume of orders for plates, shapes and other material for ship building. In some lines, such as bars, the orders exceed the capacity of the mills.

Under these conditions is is to be expected that the advances in price on finished steel should be held, and more are expected to be made soon.

There is a shortage of billets, blooms and half-finished steel and mills using purchased billets are anxiously looking for supplies.

Pig iron is stronger, though not yet as active as finished steel. The chief demand just now is for basic iron, foundry grades being rather quiet. The market is strong enough, however, to enable furnace managers to hold the advances they have already asked and to suggest further advances on first-quarter business.

Exports from Baltimore for the week included 5,450 tons billets, bars, wire rods and skelp steel to Great Britain; 2,501 tons steel rails to Archangel; 5,637 tons steel scrap to Naples.

Imports at Baltimore for the week included 322 tons ferromanganese from Great Britain, 6,900 tons manganese ore from Brazil.

It is now stated with some authority that Charles M. Schwab, president of the Bethlehem Steel Co., is negotiating for the purchase of the stock in the Pennsylvania Steel Co., the majority of which is owned by the Pennsylvania R.R. There are also reports that negotiations are going on for the sale of the majority stock in the Cambria Steel Co., an option on which is held by W. H. Donner and Henry C. Frick.

Foreign Trade of the United States in iron and steel, including machinery, is valued as below by the Department of Commerce for the seven months ended July 31:

	1914	1915	Changes
Exports	$120,816,919	$174,970,645	I. $45,153,726
Imports	18,752,973	11,731,263	D. 7,021,710
Excess, exports	$111,063,946	$163,239,382	I. $52,175,436

The increase in exports has been chiefly in the later months. In July the total exports were valued at $35,891,575, against $16,737,552 in July of last year.

the Wilfley No. 5 head motion in conjunction with vertical supports, and these gave better results in the treatment of the slimes. Any type of head motion may be used.

The feed trough consists of a band of sheet iron 1 bent to form the front and side of the trough, which is about 1 m. long and 8 cm. wide. The back of the trough is the backboard of the table, and the bottom of the trough is the surface of the table which, however, within this inclosure, is raised toward the back by the insertion of a wedge-shaped strip of wood 2 under the linoleum. The distribution of the feed onto the table is through a row of small holes 3 at or near the bottom of front side of the trough. To check the flow of the water in the feed as it enters the trough and to cause a classification of the material in the feed, several small screens 4 are secured in the trough perpendicular to the sides. The best results are obtained when the tops of these screens are inclined toward the feed entrance. From this type of feed trough the coarse ore is discharged through holes nearest the head of the table and the slimes nearest the concentrate end. Wash water is supplied through the pipe *m*, and *n* is a stanchion to support it.

The Arrangement of the Riffles

As to the riffles, the arrangement used on the Wilfley tables with diagonal line of termination was first tried, the riffles being high at feed and tapering to 0 toward the concentrate end. This height was gradually cut down and the spacing reduced. The present size of riffle is 3 to 4 mm. in height, 6 mm. in width and spaced 15 to 20 mm. c. to c. and tapered only near the ends. With the diagonal termination of the riffles it was found that the middlings, which are usually coarser than the concentrates, discharged onto the smooth surface of the table at the ends of the riffles and formed a narrow diagonal band, dragging along under them in their downward course a portion of the concentrates. At the point of division where the concentrates and middlings discharge from the table, the separation was not distinct and the result was that some middlings would go with the concentrates and some concentrates with the middlings.

Ending the riffles or grooves so that their termination points on the upper half of the table form a diagonal line and those on the lower half form a curved line, as indicated, holds the concentrates higher on the table and spreads them over a wider area of smooth surface at the concentrate end, besides forcing the middlings to work down more rapidly toward the lower side of the table. Thus the fine concentrates in the middlings have a chance to push out from under them and continue to the concentrate edge. The line of division between concentrates and middlings is thus widened, and a more perfect separation takes place.

This practice of carrying the concentrates higher on the table and thus widening the bands of concentrates on the smooth portion of the table surface is important in the separation of complex ores like cerussite and calamine or galena and blende such as we have to treat here in Sardinia. The use of low riffles closely spaced is also important, as it allows a bed of sand to spread well down on the table, and thus the fine concentrates, which are often carried away in the flow of feed water over the table, are caught in this sand bed and travel under it to the concentrate end. The use of high riffles usually causes the ore to crowd forward in a narrow band and to leave the portion of the table below the feed box bare of material, so that the feed water has only the riffles to pass over and the fine mineral in it cannot be caught.

For treatment of slimes, grooves cut into the linoleum are preferable to riffles. In this case a linoleum of 6 mm. thickness is used and grooves 2 to 3 mm. deep and about 6 to 8 mm. apart are cut. The ends of the grooves are tapered to 0 and the points of termination form a diagonal for the upper grooves and a curved line for the lower grooves as shown on plan for riffles.

A Simple Table-Tilting Device

Another feature of the table is the tilting device, which consists of a double wedge *u* inserted between the two central supports of the table. This is entirely carried by the table top, and thus a tilting frame or rods connecting with the foundation or other complicated devices are avoided.

The bars *b* rest on the upper face of the double wedge, while the lower-wedge surfaces rest on bolts *t* carried by the supports *p*, these bolts passing through slots *s* in the vertical web of the angle-bars *c*.

To adjust the table, the bolts *t* at the top of the supports *p* should be loosened slightly, and when the table is adjusted these should be tightened again. The adjustment is effected by rotating the rod *r*, secured at its inner end to the wedge *u* and having near its outer end a screw engaging a nut secured to the frame *a* of the table. A handle *w* is attached to the end of the rod *r*. By moving the wedge, the table can be given the desired inclination. As the central member, or rod, passing through the center of the table is pivoted in the grooves of the central supports and the end of this rod is suitably connected with the head motion, the table may be tilted to any desired extent without affecting the driving mechanism or the supports.

Tilting devices as a rule make a table less rigid and often cause it to lose its proper adjustment, since they give the millmen something to fool with. The mill superintendent should be the only one to readjust a table, and when running properly the tilting devices should be so clamped that they cannot be moved.

Application of the Wash Water

The distribution of the wash water is through an adjustable perforated pipe *m*, as shown on the sketch. In case the line of concentrates is high on the table, the end of the wash-water pipe can be moved down and the line of the concentrates will move down accordingly. Thus with the wash-water pipe alone the necessary small adjustments for the position of the line of concentrates or middlings can be made immediately. The lower half of the concentrate edge is cut off at an angle *o* as indicated, so that the flow of wash water keeps the entire edge wet.

It has been found that a stroke of 12 mm. and a velocity of 300 r.p.m. are best for the finest ores, of 80 mesh and less, while a stroke of 18 mm. and a velocity of 240 r.p.m. are best for ores from 1 mm. and under, or from 16 to 80 mesh.

The advantages of this new table are its regular shape and rigidity, its light weight, small floor space required, simplicity of foundation, free space under table for launders or boxes for products, and its very low cost. Th

Mining & Metallurgical Machinery

Wright Concentrating Table

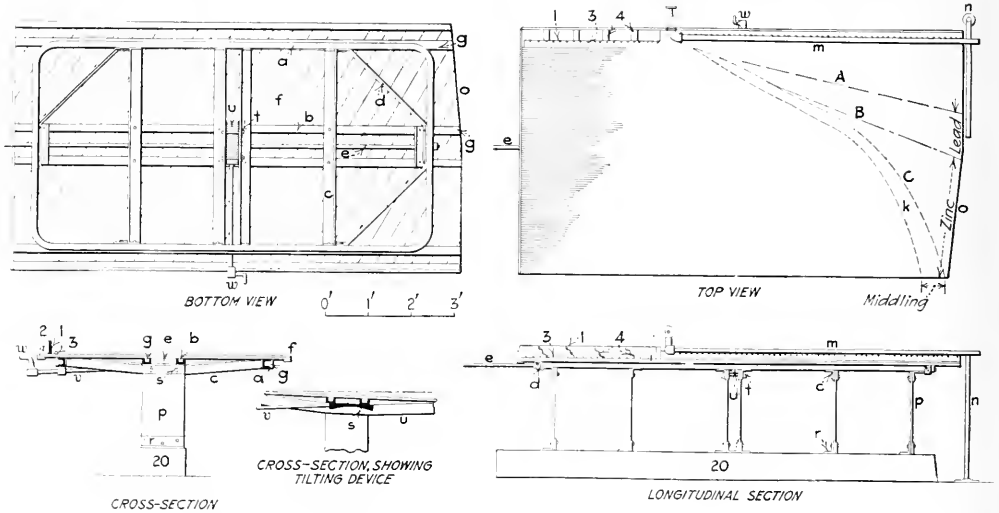
By C. W. Wright*

Table treatment of crushed ore is a simple process and one that requires a simple machine to secure best results. Most manufacturers of milling machinery make a type of table with some special improvement not found on others. There are tables of various shapes with many forms of grooves and riffles, and some tables having doubly inclined surfaces that attempt to treat an unclassified feed of sands and slimes on the same deck. Often several different types of tables may be seen in the same mill, especially when the millman has been anxious to have the best. They all do good work if run properly. It is more often the fault of the mill foreman than of the table if good results are not obtained. In many mills the tables have little chance to do efficient work because of the criminal amount of water in their feed. This is often due to the mill design, which does not allow sufficient grades for the launders, making necessary the use of an excessive amount of water.

The type of table to be described is one which we have had in use in Sardinia in some of our lead-zinc mills for four years. All of our mills are equipped with them, a total of about 60 being in use. Six years ago there were no tables used and the streams below the mills were sparkling with galena. It was not a pleasing sight, and I found it necessary to design and build tables on the ground. The machines have been modified somewhat each year, and the final result is the one now in use.

*Mining engineer, Ingurtosu, Sardinia, Italy.

The details of construction are shown in the accompanying drawings. The rectangular frame *a* is made of channel iron 60 mm. high by 40 mm. wide, and two longitudinal channels *b*. Small angle irons *d* placed diagonally across each corner are bolted to the frame to give rigidity. Large angle irons *c* constitute the transverse members of the frame, and to these the supports and tilting device are attached. An iron rod, or bolt, *e* passes longitudinally through the center of the frame, serving to clamp the entire frame rigidly together. The end of this rod extends beyond the end of the table and to it the head motion is attached. This central longitudinal member is important, as it distributes the pull of the head motion over the entire length of the table and also acts as a pivot for tilting the table on its supports. The table top *f* is made of 1-in. boards spaced $^1/_{12}$ in. apart to allow for swelling. These are screwed to four longitudinal stringers *g* of pitch pine which are bolted to the channels. There are six flexible supports *p* 30 cm. wide for the table with notches at the top in which the central rod rests. These supports are bolted to the transverse angle irons *c* of the frame and to angle-iron plates *r* bolted to the foundation beam 20.



DETAILS OF CONSTRUCTION OF THE WRIGHT CONCENTRATING TABLE

Head Motion and Feed

On the first tables built a simple eccentric head motion was used in conjunction with the flexible supports, which were inclined so as to impart a throwing motion to the table, this being the patented principle of the Ferraris table. Tables with this motion give satisfactory results, especially in the treatment of sands. Later we adopted

crucible or in a crucible heated by the oxyacetylene flame. The alloys are said to be particularly valuable as filaments for electric lights. Those covered by the patent contain not less than 40% or over 90% of zirconium.

Failure of Structural Brasses*

In an investigation of the season-cracking of brass, by P. D. Merica and R. W. Woodward, the following conclusions were reached:

Season-cracking and similar failures occur in brass materials that are under initial stress, provided these stresses average over 5,000 to 6,000 lb. per sq.in.

These stresses may be almost entirely removed by annealing at temperatures of about 300° C. to 400° C., which temperatures do not affect sensibly the ordinary physical properties.

No certain indication of the magnitude or even presence of such stresses has so far been found in a study of (a) the action of etching agents such as $HgNO_3$ or NH_4OH on brass, or (b) the micro- or macro-structure.

Brass may be manufactured practically free from stresses, and still retain excellent mechanical properties; that is, be not too soft.

Thus it would seem that from the standpoint of the user of brass further investigation should continue to correlate the service behavior of brasses with their physical properties and initial stresses so that it may finally be possible to decide what are the magnitude and the distribution of initial stresses which are allowable in such materials. Further, the most convenient method of measuring or obtaining an indication of the value of these stresses should be sought. At present this is the elongation method, which is a fairly tedious one.

From the standpoint of the manufacturer, investigation should concern the influence of the mode of manufacture on the initial stresses, the influence of other chemical elements in producing hot or cold shortness and a study of the best manner of annealing such materials. To anneal brass at 300° to 400° is not convenient with the ordinary brass-rolling mill equipment, and it is possible that some higher temperature might be used without softening the material unduly.

Sampling Lead Bullion at the El Paso Smelting Works

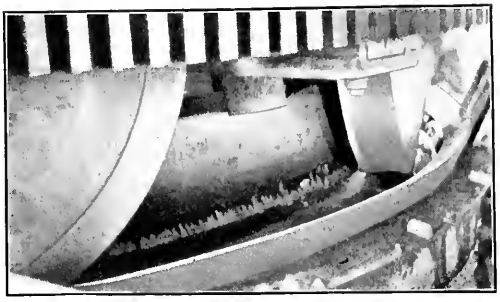
In discussing the lead-smelting practice at the El Paso Smelting Works, El Paso, Texas, H. F. Easter describes[1] the sampling of the base bullion as follows:

Whether drossed at the blast furnace or at the remelting furnace, the bullion is tapped into a cast-iron cooling pot. The dross is skimmed off carefully and thoroughly. Before the final skimming the contents of the kettle are well stirred and the dross thereby raised is taken off completely. After skimming, the contents of the cooler are stirred again and, while the lead is still in motion, gum-drop samples are dipped. A few more gum drops are taken than it is expected to make into bars of lead, to insure having a gum drop for each bar of lead.

The bullion is ladled into molds, and after the pot is empty all extra gum drops over the number of bars produced are thrown out. These gum drops are held and delivered to the assay office whenever the bullion corresponding to them is removed. A shipping lot consists of 780 bars (about 42 tons), and, when complete, the 780 gum drops corresponding are placed in a graphite crucible and melted at as low a temperature as will give a homogeneous mass from which to dip the final gum-drop samples, upon which the actual assay of the lot is made. Great care is taken not to get the sample hot enough to oxidize the lead during the process. The gum drops, which weigh about 10 grams each, are assayed without clipping and the gold and silver calculated to an assay-ton basis.

Amalgamating in a Lane Mill

The accompanying photograph shows the condition of the inside of a Lane slow-speed chilean mill in which amalgamation is taking place. The clustering of the amalgam to the ring and close to the roller shows that the agitation, even at that point, is not severe enough to



AMALGAM IN 10-FT. LANE MILL

The overflow is removed ready to clean up. The amalgam builds up as an inner mud ring

scour the amalgam off and indicates extremely favorable conditions. This installation is at the McCausland plant, Death Valley, Calif., where mills of this type have proved satisfactory in all respects.

Bacon's Precipitation Method for Copper Solutions

A cyclic process for the recovery of copper from copper-leaching operations has been patented by Raymond F. Bacon, of Pittsburgh, Penn., assignor to Metals Research Co., of New York (U. S. Pat. 1,151,234). In this process, the solutions from the leaching operations are treated with hydrogen sulphide, producing cupric sulphide and regenerating the solution for further leaching operations. The cupric sulphide, together with a quantity of elemental sulphur equal to one-half its sulphur contents is then treated in a still with hydrocarbon gases which convert the elemental sulphur and one-half the sulphur in the cupric sulphide to hydrogen sulphide. This may then be used as a precipitant.

The production of the elemental sulphur is covered by U. S. Pat. 1,151,236, sulphur dioxide from roasting the ores preparatory to leaching being mixed with the hydrogen sulphide produced as specified above, water and sulphur being formed. This action goes on either in the mixed gases, or when they are in solution.

Magnalium Turnings Should Be Melted by forcing them down into a pool of the molten metal, according to John Coulson, at the Institute of Metals meeting

*From a paper presented before the Atlantic City meeting of the American Institute of Metals, September, 1915.

[1]Excerpt from a paper entitled "Lead Smelting at El Paso," presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

Details of Milling and Smelting

Intermittent Discharge on Dorr Thickener

At the plant of the Bunker Hill & Sullivan Mining and Concentrating Co., at Kellogg, Idaho, the equipment includes several 40X12-ft. Dorr thickeners. Since some difficulty has been encountered through the plugging and stopping of the discharge pipe, due to thick pulp and the introduction of some foreign material, it was thought better greatly to increase the size of this pipe. To do this, however, without providing some means of reducing the quantity of material discharged would have been calamitous.

The difficulty was solved by providing a simple intermittent discharge from the delivery pipe. The pipe was carried from the center of the bottom of the tank to the outside, and there an equipment similar to an ordinary gate valve with a long stem was provided. The stem of this valve was connected to an eccentric taken from a worn-out jig and so arranged that the throw of the eccentric opened and closed the valve. The arrangement is perfectly simple and accomplishes the desired result without any trouble. Of course the size of the discharge pipe and the number of openings of the valve per minute can be arranged to suit any local requirements. The speed of opening and closing may be anything between 15 and 25 per min.

Vanadium in Nonferrous Alloys

In a paper read before the Atlantic City convention of the American Institute of Metals, on alumino-vanadium, W. W. Clark reaches the following conclusions:

"It is doubtful whether small amounts of vanadium will increase the tensile strength of nonferrous metals beyond that due to its powerful deoxidizing properties. Vanadium is a scavenger which unites with the oxygen in the metals and, as claimed by some investigators, the nitrogen. It, however, should not be used as a scavenger, as there are a number of as good and cheaper ones available. If one of these is used to cleanse the metal before adding the vanadium, the latter is retained and its full alloying effect is available. Vanadium in small amounts does increase the elongation, and I have no doubt that if it were produced and sold at a price that would make it available it would come into general use."

Old Car Wheels for Sheaves

By Jesse Simmons*

Old car wheels make excellent sheaves and carriers for haulage ropes, according to Edward Manion, superintendent of the Wasp No. 2 property, Flatiron, S. D. At this property two old wheels are bolted together with three bolts, with the flanges on the outside. The old axles may be used for shafts. When used as sheaves, as in Fig. 1, the shaft is provided with a single collar at the bottom and extends downward into the foundation timber—usually a 2x8—and upward into a wooden support. When used as carriers, as in Fig. 2, they give equally satisfactory service.

FIG. 1. OLD CAR WHEELS AS SHEAVES

FIG. 2. OLD WHEELS AS CARRIERS

The chilled treads of the wheels form ideal surfaces for the rope to travel on and are much harder and more durable than the carriers and sheaves ordinarily sold for this purpose. As any mine has at all times a more or less liberal supply of old car wheels and axles, it may never want for carriers and sheaves if this plan is followed.

Zirconium-Iron Alloys

According to John L. Brown, of Baltimore, Md., alloys of zirconium and iron can readily be produced by the reduction of a mixture of the oxides of the two metals (U. S. Pat. 1,151,160, assigned to Edward R. Cooper, of Baltimore, Md.). Especially is this reaction easily carried on in the presence of a little titanium oxide, which is likewise reduced, the titanium giving valuable qualities to the product. The reduction may be carried on by aluminum, or by carbon in an electrically heated

*Deadwood, S. D.

dotted curve on this same chart is the efficiency that should be obtained when burning the coal under good conditions, and the lower curve, "Efficient B.t.u.," shows what to expect from good operation.

On the right-hand side of the diagram various kinds of coal are shown and lines point to the evaporation that could be expected from this coal, so that the chart can be used without following through the entire diagram. For example, Hocking Valley (Ohio) coal is shown to have an evaporation of 8.1 lb. of water per pound of coal.

The basis for this chart was loaned the committee by W. H. Schott, of Chicago. The evaporation factors and the cost of steam per 1,000 lb. have been worked up by the committee. It will be interesting to notice that the curve shows nicely that the highest thermo-value occurs when the volatile matter in the combustible is somewhere around 20%, ranging possibly from 16 to 24; or in other words, in the highest thermo-value coal the fixed carbon in the combustible ranges from 76 to 84%.—*Power,* Sept. 28, 1915.

Box-Car Dimensions

A proposed standard box car of steel construction has been designed by the Committee on Car Construction of the Master Car Builders' Association and was reported at the annual convention at Atlantic City for criticism. The cubic volume of the car body under the carlines is 3,096 cu.ft. The principal dimensions are as given in the accompanying table, taken from *Engineering News.*

	Ft.	In.
Length of frame over striking casting	42	6
Width over sheathing	9	1½
Length, inside	10	6½
Width, inside	8	6
Height, inside	9	0
Height, from rail to bottom of bolster	2	6
Height, from rail to floor	3	8½
Height, from rail to top of running board	13	4½
Height, from rail to top of brake staff	14	2
Width, at eaves	9	2¾
Height, at eaves	12	5¾

Ore-Loading Rate on the Gogebic Range

At the Colby mine a 70-ton Bucyrus shovel loaded 150 cars, a total of 6,615 tons, of ore from stockpile in 10 hr. Later at the Newport mine a 70-C Bucyrus shovel loaded 162 cars, a total of 8,094 tons, of ore in 10 hr.—*The Excavating Engineer,* Aug., 1915.

Mine Accidents in New York

There were 41 mines and 135 quarries operated in the State of New York during the year 1914, according to the report of the state mine inspector. A steady decrease in fatality rate per thousand employed per annum in these mines is noted during the last three years—from 6.27 in 1912 to 5.6 in 1913 and to 3.77 in 1914. The total number of men employed in mines was 3,033, of whom 1,855 were employed in iron mines; the quarries employed 4,855, making the total number employed in mines and quarries in the state for the year 7,888.

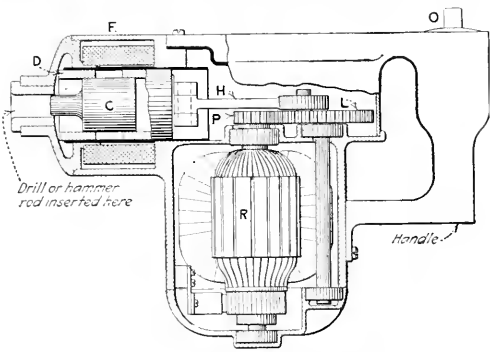
The limestone quarries were the largest employers of this class of labor, with a total of 2,607 men; the iron-mining industry was next, with 1,855; sandstone and granite quarries followed, with 584 and 554 respectively; the gypsum and rock-salt mines employed 378 and 376 respectively; bluestone quarries employed 267; the balance of the total was divided variously among the pyrites, graphite, garnet, talc, natural-cement and zinc mines, and marble, slate, spar, shale, trap and millstone quarries.

New Electric Hammer Drill

The Western Electric Co. has placed on the market an electric hammer drill that may be operated at small cost from any convenient light-socket.

The principle upon which this hammer works is as simple as it is effective. The main parts of the machine are the motor, a drill or hammer, and the magnetic clutch plunger. The motor *R* in the accompanying drawing transmits motion through the hardened gears *P* and *L* and the connecting-rod *H* to the cylindrical sleeve *D*, which has two relatively thick end sections with a thin center section connecting them. This center section is as thin as is consistent with mechanical strength.

The plunger *C*, which delivers the blow to the drill, lies loosely within this cylinder and is not mechanically connected to it or to any other part of the mechanism. Outside of the sleeve is placed the magnet coil *F*. This coil is stationary, the sleeve moving backward and forward within it. The coil is in series with the motor, and the current traversing it is always steady and in the same direction.



CROSS-SECTION OF THE DRILL, SHOWING THE ARRANGEMENT OF PARTS

As soon as the circuit is switched on (by the button *O* conveniently arranged on the handle) a magnetic circuit is created with the thick sections of the sleeve as the poles and the plunger as the armature. As the sleeve is oscillated back and forth by the motor, the effect is that of moving the polepieces of the magnet back and forth, and the plunger clutched across the poles moves similarly, transferring its energy to the drill when the two parts come in contact, which takes place near the end of the stroke. The plunger is slightly longer than the thin section of the sleeve, which gives it a certain amount of overtravel and an elasticity of connection that entirely removes the stress and jar of the blow from the machine.

The motor is series-wound and the gears are of oil-hardened special gear steel, while ball bearings are employed throughout.

A number of these drills have for some time been in successful use in coal mines, where they have been employed not only for taking down top and lifting bottom, but also for drilling the coal face preparatory to shooting.

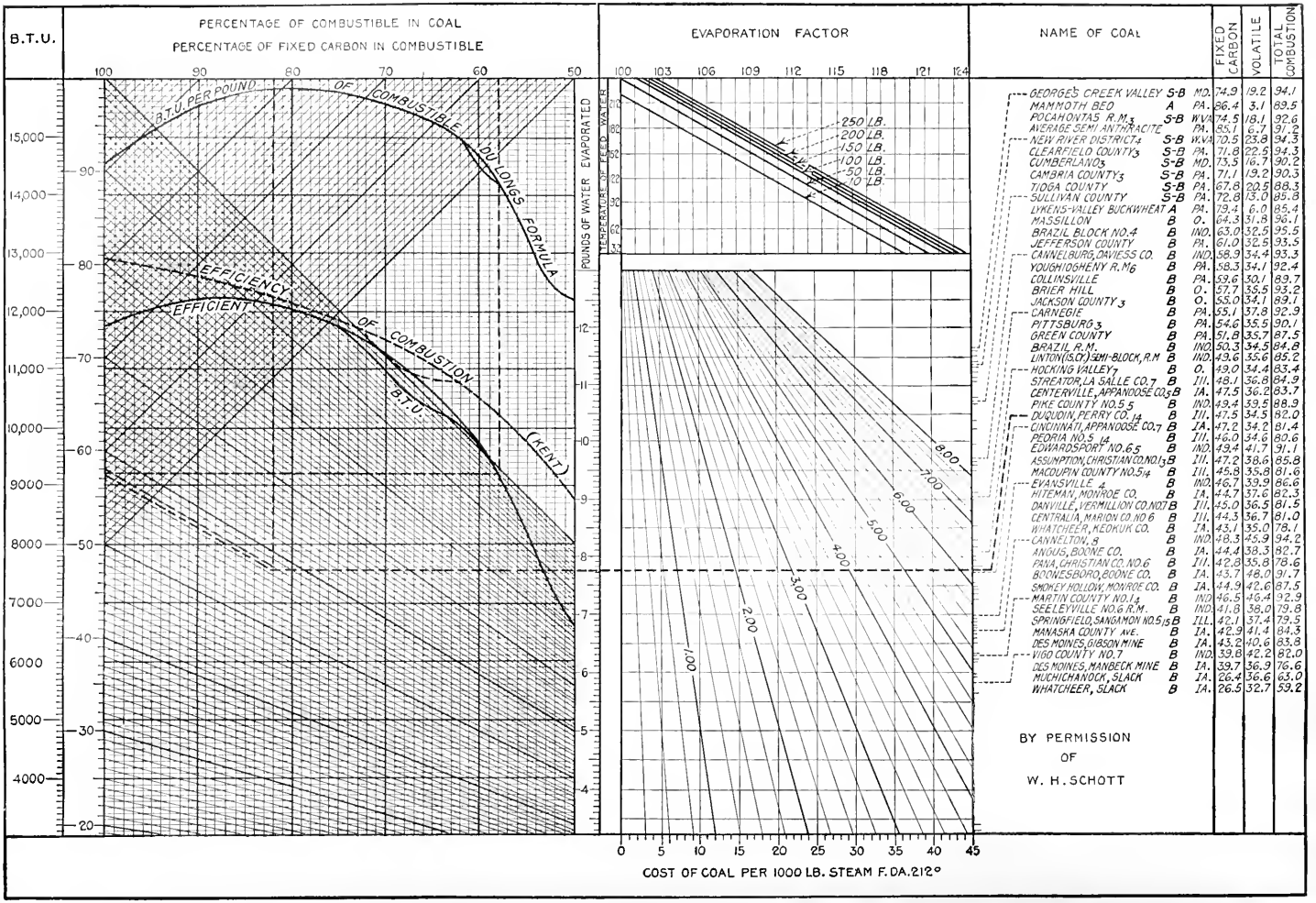


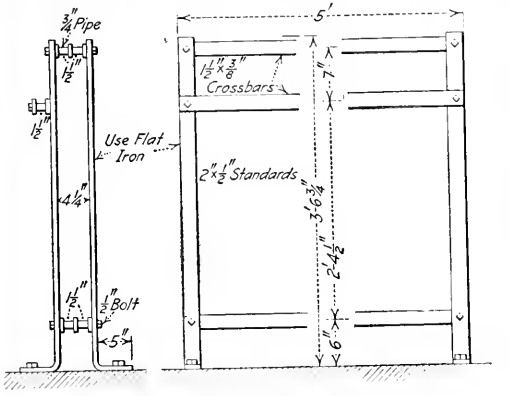
CHART SHOWING THE COST OF STEAM FROM A GIVEN GRADE OF COAL UNDER VARIOUS CONDITIONS

Details of Practical Mining

Blacksmith-Shop Tool Rack

By D. E. Charlton*

At mine blacksmith shops, where the space is small and it is necessary to keep the floor clear of tools, the rack illustrated has proved satisfactory. The construction is simple. The contrivance consists essentially of four standards, the lower ends of which are turned over, as shown in the sketch, to form a means of fastening the rack to a base, and six crossbars 5 ft. long, made of 1½x⅜-in. flat iron held to the standards by means of ½-in. bolts. The standards are made of 2x½-in. flat iron, each 3 ft. 11¾ in. long. Between the crossbars are placed 1½-in. lengths of ¾-in. pipe, to make the



TOOL RACK FOR BLACKSMITH SHOP

spaces in which the tools are placed. The upper spaces can be used for hammers, the outside one farther down for tongs and the lower ones for swages. The length of the rack may be increased or decreased. If it is desired to lengthen it, an additional set of standards should be placed half-way between the end standards. The rack is bolted to a base on a level with the floor.

Angove Skip-Dumping System

In the Copper Range mines the filling system makes necessary the dumping of poor rock at various levels. The Angove system of dumping is employed, pockets being attached beneath the skipway to receive the rock and lead it into chutes. Naturally, if the strain on the skip rope at this point continued, should the engineer happen to hoist his skip too far, the skip would keep on turning and instead of dumping its rock into the pocket would dump it back down the shaft, endangering life as well as the operation of the shaft. Angove has forestalled this possibility by a very simple device.

At each of the dumping stations he has placed a hinged bar across the skipway, high enough to clear the skip in its ordinary passage. But when the dumping device is in place at any of these points the engineer cannot now hoist his skip too far because if he does so the rear of the skip will strike this bar and will be prevented from rising. The continuing strain on the rope will pull the skip through, and it will go up the shaft in its natural position.

The device has greatly facilitated the dumping of poor rock in the Copper Range mines. It is in line with the "safety-first" principle, as well as that of efficiency.

*Mining engineer, Virginia, Minn.

A Serviceable Coal Chart

In its report to the National District Heating Association at Chicago, June 1-3, the Station Operating Committee incorporated the accompanying coal chart.

From the proximate analysis of the coals given the chart may be used to determine the cost of steam per 1,000 lb. with various grades of coal at prices ranging from $8 to 25c. per ton and the evaporation to expect. Take, for example, Duquoin (Ill.), coal. The analysis shows that this has 82% combustible; the remaining 18% is ash, moisture and other noncombustible materials. The analysis at the right of the table also shows that this coal has 47½% of fixed carbon and 34½% volatile matter.

Referring to the left-hand side of the chart at the top, under "Percentage of Combustible in Coal" find the dotted line starting at 82. Follow this line down until a point on the vertical scale is reached reading 47½, which is the fixed carbon in the coal. Then by reading the slanting line to the left, it is found that there is 58% of fixed carbon in the combustible. From here the dotted line reaches the point 58 at the top of the chart and then passes down to the heavy line "Efficient B.t.u." Then by reading to the left it is found that a pound of combustible should contain about 9,200 B.t.u. As this coal has only 82% combustible, the line sloping downward is followed until it intersects the 82% on the horizontal scale. Then by reading to the right it is found that the evaporation should be about 7.8 lb. of water per pound of coal. Follow this line on through to the $2 line in the center diagram of the chart, and the price of the coal in the bin is found. From the intersection read down to the bottom of the center diagram, which shows that the coal would cost 14½c. per 1,000 lb. of steam.

At the top of the center diagram the evaporation factors have been graphically displayed. Assuming that water at 62 deg. F. is evaporated into steam at 150 lb. pressure and no superheat, it will be found by reading to the right from 62 to the slanting line representing 150 lb. that the evaporation factor is 120%; consequently the cost of steam per 1,000 lb. will be increased 20%. The steam would then cost approximately 17½c. per 1,000 lb.

This chart is based on high-class operation. The top curve on the left-hand chart is based upon Dulong's formula for figuring the B.t.u. in the combustible. The

2,524 long tons; magnesite (crude), 14,086 long tons; alum, 7,742 cwt.; clay, 47,422 long tons; chromite, 5,676 long tons; corundum, 7,960 cwt.; diamonds, 116 carats; garnet, 334 cwt.; gypsum, 24,961 long tons; bauxite, 1,184 long tons; amber, 10 cwt.

These figures differ from those already issued by the Chief Inspector of Mines and given by the *Journal*. This is due to the fact that the inspector includes in his report only the production from those mines which come under the Indian Mine Act of 1901, while the figures just quoted give the complete returns collected from all sources.

Zinc Concentrates in the British Prize Courts

Several cases arising out of shipments of zinc concentrates from Australia, either captured or diverted to English ports as a result of the war, were heard by the President of the Probate, Divorce and Admiralty Division of the High Court during the week of Sept. 25, says the *Mining Journal*. In all there are five cases to be tried, involving something like €1,000,000. During the course of the hearing much important information as to the interrelation of various firms connected with the zinc industry was disclosed. The circumstances with regard to the various ships concerned vary.

Where the consignments were, on the face of them, to Aron Hirsch & Sohn, the property was condemned, but a lengthy argument was addressed to the Court, both on behalf of the Crown and on behalf of the firms concerned, with regard to parcels claimed by Henry R. Merton & Co., Vivian, Younger & Bond, the Australian Metal Co., and the Cie. des Minerais. The solicitor-general argued that the charterers were the Metallgesellschaft, and that the Australian Metal Co. and the Cie. des Minerais were its puppets. From the correspondence it was to be inferred that the Australian company purchased the concentrates on behalf of the Metallgesellschaft, which took entire control of the sale of the leady concentrates, and merely informed its English partners of what had been done. The so-called British firm, Henry R. Merton & Co., with its intimate German commitments and German origin, came to ask the court to help it to set up a partnership in a business mainly carried on in an enemy country.

Shipments Made Before War Broke Out

Maurice Hill, K.C., for the claimants, said this was no question of trading with the enemy, as it was concerned with shipments made before the war. The only question was as to the enemy or non-enemy character of the goods. The solicitor-general had referred to a German octopus which had spread its tentacles over the metal trade of the world, but it would be just as true and just as false to say that an English octopus had spread its tentacles over the German trade. Mr. Merton started the London business of Merton & Co. in 1860. He was born in Germany of English parents, and in 1899 or 1900 H. R. Merton & Co., Ltd., was formed. Mr. Merton had carried on business in England for 20 years before the Metallgesellschaft was formed in Germany. That was also a company in which Mr. Merton was interested, but to represent the whole concern as a German firm which was gradually, by means of subsidiary companies, getting its grasp on the metal trade of the world was wholly misleading. The majority of the shareholders in H. R. Merton & Co., Ltd., were English. Of the directors all except two were British. The Metallgesellschaft was formed in 1882, and the directors of H. R. Merton & Co. were the holders of a very large quantity of the shares. One shareholder, a Mr. Zuny, who died a short time back, by his will left the income on 300,000 shares to British charities.

The firm of Vivian, Younger & Bond was a partnership firm. At the beginning of the war two of the partners were British born, and the third, who afterward resigned, was a naturalized British subject. As to the Australian Metal Co., the shareholders in the majority were German—26,700 out of 50,000. The directors also at the beginning of the war were in the majority Germans—four against three. The Cie. des Minerais was formed in 1900, and of its shareholders about 60% were German and the rest mainly Belgian and French. As to the Ore Trading Co., which came into the matter as merchants for dealing with certain ore on behalf of all these companies and firms, the large majority of the shareholders were British, American and German. Mr. Hill submitted that the evidence showed that the property in the zinc concentrates in question was in the Cie. des Minerais, and the property in the leady concentrates was jointly in the Metallgesellschaft, H. R. Merton & Co., Vivian, Younger & Bond, and the Australian Metal Co. Therefore, applying the test of property, the proper order to make was to release the zinc concentrates altogether and to release the leady concentrates as to three-fourths and to condemn it as to one-fourth—the fourth share belonging to the Metallgesellschaft.

Belgian Testimony Unfavorable to Defendants

At this point the solicitor-general interposed, as a witness as to the constitution of the Cie. des Minerais, J. C. Van der Taelen, a Belgian, managing a leading Belgian metal company in Antwerp, but at present connected with Peters & Co., of London. He stated that the company did not smelt or work the zinc, but sold the ore to the smelters and bought back the metal produced. So far as he knew, most of the directors were associated with the Metallgesellschaft and the company was practically German.

In the course of cross-examination, W. M. Wilson, a director of Henry R. Merton & Co., stated that his firm acted as bankers for the Australian Metal Co. and the Cie. des Minerais and that the Gesellschaft supplied them with money to meet these charges. Since the war they had received no remittances from the Continent, and he feared at the end of the war it would be impossible for Germany to remit in full, if at all.

Further hearing was adjourned.

Utah Apex Quarterly Report

The report of the Utah Apex Mining Co., Bingham, Utah, for the quarter ended June 30, 1915, shows net earnings of $12,154. Gross receipts were $233,822; mining expenses, $118,980; development, $38,214; and accrued bond interest and all other expenses, $4,474. The company had about $200,000 cash on hand. A dividend of 12.5c. a share was declared payable on Oct. 1. Out of an original bond issue of $350,000 all bonds but $36,000 have been retired, and the treasurer is prepared to purchase these bonds at par and accrued interest.

in appearance of which seems to indicate its value, in a measure. It contains variable amounts of lead and zinc sulphides which do not, however, constitute controlling factors in its mining and milling, except at infrequent intervals. The stringers are irregular in dip, being nearly vertical in the Davis and vicinity and flat in some instances near the Gold King, one vein being designated by its dip the "Flat Vein." In the Davis vein the free gold is usually associated with blende, while in the other veins it occurs more often with the iron pyrite and galena, and in both localities it is found in white quartz.

Nearly all of the work at present is confined to Nos. 2, 3 and 4 levels, and about 70 men are engaged in ore production.

The ore is mined by the lessees and sublessees and delivered to separate chutes passing down to No. 7 level, or the "American Tunnel," below. A vertical shaft connects Nos. 1 and 7 levels, and a cage with hoist in No. 1 level is used to handle men, tools, supplies, etc.

The operating lessees, who handle the tramway and mill and who are responsible for the management of the property, take the ore from the chutes on No. 7 level and bring it to surface by mule train, where it is dumped into the tramway-loading bin of 250 tons' capacity. It is there loaded by chutes into the tramway buckets of 850-lb. capacity and transported to the mill at Gladstone.

Here it passes through gyratory crusher and stamps and is concentrated on Wilfley tables and by a flotation scheme developed by Louis C. Bastian, the present mill superintendent, formerly with the American Smelting and Refining Co. in the same capacity, and construction superintendent of the Silver Lake mill near Silverton.

The experiments conducted by Mr. Bastian alone, resulting in the present successful operation, were begun a year ago in February and constitute the first successful treatment by flotation of San Juan County ores.

The accompanying flow sheet describes the general mill practice, which needs no special mention at this time outside of the flotation plant.

The Flotation Plant

The material treated in this plant is the middling and slimes product of the second retreatment tables. They are pumped into a square stock tank which has a capacity of 100 tons of pulp. Thence they pass to an 8-ft. Callow cone, the overflow from which joins the overflow of the stock tank, running to waste.

The thickened product is pumped to the first agitating compartment and passes through this and two other similar ones before it enters the first frothing compartment through a gate about 6 in. below the water level. Here it is skimmed by a revolving drag, and the underflow passes to the fourth agitating compartment and similarly diagonally through the five remaining frothing and four remaining agitating compartments. The underflow from the last frothing compartment runs to waste.

A cone plug regulates the flow of pulp from each frothing compartment and consequently the capacity of the plant. To maintain a uniform pulp level for successful skimming, Mr. Bastian has provided a 2-in. pipe, connected to the discharge pipe, which is fed from the lower strata in the frothing compartment by a surrounding 3-in. pipe, rising above the water and froth levels, which serves to hold back the froth. The concentrate froth discharged from the first three frothing compartments is sent over Wilfley and Card tables to aid in breaking it down and thence to a 10-ft. settling trough. Two tons of final concentrate are produced from each 30 tons of pulp handled.

Carbolic oil is fed to the pump used to hoist the pulp to the stock tank. Creosote oil is fed to the first compartment agitator, and pine oil is fed to the fourth compartment agitator, 300 c.c. of total oil per ton of pulp being used. No acid is found necessary. At the mine there is sufficient sulphuric acid in the mine water, the amount of which is not great, to destroy the air pipes and rails, which must be protected by splash boards, and it is probable that this preliminary treatment by nature renders further acid treatment unnecessary. For feeding the oil to the pulp Madison-Kipp No. 50 lubricators are used.

Experiments being conducted at present indicate that more of the mill products can be successfully treated through finer grinding, and plans now laid include the installation of Hardinge mills or the use of tube mills already installed but not used under the present system. Dorr thickeners will in all probability also be used.

The flotation and mill table concentrates run about the same, or in the neighborhood of $40 per ton. They contain in excess of 28% silica. The saving of metallic is said to be in excess of 85%.

Shannon Copper Co.

The quarterly report of the Shannon Copper Co., Metcalf, Ariz., for quarter ended June 30, 1915, shows a production of 2,867,000 lb. of copper, 320 oz. of gold and 16,100 oz. of silver. During this period 62,913 tons of ore was treated from the Shannon mine and 10,086 tons from the company's outside properties. The average price received for copper was 16.811c. in April, 18.506c. in May and 19.477c. in June. The average price received for the quarter was 18.398c. per lb. The net profits for the period were $164,648, of which $4,388 represented railroad earnings. The following table shows a comparison of operating costs for the quarter and for 1914:

	Quarter Ended June 30,1915	Year 1914
Mining cost per ton Shannon ore, including development	$1.74	$2.32
Concentrating cost per ton concentrated	.67	.85
Smelting cost per ton of burden	1.86	1.95
Converting cost per ton of fine copper	7.85	10.56

A plant of 150 tons' capacity for leaching the slimes and tailings will be constructed, and if this is operated successfully it will be increased to 500 or 600 tons' daily capacity. Quick assets amounted to $507,674 in excess of current liabilities at the end of the quarter.

Mineral Production of India in 1913

The following figures of mineral production in 1913 are given in *Records* of the Geological Survey of India, Vol. XLVI, 1915, the items being arranged in order of descending value: Coal, 16,208,009 long tons; gold, 595,761 oz.; manganese ore, 815,047 long tons; petroleum, 277,555,225 gal.; salt, 1,473,189 long tons; mica, 45,422 cwt.; saltpeter (exports, fiscal year 1912-13), 296,928 cwt.; tungsten ore, 1,688 long tons; lead ore and slag, 20,299 long tons; ruby, sapphire and spinel, 278,706 carats; tin ore and tin, 7,062 cwt.; monazite (value), £42,012; iron ore, 370,845 long tons; laterite, 292,985 long tons; silver, 125,209 oz.; copper ore, 3,810 long tons; steatite,

ations. A subsidence of a foot or two in the tailings stack will not affect the alignment or running of the conveyor, because it is self-contained.

Several of the local mills practice sluicing out tailings. In most cases water is expensive, the cost for one 125-ton plant exceeding $500 per month. Construction and maintenance of dams, etc., are costly, and to this is added annoying litigation brought by owners of property damaged by tailings. Much greater space is required to contain tailings in dams than is needed to pile them semi-dry at a steep angle. Sluicing demands constant attendance, whereas the excavator and conveyor system is automatic. The high-pressure stream necessary for effective sluicing damages filter bottoms, whereas the excavator has stops which absolutely prevent damage to the filter canvas.

Precipitation and Recovery of Gold

But one strength of solution is used with this low-grade ore. Time is saved in applying solution and wash water by having extra-large pipes for these purposes. A charge of sand is thus saturated with solution almost as fast as it is placed in the tank. Zinc dust is used for precipitation, which takes place in a circular, locked compartment in the gold tank. Precipitate is cleaned up daily, the operation requiring not more than five minutes. The zinc-dust feeder and precipitating apparatus are my invention.

When melting, the precipitates are charged semi-dry without acid treatment and with crucible and furnace cold. A crucible cover having a special condenser attached is used, and as the temperature rises the zinc is distilled early in the melting process.

Power for all purposes except precipitation is furnished by a 30-hp. three-phase 30-cycle G. E. induction motor of the old and heavy type. It will carry a 50% overload for indefinite periods. It drives the lineshaft with a short belt using—on the slack side of the belt—a swinging idler pulley, an arrangement which gives a large arc of belt contact with both pulleys without any unnecessary belt tension and requiring but little room and a short belt. The small amount of power required by the zinc-dust apparatus is supplied by the flow of solution.

Mineral Output of Sweden

The official report of Swedish mineral production shows the following: Iron ore, 6,586,630 metric tons; bituminous coal, 366,639; gold ore, 639; silver-lead ore, 3,100; molybdenite, 7; copper ore, 8,839; manganese ore, 3,643; zinc ore, 42,279; nickel ore, 156; pyrite, 33,313; feldspar, 20,818; quartz, 36,128; copper sulphate, 158; iron sulphate, 651; graphite, 56; powdered pyrolusite, 81 metric tons.

Owing to the war, the production of iron ore decreased about 11.9% from the figure of last year (7,475,571). Of the iron ore produced, 3,966,863 tons carried 60 to 70% Fe. There were 8,732 metric tons of ferro-silicon produced, 1,304 of ferromanganese-silicon, 1,300 of ferrochrome and 865 of all other ferro alloys. At Höganäs there were 6,394 metric tons of sponge-iron produced. Slig production was 620,591 metric tons.

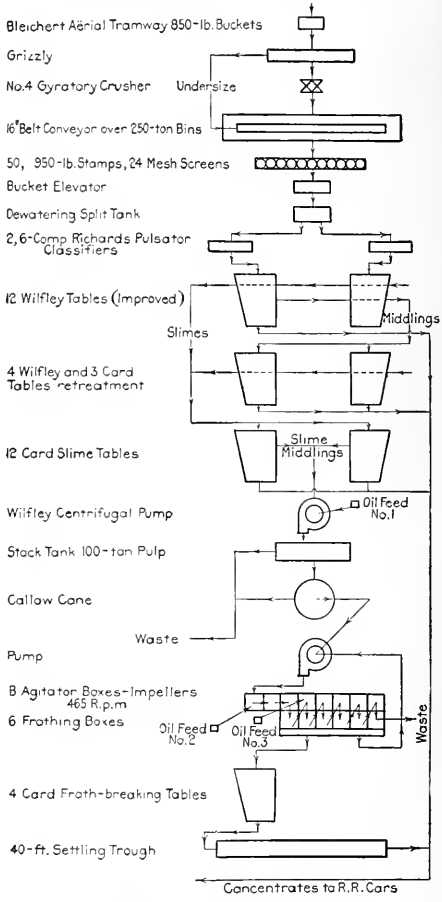
The metal production, excluding iron, was: Gold, 84 kg.; silver, 1,074; lead, 1,395,566; copper, 4,692,244, and zinc, 2,299,761 kg.

Concentrating Gold King Ores

By Warren C. Prosser*

The Gold King mine at Gladstone, San Juan County, Colo., has made a good production record, the total value of which is estimated to be in excess of $12,000,000. The property has suffered from continued heavy mill losses and high-grading.

The development early disclosed the valuable Gold King and Davis veins and has since opened many other profitable veins and stringers, together with irregular occurrences of free gold ore worth up to $15 per lb. These have proven a big factor in inducing sublessees to under-



FLOW SHEET, GOLD KING MILL

take the exploitation of various blocks of ground. A fault, which passes through the mine in a northerly direction, was explored several years ago, and the vein—containing some ore—opened beyond was called the Becker vein.

An irregular system of variable quartz stringers, separated by altered and decomposed horses of andesite, forms the orebody. It contains much iron pyrite, the greasiness

*Mining engineer, Silverton, Colo.

occupied. It requires little power, and repairs are quickly and easily made. The use of the 100-ton sand-storage bin, placed high enough to enable filling the leaching tanks through launders, not only gives storage, avoiding stoppage of the leaching plant in case of delay at mine or crushing plant, but also makes it possible to charge a 75-ton leaching tank—using the rotating distributor—and level the charge with the excavator in less than 30 min. A sliding gate combined with deflectors at the outlet of the sand bin controls and directs the flow of the sand to the distributors. It is operated by a lever having ropes reached conveniently from the ground floor.

Sand Distributor and Excavator

The excavator consists essentially of a four-arm plow, made of 2-in. pipe and equipped with sheet-steel blades, or rabbles, which resemble those used with circular mechanical roasting furnaces. This plow is rotated around the central 5-in. pipe column by a wheel 2 ft. less in diameter than the leaching tank. This wheel has arms and rim of 2-in. pipe, with small rods extending from the upper hub to the rim. Wooden blocks clamped on the rim in pairs about 12 in. apart constitute an interrupted groove for the driving rope.

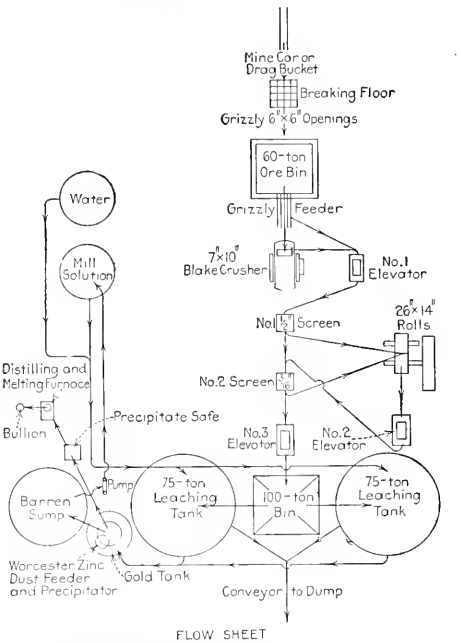
The rope is guided from the jackshaft which drives it to the plow wheel by one stationary sheave and one horizontally movable sheave, which is used as a tightener. When the tightener is relaxed and the plow stopped, the same movement throws a curved lifter between the sheave and the rope, taking the rope clear of the sheave and preventing rubbing. When charging a leaching tank the operator first puts the rope drive in action, using the tightener. He then opens the deflector gate, allowing 3 to 5 tons of sand per minute to flow from the sand bin to the distributing spout, which is mounted on the rotating plow wheel. The hinged end of the spout is then moved, a little at a time, toward the center of the tank as fast as it fills. The plow, hung up close to the wheel, smooths out the ridges and the charge is leveled as the tank is filled. The hinged spout is retained at any desired angle by a telescoping rod with a screw clamp. When excavating and discharging tailings the plow is lowered so as to rest its weight on the charge. A gate beneath the center column is opened and an opening punched through the sand. The plow and conveyors are put in motion, and the plow blades move the tailings to the center, where they drop through the gate to the short conveyor below.

Tailings Stack Formed by Conveyors

The short conveyors deliver to a long bridge conveyor which is pivoted and radially movable. This conveyor has radial movement both vertically and horizontally and covers a large dumping space before extension is necessary. Its outer end is supported by a ratchet jack of 5-ft. lift. When the tailings pile has grown so that the conveyor has been raised to the extreme angle at which sands will carry without running backward, the horizontal radial movement will begin, the jack being pinched along or around the arc on planks laid on flats dug in the tailings pile. An A-shaped tripper is made so that it can be clamped to the bridge at any point in its length. It scrapes the sands off equally on both sides of the belt. The sands are dry enough to pile with slopes of 38° from the horizontal. By occasionally moving the tripper and by radial movement of the conveyor both vertically and horizontally, any one of these operations requiring but a few minutes' time, the available dumping ground is fully utilized. The bridge conveyor is driven from the same jackshaft that drives the two short conveyors and the excavators. The belt tension and direction are easily and quickly adjusted by two movable idler pulleys which are set to suit any change of position of the bridge. The time required to discharge a 75-ton tank is about 2½ hr., so that but little time is lost in charging and discharging and the plant is kept up to capacity.

Usual Methods of Tailings Disposal

The almost invariable method of using tailings conveyors in this district has been to start with a stationary conveyor 25 to 40 ft. long on one or more high trestles and then patch on additional conveyor 10 or 20 ft. at a time,



FLOW SHEET

TREATMENT SCHEME FOR CYANIDE PLANT

building new trestles for each extension. The high trestles are expensive when built on solid ground, and when the usual short trestles are built on tailings heaps they settle irregularly and the conveyors run miserably. When one pile has reached the property line a new string of trestles and extensions is begun in another direction. Trippers are not used, and the one point of delivery is at the end of the conveyor. Patching an extension on the end of one of these conveyors on the top of a tailings heap in stormy, zero weather is a very undesirable job, and the contrivance is always getting out of order. The main drive has to be remodeled every time the direction of the conveyor is changed, and the conveyor is usually the worst nuisance around the plant.

On the other hand, the bridge conveyor here shown costs no more than a trestle conveyor of equal length, and it will pile to the limit all of the ground within its radial reach without any new construction or alter-

Simple Cyanide-Plant Design

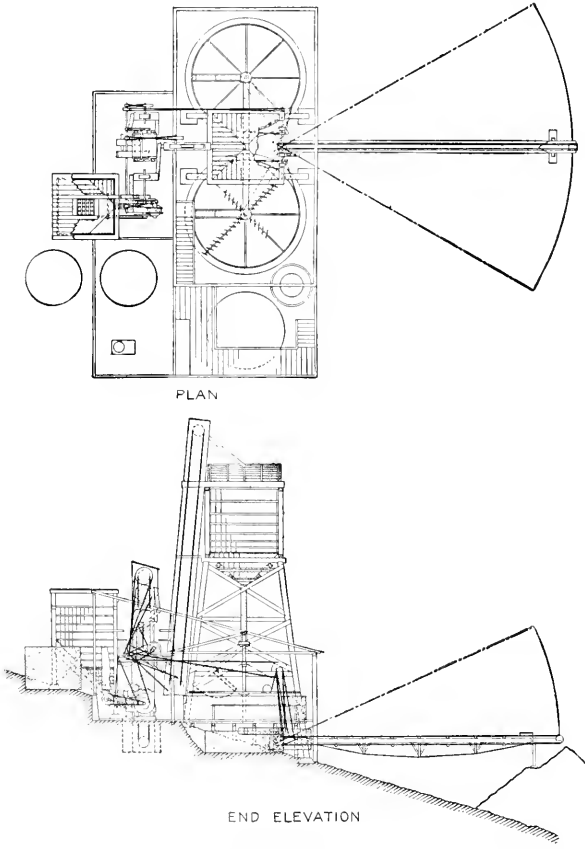
By S. A. Worcester*

SYNOPSIS—A highly oxidized ore, free from cyanicides, is treated by moderately coarse crushing and simple leaching. Automatic appliances and conveniences minimize labor and give maximum capacity. Limited space available for tailings is fully utilized. A new zinc-dust feeder and precipitator is used. Acid treatment of precipitates is eliminated.

This plant, which I recently designed for a local mine in which I am interested, has a capacity of 30 tons daily, treating a friable, thoroughly oxidized ore well-adapted to simple cyanidation. The mill, although small, is highly automatic and includes a number of simple and inexpensive devices which save labor and attendance and insure satisfactory and continuous operation. After passing the coarse grizzly above the 60-ton coarse-ore bin, the material is handled entirely by elevators, launders, excavators and conveyors, and all manual labor is avoided.

The ore, carrying about $4 per ton in gold, is dumped on the coarse grizzly either by the car from the mine or by the drag-bucket of the dump excavator. The attendant who delivers the ore breaks any oversize, and as about 99% of the ore will pass the grizzly without breaking, very little hammer work is necessary. Any coarse waste carrying less than $1 per ton is rejected at this point and sent to the waste dump.

Failure to eliminate coarse and entirely unprofitable waste from the material treated has been the cause of immense losses at several of the mills of this district. A large tonnage of rock averaging less than 50c. per ton in gold is being regularly treated along with the better rock, at a cost exceeding $1 per ton. This low-grade waste is nearly all in large pieces and could easily be sorted out and rejected at a cost not exceeding 15c. per ton. The feed to the crushing plant is regulated partly by adjusting the gate at the mouth of the storage bin and partly by varying the stroke of the oscillating fingers which serve the double purpose of keeping the stationary grizzly clean and feeding the oversize to the crusher. Fully 30% of this ore will pass the 1-in. grizzly spaces and is elevated to the screens, thus increasing the effective work of the crusher by eliminating the undersize and also reducing the production of fines, which have a detrimental effect on percolation. The screens following the crusher also eliminate undersize, sending it direct by elevator to the sand storage, this procedure having a beneficial effect on the work of the rolls, giving a more uniformly granular product and economizing power. The impact screen was chosen as the result of experience. It has great efficiency per foot of screen surface and space



DESIGN FOR A COMPACT CYANIDE PLANT USING BELT-CONVEYOR TAILINGS DISTRIBUTORS

*Mechanical engineer, Victor, Colo.

The lead present in the gray slag is approximately combined as follows:

	%
$PbSO_4$	10 0
PbS	6 0
PbO	25 0
Metallic lead	8 5

From the standpoint of roasting, the elimination of sulphur on the hearth is high in comparison with the other methods now in vogue.

Of the material drawn into the flues and bag chambers the proportion by weight is one of dust to two of burnt fume. From the analyses given below it will be seen that a considerable portion of the lead is present as sulphate, and on retreatment the sulphate, reacting on the sulphide, greatly assists the desulphurizing process.

	Pb, %	S, %
Dust	62 0	11 1
Burnt fume	76 0	5 9

The lead present is combined approximately as follows:

	Dust, %	Burnt Fume, %
$PbSO_4$	18 9	53 6
PbS	55 4	1 2
PbO	2 0	41 5

Taking the foregoing average runs as a basis, the sulphur elimination is calculated as follows:

NEWNAM HEARTH

	Lb.	Sulphur, %	Sulphur, lb.
Dry ore charged	13,179	15 1	1,990
Gray slag	3,318	1 9	63
Dust	776	11 1	86
Burnt fume	1,552	5 9	92
Pounds of sulphur eliminated			1,749
Per cent. of sulphur eliminated			87 9

HAND HEARTH

	Lb.	Sulphur, %	Sulphur, lb.
Dry ore charged	5,091	15 1	769
Gray slag	1,329	2 6	35
Dust	497	11 1	55
Burnt fume	994	5.9	59
Pounds of sulphur eliminated			629
Per cent. of sulphur eliminated			80 6

In several localities the ore hearth has been operated on high-grade galena containing about 80% lead, with an extraction of from 80 to 85% of the metal. In order to determine the adaptability of this grade of ore to the Newnam hearth a test run was made, the average results of which per 8-hr. shift are given here:

TEST ON GALENA CONCENTRATES, CONTAINING 82 0% LEAD AND 11 2% SULPHUR

	Lb.
Dry ore charged	14,436
Lead contents	11,837
Pig lead made	10,790
Gray slag made	1,075
Per cent. of coke breeze used	2 4
Per cent. of crushed limestone	2 0

Percentage of Total Lead Products

Pig lead	91 15
Gray slag	4 25
Dust and fume	4 60
	100 00

Sulphur Elimination

	Lb.	Sulphur, %	Sulphur, lb.
Dry ore charged	14,436	11 2	1,617
Gray slag	1,075	2.5	27
Dust	254	11.1	28
Burnt fume	508	5.9	30
Pounds of sulphur eliminated			1,532
Per cent. of sulphur eliminated			94.7

Beaver Consolidated Report

For the quarter ended Aug. 31, 1915, the Beaver Consolidated Mines, Cobalt, Ont., reports that 1,600 ft. of development work was performed and 1,133.5 cu.yd. removed in stoping. The main shaft is down to 1,100 ft. and will be continued until it reaches the lower contact between the diabase and Keewatin formations. Additions to the mill will increase its daily capacity to 150 tons. Owing to the low price of silver, the company now has 235,075 oz. of bullion in storage in New York. There is also 22,801 oz. due from smelters and 56,634 oz. are contained in ore bagged at the mine. The company has $116,017 in cash.

A. I. M. E. Excursion Around San Francisco Bay

EDITORIAL CORRESPONDENCE

Cottrell and baghouse methods were demonstrated to the members of the American Institute of Mining Engineers that visited Selby, Calif., on Sept. 18. The visitors, including ladies of the party, numbered 198 and were guests of D. C. Jackling aboard his yacht "Cyprus." The A. I. M. E. convention at San Francisco closed on Sept. 17, and the following day was given over to various excursions, of which the yacht cruise was one of the most interesting.

The various points of interest in San Francisco Bay were visited before and after the stop at the smeltery. Just prior to the landing of the yacht at Selby, the dampers were opened and the smoke and fumes poured out of the stack in large and dense volumes, giving a very positive demonstration of the conditions that accompanied the smelting of ore several years ago, which conditions caused a great deal of complaint by farmers, resulting in the installation of the baghouse and the Cottrell system. Within a few minutes after the smoke had been allowed to escape, and at a given signal, the dampers were changed, throwing the smoke and fumes through the Cottrell and the baghouse, demonstrating clearly and practically to the visiting engineers a successful application of these methods of eliminating fume.

The courtesy of Mr. Jackling in placing his yacht at the disposal of the members of the Institute, and of Eugene Braden, manager of the smeltery, in providing the demonstration, was highly appreciated. The excursion gave the members and their ladies a delightful cruise on San Francisco Bay and showed them in a practical way that the control of smelting fumes not only can be, but has been, accomplished.

Chronology of Mining for September, 1915

Sept. 1—Price of silver went to 46¼c., the lowest on record.

Sept. 2—Crushing started in Nevada-Douglas mill.—Entire holdings of Tin Cup Gold Dredging Co. sold by the United States Court of Bankruptcy.

Sept. 10—Final decree of the Circuit Court filed at Trenton, N. J., dismissing suit against the United States Steel Corporation.

Sept. 11—Strike of miners at Clifton and Morenci, Ariz.

Sept. 14—Investigation of alleged zinc-smelting trust in Missouri started at Joplin.

Sept. 15—Holdings of Pittsburgh & Lake Angeline Co. sold to Cleveland-Cliffs Iron Co.

Sept. 17—Teck-Hughes taken over by Buffalo Mines.

Sept. 22—National Association of Mining and Stock Brokers organized at San Francisco.

Sept. 25—Old board of directors of Northport Smelting and Refining Co. resigned and new board elected.

purpose of this paper to describe a new and more fortunate endeavor in this direction.

After a careful study of the hand-hearth operation, it was decided that three things were necessary to perfect it, namely: A cool and sanitary hood; a mechanical rabbler that would effectually replace the continuous and laborious use of the hand rabble; and a lead-well attachment that would mold clean lead direct from the hearth basin with little attention on the part of the furnacemen.

All our experiments were carried out on the ordinary 4-ft. hand hearth. The hood problem was taken up first, and soon a double hood was devised which gave the furnace room a clear and fume-free atmosphere, at the same time reducing the direct and radiated heat to the workmen by 50%. A complete cessation of sickness and an increased output were at once noted. After a few trials a simple and effective lead well and molding device was installed. A traveling rabbler was next put on the 4-ft. furnace, and after numerous changes a successful type was worked out.

Mechanical Rabbler the Chief Stunt

This rabbling machine is hung from a carriage which travels on an overhead track, and it rabbles in one direction only, for a reason given later. The machine being in such a position that the rabble arm is at the extreme end of the furnace, a releasing lever is pulled, which starts the machine, causing the rabble arm to describe a motion similar to that of the hand rabble, but more effective, since there is more power behind it. As the rabble arm is withdrawn from the fire, an eccentric connected with a ratchet wheel moves the carriage forward about 4 in. for the next stroke of the rabble arm. This motion is repeated until the other end of the furnace is reached, when the machine automatically stops and withdraws the rabble arm from the fire.

Two men, a charger and a helper, operate the furnace. The helper follows close behind the rabble arm and with a long-handled shovel pushes back the loose charge, picking out the gray slag as he goes along. Close behind him comes the charger, who spreads a thin layer of ore on the charge as fast as it is shoveled back, adding coke breeze as needed.

Thus the fire is exposed for an instant only, and by the time the trip down the furnace is completed, the end first charged is ready for the rabbling machine. It is for this reason that the rabbling is performed in one direction only. The first trip being complete and the gray slag removed from the apron, the throwing-in of a clutch causes the carriage to return without rabbling to its original position, where it automatically stops in readiness for a second rabbling trip.

Thus on each trip the fire is rabbled 24 times in 48 sec., the return motion requiring 12 sec. One horsepower is required under full load and is supplied by a 1-hp. alternating-current 220-volt motor. The rabbling machine is simple, strong and durable and only requires a few minutes' attention daily.

From the data compiled it was determined that the hearth could be increased to 8 ft. in length, that it would then produce 2.5 times as much pig lead as the hand hearth, and that two men could operate it with less fatigue than that sustained by two men on the ordinary hand hearth. An 8-ft. hearth was at once constructed, and from the first day of its operation it has not only realized our expectations, but considerably exceeded them.

As direct-hearth labor is paid a certain rate per hundred pounds of pig lead produced, it will be seen that the cost of production, as well as the number of furnaces and number of men employed, has been more than cut in half. Moreover, the hearth laborers can earn more money per shift, through the increased efficiency per square foot of hearth area; and this, in turn, enables us to secure a more desirable class of men.

The following tables show that the 8-ft. furnace gives a much higher extraction of metallic lead, with a corresponding decrease in the amount of dust and fume produced.

Another gratifying feature is the reduction of the fuel added in the form of coke breeze. Whereas the hand hearth uses from 8 to 9% of fuel, the 8-ft. mechanical hearth consumes from 3 to 4%; only it is probable that the decrease in dust and fume, as well as in fuel consumption, is due to the shorter time the fire is exposed after rabbling on the 8-ft. hearth.

It has been found that by pugging the flue dust with a certain cheap chemical and mixing it with a portion of burnt baghouse fume, the mixture can be successfully worked up on the hearth, giving a high lead extraction and a very low percentage of dust and fume.

Thus it will be seen that for galena concentrates of over 68% lead content, the disadvantages of the old-style hearth have been overcome and the cost of production has been lowered to such a degree that sintering with subsequent blast-furnace smelting is no longer comparable therewith.

Smelting Flue Dust on the Hearth

The following is an average of the results obtained by smelting a mixture of pugged flue dust and burnt baghouse fume. This mixture is made up so that the average weight of pig lead produced per shift will be approximately the same as that extracted from 70% galena concentrates.

Owing to the low percentage of sulphur present in the mixture as sulphides, 10% of coke breeze is required.

Burnt baghouse fume, containing 76% and pugged flue dust containing 62% are made into a mixture containing 67% of lead. Of this lead 81.3% passes into pig lead, 10% into gray slag and 8.7% into fume and dust.

The gray slag contains: Pb, 32.4; FeO, 41.7; CaO, 11.1; S, 1.2; and insoluble, 18.7%.

The following table is a comparison of the two types of hearth, operating side by side on the same ore, showing the average results per 8-hr. shift over a period of four weeks, the labor being the same on each type.

COMPARATIVE RESULTS ON NEWNAM AND HAND HEARTH

Ore charged, galena concentrates, containing 72.5% lead, and 15.1 sulphur.

	Newnam Hearth, Lb.	Hand Hearth, Lb.
Dry ore charged	13,179	5,091
Lead contents	9,554	3,691
Pig lead made	6,443	2,030
Gray slag made	3,318	1,329
Per cent of coke breeze used	3 6	8.8
Rabble trips per hour	37 2	....
Percentage of Total Lead in Products		
Pig lead	67 44	55 00
Gray slag	15 18	16 20
Dust and fume	17.38	28 80
	100 00	100 00

Analysis of Gray Slag	Pb	FeO	CaO	S	Insoluble
Newnam hearth	43 7	12 8	9 9	1 9	12 6
Hand hearth	45.0	12 2	9 0	2 6	12.2

The mining costs at these mines are calculated per ton of calamine produced, regardless of tenor in zinc. However, the average content of the concentrates from a mine does not vary greatly. In normal years the total cost per ton of production is from 75 to 105 lire. This cost is segregated and distributed into departments in the manner shown in the following table:

COST OF ORE PRODUCTION

Developments	12-15 lire per ton
Mining	25-35 lire per ton
Ore dressing	13-19 lire per ton
Calcining	6- 9 lire per ton
Transport	4- 7 lire per ton
General expense, royalties, etc.	15-20 lire per ton
Total	75-105 lire per ton
Average	90 lire per ton

The developments usually consist of driving along the mineral zones and crosscutting at intervals to explore for rich calamine masses.

The mining method consists of overhead stoping and filling with waste, which for the most part is sorted in the stopes from the broken ore. Much timbering is often necessary to hold up the ore masses, or pillars of ore are left. For the ore masses that occur near the surface, the ore is mined by large openpits. One of the largest of these open workings is at Monteponi which is 300 m. wide and about 600 m. long and over 100 m. in depth.

The mining is being carried on mostly by hand-drilling, though during the last few years machine drills have been introduced. At certain of the mines practically all the underground work is now being done by machine drills.

The ore dressing consists of a careful sorting on the "piazzale" at the mouths of the tunnels where calamine product, mill ore and waste are made. The hand-sorted product is sent to vertical calcining furnaces, where it is calcined before shipping. The mill ore is sent to the mill, where it is first crushed to under 1-in. size and the size from ½ to 1 in. is jigged. Both the products and tailings from these jigs are hand-sorted by boys. The ore under ½-in. size is concentrated in jigs and on tables. The zinc recovery from the ore treated in the mills is from 50 to 60%, the tailings from the mills averaging from 8 to 12%. The mill product is calcined in revolving furnaces, increasing by about 5% the tenor of the calamine.

From some mines the product is transported to the sea and sent in the smaller boats to the port of Carloforte, at the south end of the island, while from other mines it is delivered to the railway and sent to the port of Cagliari or Portovesme. Thence the ore is shipped to the smelters in Belgium and Germany, although at present shipments are being made to England.

The average tenor of the calamine shipments in 1913 was 40.65% zinc. The average selling value of this product delivered at the ports in Sardinia was about 120 lire a ton.

Future of the Calamine Mines

Although the mining of calamine in Sardinia was begun nearly 50 years ago, only a small portion, relatively, of the mineral zones has been explored. The developments that have been made in recent years have been especially successful, and those mines that have extended their explorations now have sufficient ore reserves for the next 6 to 10 years at their present rate of output, while their tonnage of possible ore is about double that of the reserves. At the Monteponi mine it is claimed that the ore in sight is sufficient for the next 40 years. At this mine practically the entire mountain is being mined as is shown in the photograph. It is therefore probable that the Iglesias mining district will continue producing calamine at its present or an increased rate of output for the next half-century.

The Newnam Hearth*

The smelting of galena in the ore hearth has been practiced in many countries for several hundred years with varying success. In the United States the water-jacketed American hearths and the Jumbo hearths have found some favor in the Missouri lead belt, where large quantities of nonargentiferous galena concentrates are produced.

In form and method of operation the ore hearth has changed but little since its earliest conception. Since its field is restricted to nonargentiferous galena containing over 68% of lead, its use is limited to a few districts; and, on account of certain disadvantages attending its operation, modern sintering and blast-furnace practice have nearly driven it out of the Missouri field.

It is not generally known that the cost of producing pig lead is smaller by the hearth method than by sintering and blast-furnace smelting. Yet it is doubtful if any metallurgist knowing this to be true would recommend an American hearth installation—by reason of the disadvantages which will be briefly enumerated.

Disadvantages of the Ore Hearth

The furnace has been limited to a length of from 4 to 5 ft., requiring for its operation two men working an 8-hr. shift as a maximum. The product per man is small, the work is hot and laborious, and the difficulty of completely removing the dust and fume has made it a notorious source of lead poisoning. Although suitable for operations on a small scale, a large number of hearths would be required for a plant smelting 10,000 tons of 68 to 70% concentrates per month; and the number of semi-skilled laborers would be six times the number of hearths—a condition which is prohibitive.

On account of the high percentage of dust and fume produced, a large flue and baghouse installation is required, and in the past the handling and retreatment of this dust and fume has been a serious problem.

On the other hand, the advantages are the immediate reduction of from 55 to 65% of the lead contents of the concentrates, with simultaneous roasting, thus producing a small tonnage of gray slag, which is an ideal product for the lead blast furnace, since it greatly accelerates the furnace operation and is productive of but little matte, the lead being largely present in the form of sulphate and oxide. As previously observed, the cost per ton of pig lead is somewhat cheaper by this method.[1]

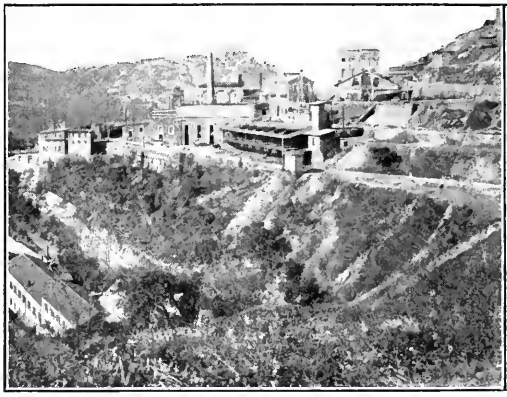
Several attempts have been made to raise the tonnage and reduce the labor on the ore hearths by mechanical means, but up to the present without success. It is the

*Excerpts from a paper by William E. Newnam, to be presented at the February, 1916, meeting of the A. I. M. E.

[1] It may be of interest at this point to note that the lead blast furnace carrying a charge with 20% of gray slag is smelting 7.5 tons of charge per square foot of tuyère area per 24 hr. The lead in this slag is under 1% and the proportion of fixed carbon consumed per charge 7.5%.

The alteration of the original sulphide ores to oxides, carbonates and silicates has probably been due to the action of meteoric waters that circulated along the mineralized calcareous strata, dissolving the sulphides and precipitating the zinc and lead in some as carbonates and silicates. This process has caused but little transfer of the ores. One usually finds some galena with the calamine; and more rarely some blende is present, showing that alteration of the ores has been in place. As gangue mineral, calcites predominate and in some of the orebodies barite and quartz are present. Limonite often occurs in large amounts associated with the calamine; also argillaceous matter where structural disturbances have occurred in the orebodies.

A study of the deposits reveals that after the initial fracturing of the limestones the cementing material along the strata and in the brecciated areas was essentially calcite, while subsequent fracturing was succeeded by the introduction of the calamine and limonite, which also serves as cementing material. Many small seams and masses of limestone in the calamine deposits show a development of calcite adjacent to the limestone walls or included masses, indicating that the deposition of the calcite is anterior to that of the calamine. The finding of these calcite veins and masses in the limestone is usually a good indication of the vicinity of calamine ore. In the calamine masses druses are often present containing small crystals of calcite and occasionally of barite, although such occurrences are later than the calamine. Quartz is of rare occurrence, though the silicate of zinc is usually present with the carbonate, which is the principal ore. The term calamine is applied to the ore, though technically it is essentially smithsonite.



VIEW OF THE MONTEPONI MINE PLANT, SARDINIA

OPENCUT WORKINGS AT THE MONTEPONI MINE

Calamine Sometimes Associated with Lead Ore

Besides the calamine some of the deposits contain lead ore in the form of galena partly altered to cerussite. At certain mines the lead content of the ore is nearly as valuable as the zinc content, while at other mines it is unimportant. Subsequent to the formation of the calamine deposits more or less movement within the mineralized areas occurred, principally parallel to the stratification of the limestones, and caused the development of the argillaceous matter and slickensides that occur frequently.

As to the age of these deposits, it is evident that the fracture zones in which they occur were developed after the limestone strata had been tilted to their present positions. As Devonian strata are interfolded with these Silurian limestones, it follows that the calamine deposits are of post Devonian age. Relatively flat-lying Tertiary strata constitute the next rock formations within the district. As no zinc deposits have been found in these Tertiary beds, they are considered to be of more recent age than the ore deposits.

The ore mined has a zinc content of from 15 to 25%, while an average content of the mineralized zones such as are being mined at Monteponi is from 8 to 12%. At the mines about two-thirds of the production is made by hand sorting, the calamine of which contains from 42 to 48% of zinc, and one-third is produced in the ore-dressing mills, which yield a calamine containing from 30 to 38% zinc. The iron content of the hand-sorted ore is usually from 6 to 8%, while that of the mill product averages from 15 to 30%. Where lead ore occurs with the calamine, as is usually the case, the calamine concentrates often contain from 4 to 8% in lead and the lead concentrates carry as high as 12% in zinc.

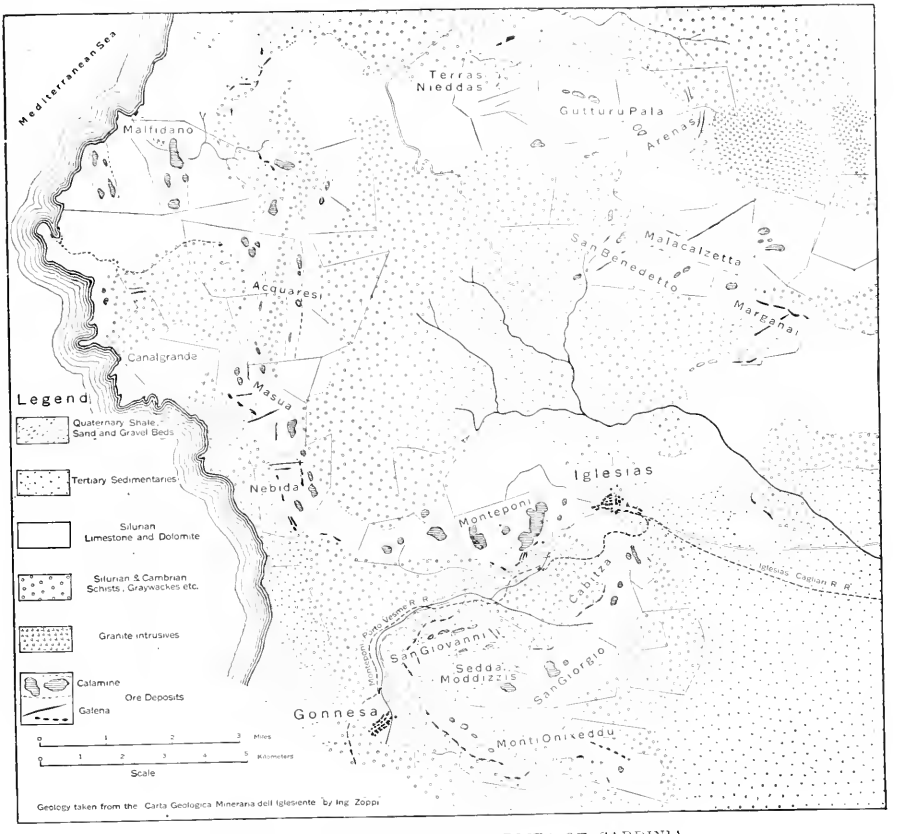
Description of the Mines of the District

The principal calamine mines of the Iglesias district are Monteponi, Buggeru, San Giovanni, Acquaresi, Masua, Nebida and San Benedetto. In normal times the production of each of the first two mines averages from 28,000 to 33,000 tons of calamine annually. The next two produce from 7,000 to 10,000 tons each of calamine and the last three average from 5,000 to 10,000 tons each annually. Besides these there are several small properties that produce from a few hundred to a thousand tons annually. The average annual production for the last 10 years has been approximately 125,000 tons of calamine.

Many of these calamine mines are important producers of lead ore and at the present time it is their lead output that permits them to continue operations at a profit.

In the district there are several important mines that produce lead ores only, and two important producers of blende.

fracturing which are parallel to the structural lines of the inclosing rocks. These mineral-bearing zones vary in width from 20 to 100 meters or more and are often a few kilometers in length. Within the zones the extent of the minable ore deposit is rarely defined by walls of waste and the limits are determined by the amount of calamine present. The ore masses mined are usually from 2 to 20 m. wide and from 10 to 100 m. in length. Usually several important ore masses occur along the same mineral zone and in the same mine. Along orebody. Other deposits consist of a confusion of limestone blocks cemented together by calamine and calcite. An example of such deposits occurs in the area of brecciated limestone and dolomite at the San Giovanni mine, and although these are quite extensive and contain rich ore, locally, they are less regular and less uniform in their zinc content than the Acquaresi type. Another type includes the superficial deposits such as at the Arenas mine, which consist of calamine and limonite ore filling basins in the eroded limestone. These deposits



MAP OF THE LEAD-ZINC DISTRICTS OF SARDINIA

certain of the mineral zones there are two or three mines, and at some of them two or three parallel zones have been developed. In one instance—at Monteponi—the entire mineral zone is being mined by large openpits a few hundred meters in width and several hundred in length.

Ore Deposits in Tilted Limestone Beds

The form of the deposits depends upon the character of fracturing of the limestones within the mineral zones. At the Acquaresi and adjoining mines the limestone beds, although steeply tilted, show but little transverse fracturing or faulting. The calamine occurs in fairly regular veins interstratified in the limestone, and where such veins are found sufficiently close together or are wide enough to be mined separately, they constitute an

are not extensive in depth and are less important than the others.

As to the formation of the ore it is evident that this has been deposited from mineral-bearing waters circulating along the fracture zones in the limestone, and in certain instances the mineral-bearing solutions appear to have dissolved the limestone-inclosing rocks along their course and thus to have formed their own channels and chambers, in which the present ore masses are found.

Originally these ores consisted of veins of sphalerite, pyrite and galena interstratified in the limestones and in masses replacing it. The calamine deposits grade into the sulphide deposits in depth at certain of the mines, while at others masses of calamine ore extend below the lowest levels—in some instances are below sea level.

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Calamine Mines of Sardinia

By Charles W. Wright*

SYNOPSIS—The calamine mines of Sardinia are comparatively recent discoveries in a very old lead-mining district. Mining is by opencut and by overhead stoping and filling. Machine drills have only recently been introduced. Development work presents many possibilities still.

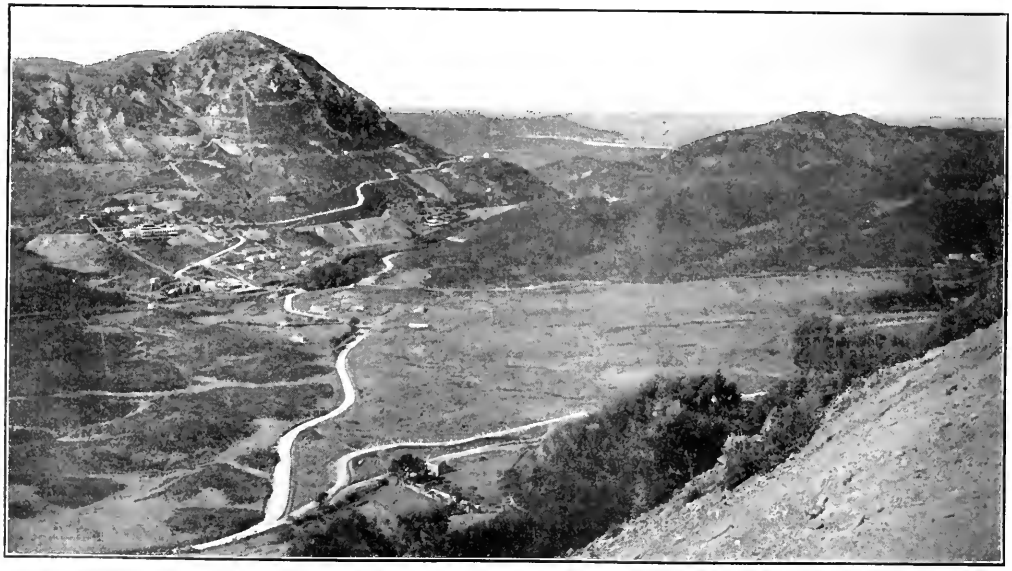
Although Sardinia is one of the oldest lead-silver mining districts in Europe, the value of its large calamine deposits remained unknown until 1865. It was then discovered that the heavy rock that accompanied certain of the lead ores was calamine and that there was a market for it. The development of the known deposits and explorations for new deposits began immediately, and 92,000 tons of calamine was produced in 1870. The output was gradually increased to 127,000 tons in 1900 and since then the annual extraction in the district has varied from 100,000 to 130,000 tons which, valued at the ports in Sardinia, amounts to from 10,000,000 to 15,000,000 lire ($1,930,000 to $2,895,000).

*Mining engineer, Ingurtosu, Sardinia, Italy.

The calamine mines are situated for the most part in the Iglesias mining district, which occupies a mountainous area on the southwest corner of the island.

A small-scale geologic sketch map of a portion of the Iglesias mining district, in which these deposits occur, is added to show the general distribution of the rock formations and the ore deposits. The oldest rocks exposed in the Iglesias district appear to be the Cambrian schists, which contain fossil evidence, principally trilobites, at Canalgrande and in the Iglesias basin at Cabitza and other points. In the limestone beds Silurian fossils have been found at many points, and overlying these, other schist beds occur which are also believed to be of Silurian age. Dolomite in stratified beds and as masses in the limestone is of common occurrence. Overlying the Paleozoic rocks and occupying the lowlands to the south of this mining district are Tertiary beds of sandstone shale and conglomerate. In these, important beds of lignite occur. Still more recent are the lava beds, which in turn overlie these Tertiary beds.

The calamine deposits are confined entirely to the limestone areas, and their occurrence is along zones of



GENERAL VIEW LOOKING SOUTH FROM MONTEPONI TOWARD THE SAN GIOVANNI MINE, SARDINIA

Assessments

Company	Delinq	Sale	Amt.
Bonanza Con., Utah	Sept 15	Oct. 6	$0.015
Buffalo, Mont	Sept 10	Oct 10	0 003
Cash Boy, Nev	Sept 29	Oct. 30	0 01
Central Eureka, Calif.	Oct. 8	Oct. 9	0 05
Coeur D'Alene, Ida	Oct. 11	Oct. 14	0 002
Columbus Ext., Utah	Oct. 10	Oct. 30	0 025
Comstock, Ida	Sept 30	Oct. 30	0 001
Con. Virginia, Nev	Sept 28	Oct. 19	0 05
Diam'field Black Butte, Nev.	Oct	4 Nov	4 0 01
E. Hercules Ext., Ida. (post.)	Sept	29 Oct	11 0 0015
Exchequer, Nev	Oct.	4 Oct. 25	0 02
Four Timbers, Wash	Oct	4 Nov	4 0 001
Gethin Le Roy, Utah	Sept.	25 Oct. 13	0 01
Giant M. & D., Ida	Oct	7 Nov	8 0 003
Goldstrike M. & L., Utah	Oct.	1 Oct. 20	0 01
Great Bend Rebpe., Nev.	Sept.	10 Oct. 10	0 01
Hancock Cons., Mich	Jan	3	1 00
Hector, Ida	Sept.	1 Oct. 4	0.005
Idaho Nevada, Ida	Sept.	7 Oct. 1	0.002
Idora, Ida	Oct	11 Nov. 11	0 005
Imperial, Ida	Aug.	31 Oct. 1	0 005
LeRoy, Ida	Sept.	25 Oct. 25	0 002
M. & P. Gold, Utah	Sept	15 Oct. 12	0 0025
Mount Pleasant Con., Calif	Oct	9 Nov. 8	0 08
Naildriver, Utah	Oct.	9 Nov. 8	0 02
Nevada Cooperative, Nev	Sept.	15 Oct. 15	0 01
Nevada-Douglas, Nev	Sept.	27 Oct. 20	0 10
New Arcadian, Mich	Dec.	1	0 50
New Baltic, Mich	Jan.	15	0 50
New Quincy, Utah	Sept.	2 Sept. 23	0.01
Northern Light, Ida	Nov.	2 Dec. 2	0 004
Oom Paul Con, Ida	Aug.	30 Oct. 4	0 01
Ophir, Nev	Oct.	12 Nov. 2	0 05
Phedora, Ida	Sept.	21 Oct. 21	0 0005
Phoenix, Mich	Jan.	1	1 00
Pioche Metals, Nev	Oct.	20 Nov. 20	0 003
Rainbow, Ida	Oct.	15 Nov. 20	0 002
Revelator, Utah	Oct.	4 Oct. 25	0 003
Rockford, Ida	Oct	4 Oct. 30	0 005
Royal, Ida	Sept.	1 Oct. 1	0 001
Silver Moon, Ida	Oct.	15 Nov. 18	0 005
Silver Pick Cons., Nev	Oct.	16 Nov. 23	0 01
Snowstorm Ext	Sept.	16 Oct. 18	0 003
Sunset M. & D., Nev	Oct.	18 Nov. 22	0 02
Sunshine, Ida	Oct.	15 Nov. 15	0 0006
Syndicate, Utah	Sept	11 Oct. 2	0 001
Temple, Ida	Sept	20 Oct. 20	0 002
Tonopah Bonanza, Nev	Sept.	13 Oct. 11	0 01
Union Cons., Nev	Oct	25 Nov. 15	0 05

Stock Quotations

The New York Exchange has listed $16,639,800 of American Smelters Securities, pfd. A.

COLO SPRINGS	Oct. 4	SALT LAKE	Oct 4
Name of Comp	Bid.	Name of Comp	Bid.
Acacia	02½	Beck Tunnel	06½
Cripple Cr'k Con	008	Black Jack	‡ 05
C. K. & N	‡ 02	Colorado Mining	03
Doctor Jack Pot	08½	Crown Point	02½
Elkton Con	23½	Daly-Judge	6 65
El Paso	75	Emma Cop	15
Findlay	03½	Gold Chain	15½
Gold Dollar	‡ 01	Grand Central	55
Gold Sovereign	03½	Iron Blossom	80
Golden Cycle	1 79½	Lower Mammoth	‡ 00½
Isabella	06½	May	17
Jack Pot	06½	Ophonogo	00½
Jerry Johnson	04	Prince Con	59
Lexington	‡ 005	Seven Troughs	01½
Mary McKinney	35½	Silver King Coal'n	3 32½
Pharmacist	008	Silver King Con	2 02½
Portland	1 56	Sioux Con	03½
Raven B. H	03½	Uncle Sam	10
Vindicator	1 50	Yankee	38

TORONTO	Oct. 4		
Bailey	04½	Dome Exten	26
Chambers Ferland	14	Dome Mines	21 75
Conlagas	4 00	Foley O'Brien	30
Peterson Lake	21	Hollinger	25 00
Right of Way	03	Imperial	05
Seneca Superior	‡ 78	Jupiter	11
Silver Queen	01	McIntyre	47
T. & Hudson Bay	20 00	Pearl Lake	‡ 00½
Timiskamiog	38	Porcu Crown	75
Trethewey	16	Preston E D	04½
Wettlaufer-Lor	07	Rea	‡ 09

SAN FRANCISCO	Oct. 4		
Comstock Stocks		Misc. Nev. & Cal	
Alta	‡ 05	Belmont	3.50
Andes	08	Jim Butler	77
Best & Belcher	05	Lone Star	02
Caledonia	59	MacNamara	02
Challenge Con	‡ 04	Midway	12
Chollar	03	Mont.-Tonopah	29
Confidence	16	North Star	11
Con. Virginia	15	Rescue Eula	09
Gould & Curry	03	West End Con	55
Hale & Norcross	05	Atlanta	27
Jacket-Cr. Pt	14	Booth	42
Julia	‡ 03	C O D. Con	04
Mexican	34	Comb. Frac	08
Occidental	79	D'field Daisy	03
Ophir	22	Jumbo Extension	1 17½
Overman	07	Pitts.-Silver Peak	06
Potosi	04	Round Mountain	41
Savage	06	Sandstorm Kendall	10
Sierra Nevada	23	Silver Pick	02
Union Con	40	Central Eureka	08

N. Y. EXCH.	Oct 4	BOSTON EXCH	Oct 4
Name of Comp.	Clg.	Name of Comp	Clg.
Am.Sm.&Ref.,com	86½	Adventure	13
Am. Sm. & Ref., pf	108½	Ahmeek	105
Am. Sm. Sec., pf. B	81	Alaska Gold M	2
Anaconda	72½	Algomah	55
Batopilas Min	1½	Allouez	58
Bethlehem Steel	395	Am. Zinc	58
Bethlehem Steel, pf.	464	Arn. Com., ctfs	8
Chino	46½	Bonanza	0
Colo. Fuel & Iron	59	Butte-Ballaklava	33
Crucible Steel	103¾	Butte & Superior	10
Federal M. & S., pf.	51½	Calumet & Ariz	118
Great Nor., ore., etf.	47½	Calumet & Hecla	550
Guggen. Exp.	66½	Centennial	17
Homestake	118	Copper Range	46
Inspiration Con.	43	Daly West	2
International Nickel	21¾	East Butte	12
Mex. Petroleum	89½	Franklin	8½
Miami Copper	33½	Granby	81
Nat'l Lead, com.	68	Hancock	25
National Lead, pf.	110½	Hedley	127
Nev. Consol	15½	Helvetia	35
Ontario Min	3½	Indiana	5
Quicksilver	12½	Island Cr'k, com.	41½
Ray Con.	25½	Island Cr'k, pfd.	88½
Republic I&S, com.	53½	Isle Royale	28
Republic I&S, pf.	103½	Kewecnaw	2
Slossshellf'd, com	61	Lake	13½
Tennessee Copper	65½	La Salle	5
Utah Copper	68½	Mason Valley	4½
U. S. Steel, com	79¾	Mass	10½
U. S. Steel, pf.	114	Mayflower	4
		Michigan	2½
N. Y. CURB	Oct. 4	Mohawk	71
Alask a Juneau	11½	New Arcadian	94
Alta Con	25	North Butte	20½
Beaver Con	26	North Lake	1½
Big Four	05	Ojibway	1½
Blue Bell	03	Old Colony	3½
Braden Copper	9¾	Old Dominion	53
Buffalo Mines	50	Osceola	84
Can. Cop. Corpn	1¼	Quincy	83
Cashboy	05	Santa Fe	3½
Chile Cop	20	Shannon	6½
Con. Ariz. Sm	1 1/16	Shattuck-Ariz	27
Con. Coppermines	1½	Superior	27
Con. Nev.-Utah	‡ 25	Superior & Bost	2¼
Dia Black B	06	Tamarack	54
Florence	45	Trinity	3½
Goldfield Con	1 1/16	Tuolumne	45
Goldfield Mercer	18½	U. S. Smelting	41
Greene Cananea	38½	U. S. Smelt'g, pf.	46
Kennecott Cop	54½	Utah Apex	3½
Kerr Lake	3¼	Utah Con	12½
La Rose	1/16	Victoria	2¼
Magma	14½	Winona	3½
McKinley-Dar-Sa	33½	Wolverine	58
Mines of Am	2½	Wyandot	1½
Mother Lode	36½		
Nevada Hills	18	BOSTON CURB	Oct. 4
New Utah Bingham	3½	Bingham Mines	7¼
Nipissing Mines	7½	Boston Ely	22
Oro	06½	Butte & Lon'n Dev	30
St. Joseph Lead	12½	Calaveras	1½
South Utah	35	Calumet-Corbin	01
Stand'd Oil of N J	486	Chief Con	85
Standard S. L.	1½	Cortez	42
Stewart	1½	Crown Reserve	37
Success	86	Davis-Daly	1½
Tonopah	5½	Eagle & Blue Bell	1½
Tonopah Ex.	2¼	First Nat. Cop.	2½
Tonopah Merger	34	Houghton Copper	2½
Tribullioo	25	Iron Cap Cop., pf	4
Tularosa	1½	Majestic	75
Yukon Gold	12½	Mexican Metals	20
		Nevada-Douglas	75
LONDON	Sept. 15	New Baltic	2½
Alaska Tre'dwell	£6 12s 6d	New Cornelia	18½
Burma Corp	1 13 1½	Ohio Copper	1½
Cam & Motor	0 12 9	Oneco	80
Camp Bird	0 4 9	Raven Copper	10
El Oro	0 7 0	Rex Cons	52
Esperanza	0 7 3	Smokey Dev	15
Mexico Mines	3 11 3	So. Lake	5½
Nechi, pfd	0 12 6	Tonopah Victor	28
Oroville	0 14 9	United Verde Ext	51
Santa Gert'dis	0 7 6	Utah Metal	8½
Tomboy	1 4 3		
Tough Oakes	0 6 6	‡Last Quotations.	

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57 572	48.855	28 083	26 553	22 731
February	61 642	57.506	48.477	28 357	26 573	22.753
March	57 870	58 067	50.241	26 669	26 788	23 708
April	59 490	58 519	50.250	27 416	26 958	23 709
May	60 361	58 175	49 915	27 825	26 704	23 570
June	58 990	56 471	49 034	27 199	25 948	23 267
July	58 721	54 677	47.519	27 074	25 219	22 597
August	59.293	54 344	47.163	27 335	25 979	22 780
September	60 640	53 290	48.880	27 986	24 260	23 591
October	60 793	50 654		28 083	23 199	
November	58 995	49.082		27 263	22 703	
December	57 760	49 375		26 720	22 900	
Year	59 791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14 223	13.641	64 304	60 756	69 488	63 719
February	14.491	14.391	65 259	63 494	70 188	*
March	14 131	14.787	64 276	66 152	69 170	*
April	14 211	16.811	64 747	75 096	69 343	*
May	13 996	18.509	63 182	77 600	67 786	*
June	13 603	19 477	61 336	82 574	66 274	95 333
July	13.223	18 796	60 540	76 011	64 955	91 400
August	*	16 941	‡	68.673	‡	82 333
September	*	17 502	‡	68 915	‡	85 250
October	*		‡		‡	
November	11 739		53 227			
December	12 801		56 841			
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 779	34 260	171 905	156.550
February	39.830	37 415	181 556	176.925
March	38.038	48 426	173 619	180 141
April	36.154	47 884	163.963	166.225
May	33 360	38 790	150 702	162 675
June	30 577	40 288	138 321	167 636
July	31 707	37 423	142 517	167 080
August	*	34 880	‡	151 440
September	32 675	33 125	‡	152 625
October	30 284		‡	
November	33 301		149 391	
December	33 600		147 102	
Av. Year	34 530			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4 111	3.729	4 011	3.548	19.665	18 606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3 970	4 053	3 850	3 997	19.651	21.883
April	3.810	4 221	3 688	4 142	18 225	21.094
May	3 900	4 274	3 808	4 182	18.503	20.347
June	3.900	5 832	3.810	5 836	19.411	25 170
July	3 891	5 659	3 738	5.531	19 051	24 611
August	3 875	4 656	3 715	4 520	‡	21 946
September	3.828	4.610	3 658	4.490	‡	23 151
October	3.528		3 384		‡	
November	3.683		3.585		18 500	
December	3 800		3.662		19 097	
Year	3.862		3 777			

SPELTER

Month	New York		St Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6.386	5.112	6 211	21 533	30.844
February	5 377	8 436	5 228	8.255	21 413	39.819
March	5 250	8 541	5.100	8.366	21.460	44.141
April	5 113	10 012	4 967	9.837	21.569	49.888
May	5 074	14 781	4 924	14.610	21.393	68.100
June	5 000	21 208	4 850	21 035	21.343	100.614
July	4 920	19 026	4 778	18 856	21 568	97.250
August	5 568	12 781	5 418	12.611	‡	67.786
September	5 380	13 440	5 230	13.270	‡	67.841
October	4 909		4 750		‡	
November	5 112		4 962		25 016	
December	5 592		5 430		27 369	
Year	5 213		5 066			

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.59	$13 23	$13 43	$13 99	$13.90
February	15.06	14.55	14 12	13 47	14 08	13 90
March	15 07	14.55	13 91	13 47	14 10	13.95
April	14.90	14 55	13 90	13 45	14 13	13 95
May	14 90	14.61	13 90	13 60	14 27	13 83
June	14 90	14 70	13 90	13 67	13 96	13 77
July	14 90	14.94	13 90	13 93	13 90	13 68
August	14 90	16.01	13 90	15 32	14 08	14 75
September	14 90	16.92	13 90	15 80	14 03	15 70
October	14 84		13 75		13 97	
November	14 59		13 43		13 83	
December	14 70		13 45		13 83	
Year	$14 88		$13 78		$14 01	

PITTSBURGH—Oct. 5

The resignation of Alva C. Dinkey as president of the Carnegie Steel Co., to become president of the Midvale Steel Co. under its new ownership, astonished the steel trade of Pittsburgh, where it is recognized remarkable financial inducements must have been offered.

Pressure for steel has been increasing still more rapidly. Except in wire products and merchant steel bars there is no question of finishing capacity, the question being simply one of steel supply. Rolling billets are almost unobtainable, and forging billets have sold at fancy prices, even above $40 a ton.

Buyers are specifying very freely on all contracts and in most products the mills entered the fourth quarter with more than half their output specified, and with distinct prospects that specifications on fourth-quarter contracts will bring them to Jan. 1 with specifications for three months' work on books. There is a corresponding disinclination to write first-quarter contracts, though some such business is being done.

Consumptive demand does not appear large, except in relation to the steel supply, and there are many industries that could, in prosperity, consume much more steel than they are taking now. There is therefore a distinct possibility of such a shortage in steel as to cause a runaway market, with prices advancing sharply instead of, as in recent months, at about the rate that obtained in the 1909 and 1912 movements.

Steel bars are up to 1.40c., a level attained last week by shapes, while most mills are quoting plates also at 1.40c. Sheets are up $1 a ton to 2c. Wire products seem on the verge of another advance. Railroad spikes are up $2 a ton for prompt, to 1.60c., and are quoted 1.65c. for first quarter and 1.70c. for second quarter. Shafting is up to 60% discount as minimum, $2 advance in a week and $10 advance on this movement, with the makers practically filled for the remainder of the year.

Pig Iron—The pig-iron market presents a sharp contrast to the steel market. There have been no advances in the past fortnight or more, and present prices are not held with the greatest ease, while actual buying is very light. Consumers are apparently covered for the balance of the year. Sellers expect a general buying movement within about six weeks, for next year's delivery, but the current make appears sufficient for requirements, with quite a number of merchant stacks still idle. Foundry is $14.50 for early delivery and $15 for first half of 1916; malleable is $14.50@15, according to analysis. Bessemer and basic remain at $16 and $15 respectively. W. P. Snyder & Co. announce average prices obtained in September at $15 for basic, a gain of 63.6c. and $15.906 for bessemer, a gain of 84.2c. All prices quoted are f.o.b. Valley furnaces, prices delivered Pittsburgh being 95c. higher.

Ferromanganese—The market is rather quiet, contract material being quoted at $100 for foreign, delivery indefinite, and at $115 for domestic, with delivery assured, and prompt lots ranging between these extremes.

Steel—The market on billets and sheet bars has become nominal. There are no openhearth billets to be had at less than $26, maker's mill, Youngstown, and higher prices have been paid. Sheet bars are nominally $1 higher, while bessemer steel might be had at $1 under openhearth, but it is growing scarcer. Fancy prices are being paid for forging billets, even above $40, with an exceptionally heavy demand, making mills indisposed to quote on rolling billets. Rods are nominally $30, Pittsburgh.

FERRO-ALLOYS

Ferromanganese is quoted at $110@112.50 per ton for domestic 80% material. **Spiegeleisen** has been sold at $27 per ton for 20%, at furnace.—**Ferrosilicon,** 50%, is quoted at $75 per ton at Pittsburgh. Bessemer ferrosilicon is from $20 per ton for 10%, up to $24 for 14%, all at furnace.—**Ferrotitanium** is 8@12½c. per lb., according to size of lots and delivery.—**Ferrovanadium** is $2@2.25 per lb. of contained vanadium.—**Ferrotungsten** is quoted in London at 7s.@7s. 6d. per lb.—$1.68@1.80—for alloy 75@80% tungsten.—**Ferromolybdenum** is quoted in London at 18s.—$4.32—per lb. for 75% alloy.

IRON ORE

Discussion of next season's prices for Lake ore is still going on, in view of the large demand for late shipments. It is generally believed that an advance of 50c. per ton will be asked.

Imports and exports of iron ore in the United States, seven months ended July 31 were, in long tons:

	1914	1915	Changes	
Imports	850,883	671,039	D	179,844
Exports	378,131	252,958	D	125,173

The chief imports this year were 432,845 tons from Cuba, 120,307 tons from Sweden, and 27,008 tons from Spain. Exports were chiefly to Canada.

Imports of manganese ore for the seven months were 163,390 tons in 1914, and 87,136 tons in 1915; decrease, 76,254 tons. Re-exports of imported ore were 28 tons in 1914, and 2,238 tons this year.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 388,884 short tons; shipments, 387,018 tons. Shipments from the Greensburg and Upper Connellsville regions, 45,713 tons.

Connellsville—The contracting movement for furnace coke for 1916 delivery continues, but buyers are showing less eagerness than was expected, and deals are brought to a head slowly. About half a dozen contracts have now been closed, for the first half or all of 1916, involving about 75,000 tons a month. Some of these have been at flat prices, $2.25 and $2.35 respectively, while some operators are still talking $2.50. Other contracts have been closed on a sliding-scale basis, with 20% as much advance for coke as basic pig iron at Valley furnaces may advance, and on such a basis that pig iron at the present market of $15 would mean coke at $2.15; $15.50 pig iron, $2.25 coke and so on. Usually the scale runs down to a minimum of about $1.85, referable to $13.50 pig iron. Contracts now under negotiation are on about the same basis as those already closed. Spot furnace coke has stiffened 5c., being quotable at $1.80@1.85, per net ton at ovens.

Exports and Imports of Fuel in the United States, seven months ended July 31, in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	2,211,664	1,997,817	15,902	2,313
Bituminous	9,307,748	10,585,552	758,044	835,222
Coke	408,441	430,604	61,715	24,389
Bunker coal	4,525,876	4,354,037		
Total	16,447,729	17,368,010	835,661	861,924

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The greater part of the trade, both exports and imports, is with Canada. There were considerable gains this year in exports to Brazil, Argentina and Italy.

Chemicals

NEW YORK—Oct. 6

The general markets seem inclined to be quieter outside of a few lines, but are rather steady.

Arsenic—Business is still rather slow, but with no change in quotations. Prices are $3.50 per 100 lb. for large lots, and up to $4 per 100 lb. for smaller orders.

Copper Sulphate—Business is steady and sales good for the season. The current quotations are $6.75 per 100 lb. for carload lots and $7 per 100 lb. for smaller parcels.

Nitrate of Soda—The market shows little change and business is fair. The current quotations are 2.42½c. per lb. for spot and 2.45c. for futures.

Pyrites—Imports at Baltimore for the past week included 6,921 tons pyrites from Huelva, Spain.

Imports and Exports of Chemicals in the United States, seven months ended July 31, in pounds:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	2,609,946	2,291,803		8,825
Bleach	25,554,389	6,181,490	12,654	120,126
Acetate of lime			38,767,339	13,602,955
Calcium carbide			21,351,263	24,732,706
Potash salts	23,041,969	13,562,685	450,302	954,607
Sodium cyanide		3,610,488		1,737,987
Soda salts, value	$380,471	$299,905	$5,542	$22,346

Exports include re-exports of foreign material. This statement does not include nitrate of soda nor crude potash salts used chiefly as fertilizers.

PETROLEUM

The monthly report of the "Oil City Derrick" gives the number of new oil wells completed in September as follows: Pennsylvania grade, 336; Lima-Indiana, 41; Central Ohio, 73; Kentucky, 4; Illinois, 66; Mid-Continent, 371; Texas-Louisiana, 139. The total number of wells completed was 1,030; the total daily production, 101,875 bbl. There were 233 dry holes and 184 gas wells. As compared with August there was a decrease of 16 wells, but an increase of 4,025 bbl in production. On Sept. 30 there were 2,130 wells drilling.

Imports of petroleum from Mexico into the United States in August were 2,039,159 bbl., being 460,512 bbl. more than in July.

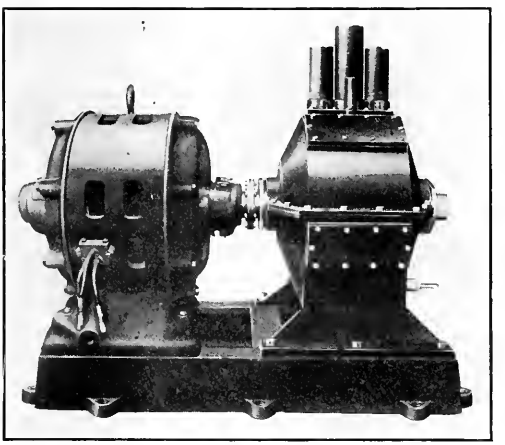
table tops complete with supports and foundation beam should not cost over $50, and to this a royalty of $10 per table must be added for patent rights. A good head motion should be purchased for from $10 to $60, making the cost of the entire table from $130 to $150.

These tables may be built by any good carpenter and blacksmith and the necessary designs and details for constructing and operating them, as well as the permission for their use, may be obtained from the writer.

Jackson Rotary Air Compressor

The Jackson Compressor Co., with office and factory at 1130 12th St., Denver, Colo., has spent about a year and a half perfecting a new type of rotary air compressor. H. O. Jackson was allowed patent for this invention July 16, 1914, his first working model having been completed the preceding February.

The accompanying illustration of the direct-connected motor-driven unit shows this compressor as a small, compact affair. The machine contains no reciprocating parts



JACKSON COMPRESSOR DIRECT-CONNECTED TO A MOTOR

and no valve gearing. Within the member corresponding to a cylinder, ingeniously contrived wings or blades actuated by an eccentric on the central shaft entrap small quantities of free air and these are immediately compressed in a single stage from atmospheric to 100-lb. gage pressure. The volume, or displacement, of each such air compartment is somewhat greater than one-fifth the entire cylinder's volume; hence every revolution of the shaft, with the action of the five compartments, compresses considerably more free air than would be indicated by the cylinder dimensions. Designs and workmanship are so accurate that clearance space is almost nil.

In the size of machine here illustrated the two outer pipes admit outside air to manifolds encircling the cylinder and furnished with poppet-type valves for each of the five chambers between the blades mentioned. The middle pipe is the discharge line, it also having a manifold to receive compressed air through poppet valves from each compressing compartment. These manifolds, as well as the cylinder, are completely inclosed by an outside casing that acts as a water jacket.

Abundant lubrication is effected through an axial hole in the shaft, high-flash oil being distributed by centrifugal action to all interior surfaces, after which it collects in the exhaust manifold and passes into the small drain pipe below, leading to an oil reservoir not included in the picture. The return oil being under the same pressure as the compressed air, a continuous flow is maintained upward from the air-tight reservoir into the shaft, the amount of oil being easily regulated by a simple valve in the line.

Packed Joints Eliminated

There are no packed joints of any sort within the machine, all surfaces being ground to air-tight fits. The compressor runs without noise or vibration. Foundations are unnecessary, the machine being portable in the highest degree. It will operate suspended by a rope with no more perceptible movement or tremor than if it were an electric generator. The intake and expulsion of air is continuous, since several valves are in action simultaneously at every instant of operation. There are, therefore, no noticeable pulsations in either the suction or the exhaust pipes.

The machine will operate equally well running in either direction of rotation, although it is especially designed to work in one direction. Furthermore, it can be used with equal efficiency as a compressor or as a suction pump. In tests for the latter kind of duty, Mr. Jackson states that his vacuum reading has been 22⅝ in. of mercury, which, in Denver, at an altitude of 5,200 ft., is very good.

The speed of revolution of the inner parts can be great. The unit here shown has a cylinder with interior dimensions of 7¾x8¼ in., runs at 1,000 r.p.m., compresses 180 cu.ft. of free air per minute to 100-lb. gage pressure and weighs 345 lb. without the motor. Weights of the Jackson compressors will be about one-tenth the weights of standard piston-displacement machines of equivalent capacities. The consumption of power is slightly less than in reciprocating compressors.

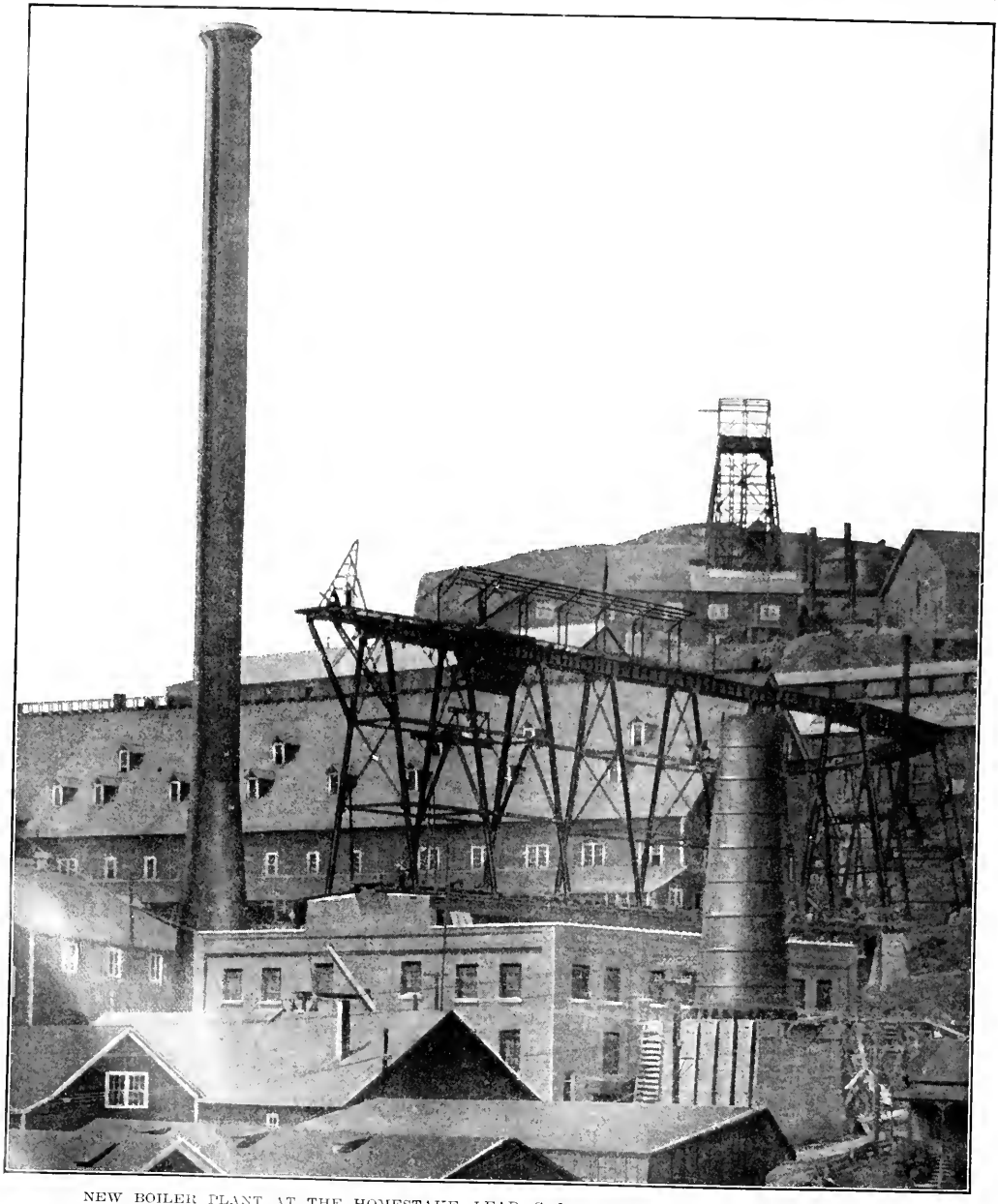
Mr. Jackson has fitted an automobile truck with one of these compressors mounted for exhibition purposes, a silent-chain drive from the engine shaft being provided, whereby the compressor can be thrown into action at any place on the road. He is visiting the mining camps and demonstrating the machine. The company is not yet prepared for or seeking orders, the present purpose being merely to acquaint users of compressors with the invention.

Ten Advantages of Wood Pipe Over Iron or Steel

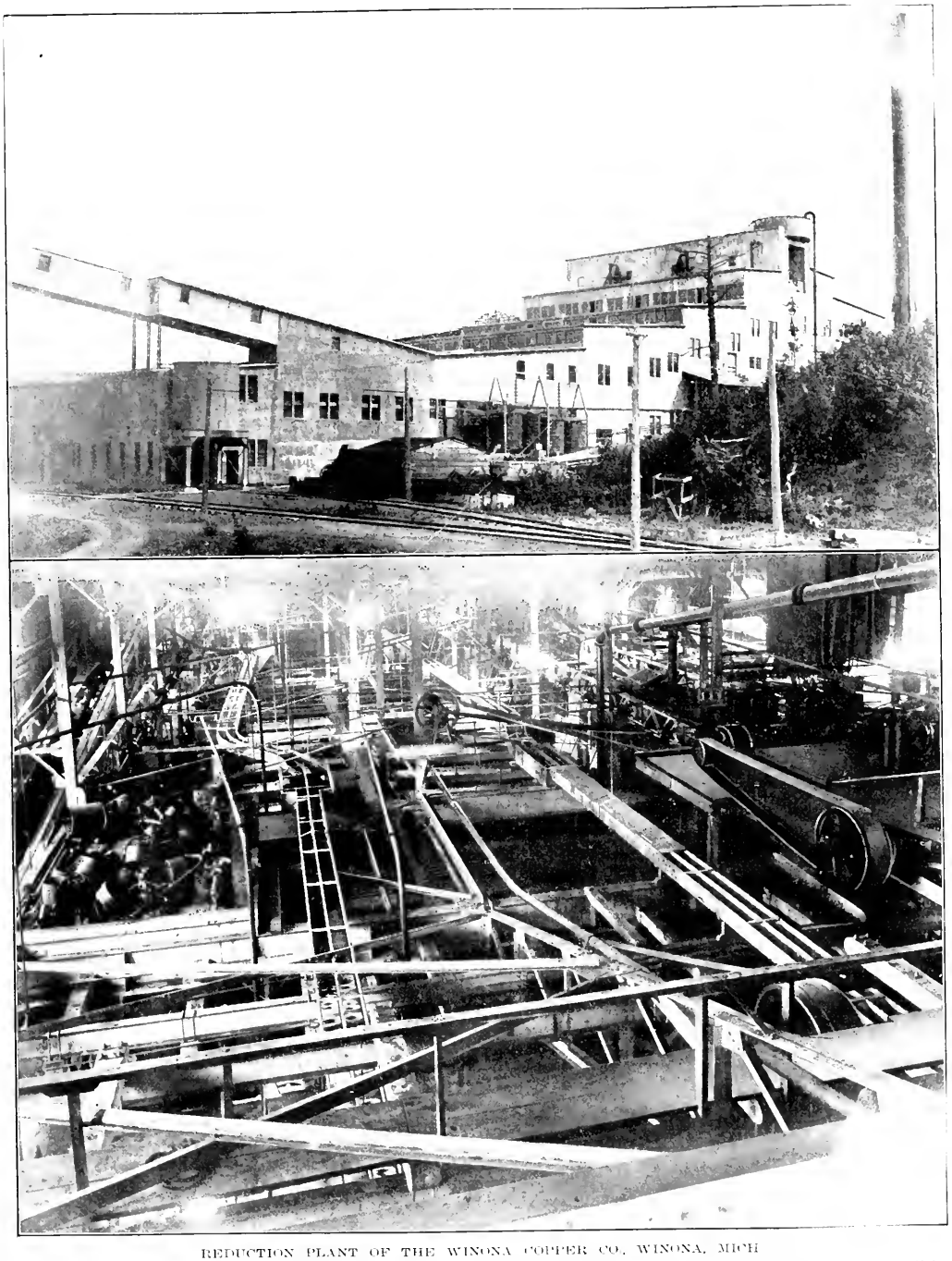
The Continuous Wire Wound Pipe Co., of San Francisco, in an interesting circular on its new method of winding wood pipe with a continuous wire makes the following 10 claims of superiority for wood over iron pipe:

(1) First cost less; (2) more durable; (3) cheaper to transport and lay; (4) lighter to handle in construction; (5) cheaper to repair and to tap for connecting lines; (6) greater carrying capacity in given size; (7) age has no effect on carrying capacity, except to increase the volume; (8) does not corrode; (9) does not affect the taste of water, and (10) is not affected by electrolysis.

Photographs from the Field



NEW BOILER PLANT AT THE HOMESTAKE, LEAD, S. D., SHOWING ONE COMPLETED STACK
This plant will contain six boilers of 600 hp. each, and will supply steam for the new Nordberg hoist at the B. & M. shaft (on the hill in background) as well as for an air compressor and electric generating plant



REDUCTION PLANT OF THE WINONA COPPER CO., WINONA, MICH.

Exterior and interior views of this company's concentrator, which is equipped with standard machine stamps, jigs, concentrating tables, etc., customarily used in the Michigan copper fields.

Correspondence and Discussion

Sensitiveness of Frozen Gelatin Dynamites

In an article on explosives, by Percy E. Barbour, which appeared in the *Journal* of Sept. 25, I noticed the following statement: "Unlike 'straight' dynamite, gelatin dynamite is very sensitive to shock when frozen." I have often heard this statement, but never proof for the same.

On p. 29 of *Bull.* 48 of the U. S. Bureau of Mines, also quoted by Mr. Barbour, is an account of some experiments in the detonation of frozen dynamites. The explosives used in these tests were all rated at 40% strength and included "straight" dynamite, ammonia dynamite, low-freezing dynamite and gelatin dynamite; No. 6 electric detonators were used; all the explosives were in a frozen condition, the temperature of experiment varying in different trials from —16° C. to 6° C. In the case of the first three, only one failure to detonate occurred; that being of low-freezing dynamite at the lower temperature mentioned. In the case of the gelatin dynamite, every cartridge failed to explode and in no case was there even a partial detonation.

From a consideration of the foregoing, it seems to me that if we can place any reliance on these experiments, they effectually dispose of the old belief in the sensitiveness of frozen gelatin dynamite.

J. A. Reid.

Kingston, Ont., Oct. 1, 1915.

Making Primers

Referring to an article in your issue dated June 19, 1915, by J. P. Ruth, Jr., entitled "Making Primers," the method he describes by passing the fuse through the dynamite cartridge is bad. It is important that the powder does not become ignited before the detonator explodes, as otherwise an incomplete detonation will result, causing noxious fumes. Although such a system as described can be employed when using electric detonators, it should be avoided with the ordinary burning safety fuse in order to obviate premature ignition of the powder. No part of the fuse should touch the explosive before reaching the detonator.

W. Gérard Boulton.

Valparaiso, Chile, Aug. 17, 1915.

Cost of Winter Construction

The recent contributions of Mr. Curran and Mr. Wood have been interesting. I hope that other builders will contribute their views about the relative cost of construction in summer and winter; that is to say, metallurgical construction. Everybody knows, of course, that the building of a mill, even in the midwinter of a severe climate is feasible. The Hollinger mill at Porcupine was built under such conditions.

I once built a plant in the Rocky Mountains in weather that was below zero—down to minus 30° F.—a good deal of the time. On some days the masons had to quit, owing to the mortar freezing on their trowels. Except for that, however, there was no trouble about the cement and concrete work that was done under cover, as most of it was. In the following summer all the foundations were as true as when they were laid. Not so in the case of some outside work that was exposed to the sun. It is the alternate freezing and thawing that plays the mischief with such work.

So much for quality. As for cost it is a different matter. It stands to reason that workmen who are trying to do their jobs with stiff fingers are not going to do so much as if they were physically comfortable. Mr. Curran is correct in saying that the cost of construction is likely to be very much more in winter than it is in summer.

B. R. W.

New York, Sept. 20, 1915.

Technical Journalism and Mining Brokers

The *Journal* of Sept. 4 blossoms out with that old perennial—"The mining broker is a gambler." This diatribe differs from sickliest effusions on the same subject in the *Mining Age, Copper, Curb and Mining Outlook, et al.,* in three ways: Their work is more artistic, the *Journal's* is the more sincere, theirs carries its antidote, slow but deadly, in the advertising columns beside the editorial, while the *Journal's* is rendered innocuous by the painful adage which echoes raucously in the wake of most humanitarian, soul-saving and money-safeguarding sermons and which may be summed up in: "Deeds, not words."

Mining swindles were a prolific source of income for certain satraps of Persia 3,000 years ago, but muleting the public was the legal industry in those days for the man-higher-up. What has the *Journal* done about it in the last six years? In 1909 the *Journal* cleaned an individual cesspool; unfortunately it used an evanescent antiseptic instead of dynamite. That the Augean stables overflow again is proved by its own aforementioned editorial. Permanent sanitation of the mining industry is beyond the strength of any single available Hercules, whether he works with a linotype, typewriter or human gas; yet it is surely within the prerogative and power of our strongest technical journal to lay the foundation for an organized activity which will accomplish the desired result.

Civilized progress, to be permanent, must be based on popular education. A religion may be promulgated with no other motive power than faith; crime, of the purely animal variety, can be hampered by legislation; but protecting the ubiquitous folly of humanity against itself, whether in the matter of typhoid germs or stock certificates, becomes a permanent possibility only when potential sufferers are shown that filth and disease are one, or that the mining broker's much advertised passes to the alms-

house are the most expensive misery with which luxury has ever baited her golden hook. Our engineering fraternity, organized with the assistance of the technical press, possesses the only voice that could effectively instruct the public. It has never tried.

Whence this hitherto insuperable aversion of American mining engineers to strike at an evil that confronts the majority of them in their daily work? To call the body of these honorable men venal—the men who after all are the backbone of the business (to say nothing of the fact that they are *Mining Journal* subscribers)—would be, as far as really useful editorials are concerned, a transfer of the shoe that pinches a small corn, from the left foot to the right, where it would contort the whole foot. This would produce a cramp in the publisher's income tax without ameliorating the condition of that great tribe—the American sucker—whom, in Broad Street, we have always with us. The difficulty lies not in want of good intention or courage among mining engineers, but in lack of organization.

When I am asked to survey, for a consideration, a tract of sand and shingle rock somewhere north of Winnemucca, do I turn down the job because I don't think there's any appreciable quantity of metal (at least in a vertical direction) closer than the molten core that separates us from China? No. My house is glass, yet it's safe if none throw stones save they who be without similar sin. Should the promoter later use my plat as a stock-selling argument, pronouncing me "one of the best-known engineers in the state," do I sue him for libelous exaggeration? No. I hope for the worst because that is the best: May the promoter or broker steal everything in sight within 90 days and drop the venture, for thus will accrue the, in the aggregate, least evil to the least number.

Engineers will always do more or less work on doubtful prospects and their reports, however honest and correct, are always amenable to misinterpretation by stock salesmen because the most hopeless-looking ground may conceal the richest ore. The remedy will lie in the ready availability of an authoritative statement as to the ascertainable condition of any mine or prospect offered to the public.

The essentials of human nature have not altered since the cave-man era. We can expect no diminution in the number of people willing to buy "1,000 shares of Euripides Oil Co. stock for $30," for isn't there "A 33% advance on this oil stock Monday, Sept. 20"? A similar announcement appeared this week in a paper of Joplin, Mo., the most active mining district in the country today. Here we have several large and countless small mines that are working at fair profit for everybody concerned. There's not a live fake broker in the town, although we've had a year's boom in production. The local business community is as firmly set against the prostitution of its mineral as of its human resources; yet, probably because the manager of the Joplin paper does not realize that he is doing for another district what he does not want to see in his own, he spills that six-column stain on his own sheet. Now for the vital question: Has any mining engineer called the attention of that publisher to his mistake? Can readers of the advertisement ask any mining engineer for advice on the Euripides Oil Co.'s prospects for oil and obtain that advice at a price within the reach of a purse opened by the offer of 1,000 shares for $30?

Let an institute of mining engineers organize an information bureau that shall have on file duplicate reports of all work done by the members of that institute. To these reports might be appended a little private mark such as Dun and Bradstreet use, then AA1 will not be set against mining promotions quite as frequently as is at present done in prospectuses. The correspondent system of the *Journal* could be utilized as a skeleton for a network of information agencies responsible to the central bureau. Their work would be far from perfect, but it would be subject to a definite check; gross misuse of the confidence placed in its men would be known to threaten disbarment from connection with any body of approved standing in the professional mining world. The public would at least have a chance to get some of the information it needs. Educational publicity could be promulgated by the bureau, training investors to a clear conception of the hazards as well as the opportunities in mining stocks. Many general newspapers could be brought into line with little trouble, and in time the majority of them. Mining-machinery makers may be persuaded to furnish some of the funds necessary to the campaign, for these manufacturers are vitally interested in seeing investment money go to users of machinery rather than to smudgers of printer's ink.

If we will face the fact, we know that a cloud hangs over our business in the public estimation. This cloud will disappear within 10 years if we but act in unison, and the commercial world will recognize that the greatest, most profitable and safest business, by daylight or candlelight, is mining.

ARTHUR PRILL.

Joplin, Mo., Sept. 10, 1915.

The Situation in Mexico

I have just read in the *Journal* of Sept. 11 some "special correspondence" from Mexico, in which the writer makes a rude criticism on the last decree of Carranza on mining taxes. This criticism I consider unjust, and I wish to give the readers of the *Journal* my own views on this subject.

Formerly the annual taxes on mining properties had been only $3 per hectare (2½ acres). The last decree of Carranza establishes an annual tax of $6 per hectare on a property not over 10 hectares; $7.50 per hectare on what exceeds the 10 hectares and is less than 20; $9 per hectare on that from 20 to 50; and $12 per hectare on all above 50 hectares. This is only an application of the proportional tax to mining property and has been very well received by all single-taxers in this country, and they would see with pleasure these same principles applied soon to rural and city properties. It will promote the subdivision of the property, making the earth available to more individuals, which is the fundamental of prosperity in any country.

At present the mining interests of the Republic, as well as agricultural lands, are in the hands of a few individuals and corporations, which hold large tracts of mineralized lands that they do not develop or explore in the least, only waiting for the opportunity to sell at a high price what has cost them almost nothing. This is not fair. The effect of the new mining tax, we hope, will be to promote the subdivision of the mining properties, forcing landlords to abandon the greater part of their mining

holdings in order to work the rest; and hundreds of prospectors will rush to the freed mineral lands, where we expect to have in the near future many small lively mines working successfully, instead of large dead property producing nothing; and all this will be highly beneficial to the prosperity of mining industry of our country.

Small companies, with hardly enough capital to explore a claim of 1 or 5 hectares, are now holding claims of 20 to 50 hectares, which they cannot develop. The new tax will oblige them to concentrate their attention and efforts over a small area, and the results they obtain will be far better than formerly, while the mining tax they must pay will mean little to them.

To powerful companies working successfully great claims of hundreds of hectares, worth many thousands dollars each, the new tax is of little significance, and it only represents a fraction of 1% of the property's value.

F. ROEL.

Monterey, Mexico, Sept. 25, 1915.

Fettling Reverberatories

Referring to L. D. Ricketts' letter in the *Journal* of Jan. 23, 1915, intimating that Harry Charles, who was employed at Cananea at the time the roof-fettling experiments were being made there, and I were identical, I have not been able to make earlier reply owing to the time necessary to secure evidence of the fact that I was not the Harry Charles referred to, that I was not in Cananea during the period in question, and that I have never been there.

I have recently been in communication with several men who were familiar with my work in Butte and Salt Lake in 1905 and 1906-1907. These men know that I was not working at Cananea during these years, as can be seen from the following quotations from their letters. From Thomas D. Hughes, Tooele, Utah, July 7, 1915:

> In regard to your inquiry about using ore for the lining in the reverberatories at the Montana Ore Purchasing Co.'s plant, it was on No. 4 furnace before I went to Humboldt, Ariz. You experimented on both the stack and the charging; you had a pipe going from the charge floor through which the Snowstorm ore was fed and after we came down to the Bingham Consolidated you fed with the self-feeder. It is "all the go" at all the plants now. In Anaconda they are charging nearly all on the sides; the same at Garfield, and they are doing so well that they are doing away with the blast furnaces.

From the letter of John C. Slater, Midvale, Utah, July 9, 1915:

> In regard to your patent reverberatory feeder, I have not gotten everything clear. After a period of 10 years many things have been forgotten, but I do know that you were intending to put hoppers to use siliceous ores for claying up (fettling) the furnaces at Butte before shutting down there. I also remember that on one of the furnaces—I believe it was No. 3—we cut out a brick from the roof along the side walls, about every 2 ft., and clayed up the sides that way with ore. I do know that while at the Bingham Consolidated we also used a feeder to charge calcine and flue dust continuously in very small quantities but we did not get that completed.
>
> It seems to me that there was some shafting and pulleys or sprocket gearing got ready at Butte for charging but I cannot remember that it was ever put in place. . . .
>
> I remember hearing you say that some day these furnaces would be charged differently, and you were always telling us to keep the ore banked high against the sides and bridgewall, so the charge would be thinner in the center of the furnace. You would say, never mind if the sides are not ready as long as the center is clear so you can skim. If I remember rightly we made two furnaces do what four did when dropping all the charge at the center.

Mr. Hughes and Mr. Slater were the general foremen at the Heinze plant in Butte, 1905-06. They both filled similar positions in 1906-07 at the Bingham Consolidated near Salt Lake City. I could name several others that worked at the Butte plant in 1905, but these two letters will be sufficient to prove who was the first to drop ore around the sides of a reverberatory furnace for fettling and smelting purposes.

In the spring of 1905 at Butte, Mont., while in charge of the Montana Ore Purchasing Co.'s works (Heinze's plant), I drew my first plans of a reverberatory furnace with side hoppers to feed siliceous ores for fettling and smelting purposes. We were treating a very profitable ore from the Snowstorm mine in the converter linings and decided that it would be a good substitute for silica in the reverberatory furnace for fettling. We tried it, but it failed as we could not make it stick to the walls. Later, we cleaned off the bottom in front of the bridge-wall and back angles and made a solid foundation for the ore, which we dropped through the roof. This seemed to hold fairly well, but before proceeding further Mr. Heinze wished me to perfect a continuous feeder that I had had in mind and to patent them both at the same time, since they are capable of being applied simultaneously. Before my plans were worked out Mr. Heinze sold his Montana interests to the Amalgamated and I was instructed to take my plans and adopt them at the Bingham Consolidated plant in the Salt Lake Valley. It was my intention to feed everything at the sides in Butte, but he made me add small charges at the center when we went to Utah.

In the spring of 1906 I started to remodel the reverberatory furnace with the idea of incorporating my feeding and fettling scheme and secured the assistance of W. N. Tanner, of Salt Lake City, now chief construction engineer for the Anaconda company, in preparing the plans and to work out the unfinished mechanical device. It was Mr. Tanner's drawings, based upon my old drawings from Butte, that went forward to prepare the patent application.

In the early days of reverberatory smelting, I was continually trying to figure out how to eliminate the labor and delay incident to fettling. After studying and experimenting with the subject for 20 years, I finally decided on the method of dropping the materials on the side walls instead of trying to throw these materials across the furnace from a small opening on the other side. That always appealed to me as a wasteful method, because it was an exceedingly exhausting task for the men and not more than one in four could place more than 60% of the material where it belonged; furthermore, the furnace became much cooled during this operation and smelting could not be resumed at full speed for some time thereafter.

The inefficiency of the old shoveling method of fettling contributed to an unsatisfactory base for the fettling material to rest upon. I had proved in a small experimental way in Montana that if a satisfactory base were secured, the material could be dropped along the side walls or bridge and made to stick, just as it does on the bottom of the furnace when charged in the old way too rapidly. This led me to the development of the idea of dropping the material along the side walls, and then I also conceived the plans of a more satisfactory distribution of the charge over the furnace, as shown in my earlier drawing at Butte. This drawing shows a bank of ore dropped along the side wall and the tines distributed over the bank and the remainder of the hearth.

At the Bingham Consolidated plant we were not able to apply these ideas exactly as outlined in my patent papers (U. S. Pat. 811,477). I wished to feed practically continuously dropping calcine on siliceous ore and corrode the siliceous-ore bank instead of the brick walls. I also wished to be able to charge anything from the finest material to ores the size of goose eggs, thereby making the reverberatory furnace more efficient than ever before. While many people were skeptical or ridiculed my plan for preventing corrosion of the side walls by dropping material against them instead of trying to throw it across the furnace, it is noteworthy that very few smelters are now attempting to throw their fettling materials across the furnace and thus cooling it down. They have incorporated in their practice my idea of preventing corrosion by dropping the ore against the edges of the hearth.

HENRY L. CHARLES.

La Fundición, Peru, Sept. 6, 1915.

Fineness of Crushing for Assaying

It may be well to preface any discussion of this subject by saying that, while there is an impression that an undetermined, intermediate degree of fineness gives the highest assay results, there is not, so far as I know, any definite information on the subject, such as screen analysis of the sample and slag assays. And it is not positively known whether this is true with all characters of charges, and the exact cause.

We may accept the theory that some of the particles of gold and silver in a sample are so small that they would be held in suspension if not dissolved by the lead, and from this it is safe to assume that the gold and silver must be liberated before the lead has settled, which condition would not obtain in a coarse sample. I am not so sure, however, that the underlying cause is the same for finely ground material, as suggested by Mr. Dewey (*Eng. and Min. Journ.*, Aug. 21, 1915). His premises are none too well taken. It is quite possible that the dusting loss is considerable with finely ground samples, and I have seen cases where this amounted to over 10%. (This is not saying that the sample was properly assayed.) The sample is usually the most infusible constituent of charge, retaining its dry state the longest, with opportunity of being lost with evolved gases.

The effect of boiling is a question which we have been investigating for some time, and find the results are so influenced by contributing conditions that a definite statement is undesirable.

As a single illustration of the difficulty in determining the exact effect of boiling, the following experiment[1] is given:

Jewelers' polishings screened through 150 mesh. The eight charges were fused and cupeled together. The assays for the two different charges were placed alternately in the furnace.

	Charge A	Charge B	No.	Pb Reduced A	Pb Reduced B	Silver, Oz. per Ton A	Silver, Oz. per Ton B
Sample, a.t....	0.2	0.2	1	22.6	21.2	4333.5	4306.0
SiO_2, grams...	5	3	2	21.3	21.3	4337.5	4297.5
Na_2CO_3, grams...	12	15	3	21.5	21.2	4329.0	4313.5
PbO, grams...	50	37	4	22.5	20.6	4316.5	4317.0
$Na_2B_4O_7$, grams...	5	7	Average	22.05	21.08	4329.1	4311.25
Argol, grams...	2	2					

Slag Volume	A	B
Maximum boiling	105 c.c.	45 c.c.
After fusion...	11 c.c.	5 c.c.

[1]Experiment by T. L. Lee, metallurgical student.

The natural inference is that the results substantiate Mr. Dewey's contention, but the slag assays leave the question in darkness. Slags 1A, 2A, 2B, 3B were assayed by adding flux to make them of equal composition, and gave practically the same results: 0.9, 1.0, 0.9, 0.9 mg. silver.

Mr. Dewey's statement in reference to the niter method considers a type of charge which has been largely superseded. The modern high-litharge niter charge boils the least and produces the most fluid slag of any charge we have, and yet is the best for excess reducing ores. It must be admitted that a lead button larger than usual is required[2], but there is no proof that this is necessitated by lack of boiling. It may be a question of relative solubility. We know that slags high in uncombined litharge will contain more silver than where the litharge is satisfied with silica, and we believe that there is an equilibrium between the amount of silver dissolved in any particular slag and the lead button, and that this varies with the ratio of lead to slag. The following illustrates this point: Two slags, from the foregoing experiment, were melted over 10 grams of lead, in compact form, for 30 min. The resulting buttons on cupellation gave 0.56 and 0.80 mg. of silver, while the slag assay of parallel fusions, as previously noted, is 0.92 mg.

These results show a relation to some of those for copper presented by Frank E. Lathe in his interesting article on "Metal Losses in Copper Slags" (*Eng. and Min. Journ.*, Aug. 7, 14 and 21, 1915).

The fallacy in regard to sodium bicarbonate ($NaHCO_3$) dies hard, particularly as there is neither theoretical nor practical evidence in its favor. Bicarbonate when heated decomposes as follows: $2\,NaHCO_3 = Na_2CO_3 + H_2CO_3$, the latter of course being dissociated. As the reaction is to all intents and purposes complete before any fusion takes place, there can be no stirring action except in the dry state, with doubtful advantage. The boiling in a charge is produced by the gases evolved from oxidation of reducing agent and the carbon dioxide (CO_2) displaced from sodium carbonate (Na_2CO_3), which is the same in amount whether the normal or bicarbonate of soda is used, provided they are employed to give equal quantities of sodium oxide (Na_2O).

As practical evidence: In a law case we used normal carbonate for 25 samples from a camp where it was insisted that bicarbonate was essential for the best results. Our results were about 0.25 oz. higher than those obtained by our opponents. The samples contained approximately 25 oz. of silver and had a siliceous gangue. Further, after using the normal carbonate for 10 years, adopted after careful testing with satisfactory results and a saving of 50% in cost of sodium oxide (Na_2O) content, we prefer soda ash to bicarbonate.

New York, Sept. 26, 1915. E. J. HALL.

Assay Charges at Salt Lake

Only a few weeks ago there was a great parade made over the determination of the Government not to compete with the local assayers at Salt Lake City; therefore, if the United States Assay Office would make a charge of $2 per determination. Now we hear that the charge will be $1. How about competition?

Salt Lake City, Oct. 8, 1915. SUBSCRIBER.

[2]"Assay of Gold and Silver by Iron-Nail," by C. Eng. and Min. Journ., Dec. 13, 1913.

NEW PUBLICATIONS

REPORT ON THE SALT DEPOSITS OF CANADA AND THE SALT INDUSTRY. By L. Hebel Cole. Pp. 174, illus. Canadian Department of Mines, Mines Branch, Ottawa.

GUIDEBOOK OF THE WESTERN UNITED STATES. Part D. The Shasta Route and Coast Line. By J. S. Diller and Others. Pp. 142, illus. Bull. 614, U. S. Geological Survey. May be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at $1 a copy.

GUIDEBOOK OF THE WESTERN UNITED STATES. Part C. The Santa Fé Route with a Side Trip to the Grand Canyon of the Colorado. By N. H. Darton and Others. Pp. 194, illus. Bull. 613, U. S. Geological Survey. It may be obtained from the Superintendent of Documents, Washington, D. C., at $1 a copy.

TRANSACTIONS OF THE AMERICAN ELECTROCHEMICAL SOCIETY, VOL. XXVII. 5½x9, pp. 486, illus. Published at the office of the Secretary, South Bethlehem, Penn.

Contains proceedings of the meeting of April, 1915, together with the papers presented and discussion thereof.

"THE ENGINEER" DIRECTORY. 5¼x8, pp. 176, paper. "The Engineer," 33 Norfolk St., Strand, London, England.

This will be a very useful book to those who are interested in foreign manufacturers of machinery and engineering supplies. It is a classified compilation of the specialties advertised in "The Engineer," the publishers of which issue it gratuitously.

POOR'S MANUAL OF INDUSTRIALS FOR 1915. Sixth annual number. 6x9, pp. cliv + 2872; $7.50. Poor's Manual Co., New York.

The sixth number of this well-known Manual contains about 412 pages more than the 1914 issue. It is impossible to say how many pages are devoted to mining companies as they are not given in a separate section as was formerly done. However, the previous issue had 375 pages devoted to mining, and at the same rate of increase the total number in the present volume is about 435.

As in former issues the volume covers all the important companies, giving complete and accurate information regarding their organization, officers, holdings, earnings, dividends, etc., compiled from official sources. In a volume of this size it is astonishing how nearly up to date it has been brought. Thus, we note certain matters referred to, which happened in mid-August.

MECHANICAL DRAWING. With Special Reference to the Needs of Mining Students. By Joseph Husband. 8½x11, pp. 79, illus., paper; 80c. Longmans, Green & Co., New York.

It is rather interesting to see a book published on mechanical drawing—a so much overwritten subject—with a definite aim. Although the book meets all the essential requirements of general mechanical drawing, containing many examples known to all branches of engineering drawing, the chief value of the book seems to be in the effort to familiarize the student of colliery engineering with all the details with which they are in everyday contact. The language is clear, concise and a well-deserved praise is to be expressed on the legible and neat-looking line-engraving plates—something which is badly lacking in the average publication on this branch of art.

A. L. ORMAY.

UNITED STATES MINING STATUTES ANNOTATED. By J. W. Thompson. 6x9, 1772 pp., cloth; in two parts. Bulletin 94, U. S. Bureau of Mines. For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at $2.50 a copy.

This bulletin is a compilation of all sections of the United States Revised Statutes, and of all acts of Congress relating to mines, mineral lands and the mining industry on the public lands. It does not include the state laws, which may be taken up by the Bureau of Mines in the future. References to Alaska and the Philippine Islands are included, and it is the only complete work in its field.

All sections and acts are annotated. These consist of abstracts of decisions of all courts and public officers wherein any of these sections or statutes are explained, construed and applied. The annotations are arranged under each section or statute with appropriate title lines in definite order, and consist of plain propositions of law, and point out how the courts have cured many defects, made clear the uncertainties, and aided in the practical application of these statutes. The large number and wide range of these decisions show that the practical value of the mining laws depends on their present status as established by the courts. The person interested is thus aided in determining the course to pursue in applying any given act to his mining enterprise. The work is indexed and any desired subject may be readily found.

Calumet & Hecla Report

The Calumet & Hecla Mining Co., Calumet, Mich., reports that in 1914 it produced 53,691,562 lb. of copper at a cost of 11.35c. per lb., which it sold at an average of 14.01c. per lb. There was 2,592,462 tons of rock treated, yielding 20.70 lb. of copper per ton. The cost of mining and milling, excluding construction, was $1.85 per ton of rock. The construction cost was equal to 1c. per lb. of copper. The following table gives a comparison of production and costs for the last four years:

	1911	1912	1913	1914
Tons of rock treated	2,909,972	2,806,610	2,035,625	2,592,462
Mine cost per ton of rock, excluding const	$1 84	$1 91	$2 38	$1 185
Pounds of refined copper produced	74,130,977	67,856,429	45,016,890	53,691,562
Pounds of copper per ton of rock	25 47	24 18	22 11	20.70
Cost per pound for construction	0 27c.	0 80c.	1 54c.	1 00c.
Total cost per pound of copper produced	8 52c.	9 86c.	14 25c.	11.35c.
Price per pound received for copper sold	12 82c.	16 65c.	15 77c.	14.01c.

The Conglomerate lode produced 37,996,045 lb. of copper from 1,139,986 tons of rock. The average yield of this rock was 26.38 lb. of copper per ton and the average mine cost, excluding construction, was $2.37 per ton. This copper was produced at a cost of 10.42c. per lb. The following gives the depths of the operating shafts on the Conglomerate lode: Calumet No. 2, 6,186 ft.; Calumet No. 4, 7,995 ft.; Calumet Nos. 5 and 6, 6,155 ft.; slope shaft, 1,588 ft.; Hecla No. 6, 7,874.6 ft.; Hecla No. 7, 7,977.5 ft.; South Hecla No. 8, 6,102 ft., and South Hecla Nos. 9 and 10, 7,930.5 ft. The Osceola lode produced 15,695,517 lb. of copper from 1,152,476 tons of rock, averaging 13.62 lb. net yield of copper. No work was carried on in the Kearsarge lode during the year.

The following table gives a comparison of results at the old recrushing plant (No. 1) and the new crushing plant (No. 8) during the year. Sixteen of the tube mills in the new crushing plant were started during the summer:

	No. 1 Plant	No. 2 Plant	Both Plants
Tons of coarse tailings crushed	351,929	75,630	427,559
Pounds copper per ton in material treated	11 52	11 84	11.58
Pounds of copper saved per ton	3 74	4 59	3 89
Pounds of copper produced	1,316,704	347,363	1,664,067
Cost per pound, excluding smelting and selling	7 38c.	5 66c.	7 02c.

In April, 1915, work was again commenced on a leaching plant to re-treat the tailings from the recrushing plants. At the smeltery the new electrolytic plant is now working to its full capacity of about 65,000,000 lb. of copper per year. Dividends of $1,000,000 paid during the year bring the total dividend disbursement to $124,250,000 at the end of 1914. Cash and quick assets amounted to $1,132,236 and current liabilities to $529,370, leaving a balance of quick assets of $1,134,000. There are further liabilities in the form of 10-year 4% notes dated Feb. 18, 1909, aggregating $1,134,000. The following stocks are owned and not included in the assets stated: 24,512 shares of the Ahmeek Mining Co.; 41,000 shares, Allouez Mining Co.; 11,500 shares, Centennial Copper Mining Co.; 19,400 shares, Cliff Mining Co.; 50,100 shares, Gratiot Mining Co.; 32,910 shares, Isle Royale Copper Co.; 152,977 shares, La Salle Copper Co.; 37,550 shares, Laurium Mining Co.; 32,750 shares, Osceola Consolidated Mining Co.; 11,207 shares, Seneca Mining Co.; 50,100 shares, Superior Copper Co.; 19,400 shares, Tamarack Mining Co.; 42,702 shares, White Pine Copper Co., common; and 15,799 shares, White Pine preferred.

Editorials

Respecting Ore Contracts and Their Failings

Producers of zinc ore are meeting with increasing difficulties in disposing of their product. New producers are in some cases running around vainly in their efforts to find anybody who will take their ore. On the other hand, some smelters are canceling existing contracts that are so loosely drawn as to permit them to find pretexts for doing so.

This is rather unfair, though what is sauce for the goose is no doubt sauce also for the gander. The matter of ore contracts between miners and smelters of ore has been from time immemorial a loose thing in this country. In other minerals it is different. The miner of phosphate rock, for example, contracts to deliver a certain tonnage of known product within a certain period. If he is unable to do it out of his own property he must buy it in the market.

Many years ago attempts were made to get ore contracts upon such a basis, but it was impossible to do this. Ores are quite different in nature from other mineral substances—phosphate rock for example—that are more uniform in character and composition. A buyer may contract for a certain tonnage of phosphate rock guaranteed to exceed a certain percentage of tricalcium phosphate and to be under certain limits of iron and alumina. If he be unable to deliver the stipulated tonnage he can go out into the market to buy it and may have to do so. The producer of lead ore, on the other hand, might be quite unable to duplicate his product. The smelter contracts for a particular thing, not something similar.

Moreover, miners are loath to enter into contracts for specified tonnages of their ore which they may fall short of in the event their mine should unexpectedly and suddenly peter out. These conditions, and others, have bred a looseness in the contractual relation between buyer and seller. The seller delivers what he has agreed to—if he wants to. If he does not want to, some accident happens in his mine; his shaft gets out of order, or by some uncontrollable event it becomes impossible to produce ore. Perhaps it is not deemed necessary to offer any excuse. About 15 years ago the custom of contracting for ore on sliding scale was introduced in the Joplin district. The sellers lived up to their contracts so long as the net yield per ton of ore was above what they could get in the open market. After a few months the condition changed. The sellers then simply broke their contracts. With them it was a case of "Heads, I win; tails, you loose."

The smelter, to meet this attitude of mind, puts in his contracts provisions about impurities in the ore, which enable him to refuse receipt whenever he wants to, always to the great surprise of the miner, who believes he has a real contract. In fact such contracts mean nothing more than the terms of settlement for such business as both parties are willing to do during the stipulated period. This relates especially to business among the small fry. There are some big contracts that are more binding.

The Old Story of Fraudulent Mining Promotions

A correspondent whose communication appears on another page discusses in a breezy way the old question of who should be the guardian of the unwary against the fraudulent promoters of mining stocks. He makes two suggestions that are good in so far as they go, which is only a little way, but are neither novel nor broad-reaching in their practicability. One of them is that the mining journals of good standing should be more energetic in their pursuit of the wildcats; the other is that mining engineers should organize and disbar from the practice of their profession any member found guilty of improper acts.

Now, it is hardly the duty of the engineering journal to act as grand jury and prosecuting attorney in the case of every suspicious promotion. The editors of a paper cannot, even with the assistance of all of their correspondents, become aware of all the schemes that are being put through to inveigle the public; nor can they spare the time and expense to run down more than an occasional one of those that come to their attention. This may be done now and then for an example, for the sake of drawing public attention to an evil, but to expect more than that is unreasonable.

The individual is in a similar position, without owing the responsibility to the public that the journal does. There is not a mining engineer whose eye does not fall often on some advertisement or prospectus that he thinks suspicious—nay, believes to be fraudulent, and would not hesitate so to advise any client that might consult him. But there is great difference between opinion and knowledge. The client that has confidence in the engineer accepts his opinion. The engineer would hardly be justified in communicating to the public any unsolicited opinion, through the medium of the press or otherwise. If he had knowledge of a fraud being perpetrated it might be his duty to expose it. Such exposures are not uncommon.

It is precisely the distinction between knowledge and belief that constitutes the whole difficulty in scotching the fraudulent promoter. If one of that ilk had been advertising a process of extracting gold out of sea water and had been caught in a diving suit putting gold on the submarine plates that he had represented as extracting the precious metal from the brine, there would be no question about his fraudulent intent or his conviction if the officers of the law could lay their hands upon him. The chances are, however, that he would previously have skipped by the light of the moon, just as the Rev. Mr. Jernegan did.

Let another artist appear, however, with an Adirondack gold-mining company or the supposed existence of an orebody beyond a fault; he will, if cornered, maintain that he honestly believed in the things that he had estimated, that he relied upon his "geologists," "engineers," etc., and it is likely to be impossible to prove the contrary.

although everyone experienced in mining may be firm in the conviction that the scheme was fraudulently conceived from the outset. Nobody of intelligence ever was under the illusion that George Graham Rice and Julian Hawthorne ever had any mines of consequence, yet how long and arduous was the adducing of legal proofs in the courts? And even today, Albert Freeman, who pulled the wires that made poor Julian Hawthorne dance, is contesting his conviction on appeal.

It happens on occasion, moreover, that chance may redeem even the baldest kind of a fake. Suppose, for example, that Chicken Bill, of Leadville fame, had promoted a stock company after he had salted the Chrysolite mine, instead of merely selling it to H. A. W. Tabor. The experts would have testified against him to a man, yet his dupes would have forgiven him, as no doubt Mr. Tabor did, and the experts would have been blamed for not being able to look into the ground. The case of the Cananea mines was quite different. There were great outcrops there, great indications of ore, but Colonel Greene, who was a man of the Colonel Sellers type, was hardly justified in making the promises he did. The promotion of his mines through the medium of newspaper broadsides impressed most conservative persons as having all the earmarks of a fake, but the thing made good. Hence the need for caution in summarily condemning some flamboyantly offered enterprises.

The position of mining engineers with respect to fraudulent promotions is perfectly clear. The mining engineer is like other professional men, neither better nor worse. There are shyster lawyers and also there are mining engineers who prostitute themselves. If the public be not discriminating it is the public's own fault. There are organizations—the Institution of Mining and Metallurgy in Great Britain and the Mining and Metallurgical Society in the United States—in which membership means something and whose members would be disciplined if they should transgress.

One other point relates to a clearing house for information about mines. Such information exists in the archives of the several exploration companies and in the files of many mining engineers. There is hardly a mining prospect of promise, besides thousands that are not of promise, about which information cannot be obtained in New York. Such information is often exchanged among engineers. It would be unwise and impracticable to throw it open to the public in the way Mr. Prill suggests.

The eradication of the evil of fraudulent mine promotion is something that can hardly be expected. It has baffled legislators, district attorneys and post-office inspectors. The blue-sky laws enacted in many states are well-meant but humorously ineffective. The actions of the post-office department in closing the channels of the mail and of the Department of Justice in taking chances on conviction where state officials feared to step in have been the most useful things that have been done. There is, however, one relatively easy reform and an important one, namely, a better attitude of the newspapers with regard to their advertising pages. The newspapers that circulate invitations to subscribe to shady and suspicious promotions know that they are aiding and abetting something improper, just as they know it when they are carrying patent-medicine advertisements, and they do it simply for the money it brings them.

Mechanicalizing the Lead Ore Hearth

In a paper just published by the American Institute of Mining Engineers, William E. Newnam, the superintendent of the smelting works of the St. Louis Smelting and Refining Co., at Collinsville, Ill., describes what is manifestly an important improvement in lead smelting in the ore hearth. This method of smelting high-grade ore, relatively simple both in plant and practice, has long been in use in Missouri and at those places in Illinois where Missouri ore is smelted. One of its old drawbacks was eliminated by adding to the smelting furnaces means for the filtration of their smoke—specifically, flues and baghouse—as a result of which the extraction of lead from the ore smelted rose to a high figure, 98% and upward being realized.

This change put smelting in the ore hearth far ahead of smelting in reverberatory furnaces as practiced at Desloge, and also ahead of the roast-reduction, blast-furnace smelting as practiced at Herculaneum. A modernization of the smeltery at Herculaneum kept it in the field, however, the great loss of lead formerly experienced in roasting being reduced, first by the use of the Savelsberg pump and later by the Dwight & Lloyd sinterer.

However, the ore hearth still had the great drawback of extraordinary severity upon the men operating it, they being obliged to work exposed to intense heat, which made their duty well-nigh unbearable in summer, and also exposed to lead fumes in about the worst form. Mr. Newnam succeeded in eliminating both of these difficulties, and incidentally greatly improved the metallurgic results of his furnaces, in fact raising a time-honored type of furnace to an entirely new plane for development. This was an achievement that was worth while.

Terms for Buying Zinc Ores

A correspondent asks about the new method of buying zinc ores that smelters are introducing in the West. We have heard of no new *method*. Any method of buying any ore must necessarily be the value of the metals extractable from it less a sum that will pay costs and leave the buyer a profit. This principle is expressable in a variety of ways. The *terms* for ore are, however, constantly changing, according as market conditions change. The only new terms for buying zinc ore that we have heard of are the fixing of maximum prices; that is, the smelter will not pay for the zinc content at anything above 8c. per lb., no matter what the spelter market may be; or he may agree to pay for only one-third or one-half of the excess over 8c.

Smelters are adopting such a course in order to avoid being stuck with a large stock of high-priced ore when the market collapses, as sooner or later it will. In view of the plethora of zinc-ore supply they are able to dictate their own terms. Two or three years ago, when spelter was very low and certain ores were especially in demand, some contracts for Leadville calamine were made at minimum prices; that is, the spelter of the ore was paid for at a fixed price no matter how much lower the market might be. Even at the present time the best terms are given for calamines. This is for the reason that many smelters have more distilling capacity than roasting capacity.

BY THE WAY

According to the first mining laws of the old Oriental district in Nevada, miners were exempted from annual location work on proving that they had served 15 days in repelling Indian raiders.

⁂

India is ordinarily thought of as one of the diamond-producing countries of the world, but the production of Central India and the Madras Presidency averaged only 45.94 carats per year from 1909 to 1913. The return for each laborer employed was about $7 per year. Rather poor, even for India.

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The *Portland Oregonian* contains the following succinct account of an accident at the Lane County rock quarry, 21 mi. west of Portland: "William Clinton Keever today lighted his pipe, then started to load a hole in a rock with 12 sticks of dynamite. He lived an hour and leaves a wife and four children."

⁂

The *South African Mining Journal* states that the South African Institution of Engineers has passed resolutions offering its services to the British Government in any way in which they can be used to further the interests of the Allies, either in the line of scientific investigation or in mobilizing existing engineering facilities.

⁂

The mystery of the origin of some of the strange market letters on mining stocks that one sometimes sees seems to be explained by the following advertisement in one of the leading financial papers:

WANTED—STENOGRAPHER-STATISTICIAN—Wall Street firm wants services of young man accomplished in stenography, with experience or ability to assist in compiling reports and writing market letters on mines and industrials. State age, experience, salary expected.

⁂

The Grove City correspondence of the Philadelphia *Public Ledger* states: "It was learned here that rich deposits of humus nitrogen estimated at over 4,000,000 tons of raw material, the value of which ranges from $9 to $13 a ton, have been discovered about 2 mi. from the city. Because of the desire to purchase land adjoining that under which the deposit lies much secrecy is being maintained. Samples of the nitrogen brought into this city have been pronounced the finest ever found in this country." We have taken three strikes at expressing our feelings on the varying qualities of nitrogen, but we must leave it up to the readers, after all.

⁂

In describing "Ghost Cities of the West," in the *Saturday Evening Post* of Sept. 4, 1915, Charles E. Van Loan has gone down to Eureka, Nev., which he characterizes as "The Camp of Nine Graveyards." It was a cruel wag from Salt Lake City who said the town of Eureka had graveyards enough to give a decent burial to everything that ever died there, with the single exception of the town itself. Automobilists who plan to drive their cars to the Panama-Pacific International Exposition, by way of the Overland Trail or the Lincoln Highway, will do well to remember that this joke gets more of a laugh in Pioche and Austin than it does in Eureka. When it comes to the subject of death, Eureka is the least little bit sensitive. True, she has nine graveyards, scattered over the low hills that hem in the town—none of them small and some of them more populous than the county seat in its present state—but she sturdily asserts that in her prime she needed them all; for was she not the second largest town in the state of Nevada? Did not Eureka County hold second place in ore production among the counties of a mining state? In the words of one of her prominent citizens—and all the citizens of Eureka County are prominent, one way or another—"The pennant, set at a hundred and twenty-five million dollars, waves unyieldingly on Retention Mountain." The second-place pennant, you understand; the first-place pennant flies on Mount Davidson.

⁂

A careful study of men's fashions has been made by *Engineering and Contracting*, the results of which follow: "Overalls for business wear will remain in vogue at least another season, the most popular shades being sky blue and army brown. There are strong indications that reinforced seats are on the wane. The tendency is plainly to revert to the old-style single-ply effect even though it is less resistant to wear. One regrets that conservatism retards adopting brighter colors for overalls. There is an innate attractiveness, an appeal to the esthetic in the more brilliant hues. Then, too, they often have practical advantages. Leaf-green, for example, is so inconspicuous in the woods and among the tall grass that a foreman clad in overalls of this color may readily come unobserved upon one or more of his gang who are prolonging their vacation beyond all reason. However, leaf green is not insisted upon for evening wear. After 6 p.m. it should be *de rigeur* to don more sedate colors. Dark-maroon pants are a welcome change when worn with a black-velvet waistcoat and a *chic* Stetson hat in one of the mouse grays that are so deservedly popular. Now, a word about the proper buttons to select for overalls. Nothing shows the taste of the well-dressed foreman more clearly than the buttons he chooses. 'Tis a little thing—a button—but much depends on it. The small tin saucers that have served so well for many years are going out. On this point, at least, there can be no question, yet many will regret the change. There was so much that was eminently sensible about the tin-saucer type of overall button. You will recall how readily you could find one if lost in the bunkhouse, even without lighting a match. You had merely to walk around in your bare feet until you felt the sharp circular edges of the tin button pressing deeply into the skin. Then you lifted your foot and removed the button. Also, the old tin button would never split, as do the more beautiful but fragile celluloid substitutes that you must use this fall. A word of caution right here as to the new celluloid buttons for overalls. Considerately handled they are a constant delight. They never rust. They may be had in colors to match the pants, or they may be had in colors that vividly contrast with the pants—just as your personal taste dictates. They depreciate slowly, at least if not brought too near a fire. But avoid scratching a match upon or even near a celluloid button, for celluloid is made, as you may not know, of gun-cotton steeped in nitro-glycerin and then kiln-dried. Clearly, some caution should be exercised by those who adopt this [illegible] styles in overalls and celluloid buttons."

Midvale Steel and Ordnance Co.

William E. Corey, a former president of the United States Steel Corporation, announced on Oct. 6 the details of the formation of a new independent combination of steel companies as follows:

The Midvale Steel and Ordnance Co., organized in Delaware, with an authorized capital stock of $100,000,000, divided into 2,000,000 shares of only one class of the par value of $50 each, today concluded a contract for the purchase of all of the capital stock of Worth Bros. Co., a Pennsylvania corporation, and for all the property and business of the Pennsylvania copartnership trading as the Coatesville Rolling Mill Co.; also for somewhat more than 98% of the capital stock of the Midvale Steel Co., of Pennsylvania, and for all of the capital stock of the Remington Arms Co., of Delaware, which last-named concern has contracted to manufacture 2,000,000 Enfield rifles for the British Government. The company has also under option 300,000,000 tons of iron ore. To acquire the stock and property named and provide working capital, $70,000,000 of the capital stock of the Midvale Steel and Ordnance Co. will be issued.

Neither the Midvale Steel and Ordnance Co. nor the three companies and firm whose capital stocks and properties it is acquiring have any debts other than current and no bonds or mortgages or preferred stock outstanding, and the aggregate working capital of the parent company and its subsidiaries will be in excess of $15,000,000. The money necessary to carry through the transaction has been privately subscribed at par for the stock.

The following are the directors and officers of the Midvale Steel and Ordnance Co.:

Directors—William E. Corey, Albert H. Wiggin, Samuel F. Pryor, Ambrose Monell, Frank A. Vanderlip, Alva C. Dinkey, Samuel M. Vauclain, William P. Barba, Percy A. Rockefeller, Charles H. Sabin, Marcellus Hartley Dodge, and Frederic W. Allen.

Officers—President, William E. Corey; vice-president, Alva C. Dickney; secretary and treasurer, William B. Dickson.

Schwab in New Steel Combine

C. M. Schwab had an all-day conference at the Bethlehem Steel Corporation's office on Oct. 5, with directors of the Pennsylvania R.R., having as its purpose the purchase by Mr. Schwab and his associates of the railroad's controlling interest in the Pennsylvania Steel Co., says the New York *Times*.

On Oct. 12 it was rumored that the Bethlehem Steel Co. did not wish to guarantee the obligations of the smaller companies and that the outcome would be merely a union of the Cambria and Pennsylvania companies. The Pennsylvania Co. owns 51% of the Pennsylvania Steel Co.'s stock and Mr. Schwab desired to take over all of it. The steel company has outstanding $31,200,000 of preferred and common stock and owns all of the stock of the Maryland Steel Co., which has large rolling-mill and blast-furnace capacity at Sparrows Point, Md. More to the point from Mr. Schwab's point of view, the Maryland company has also at Sparrows Point a well-equipped shipyard able to build the largest class of merchant vessel.

Through ownership of all the stock of the Spanish-American Iron Co., the Pennsylvania Steel Co. possesses 52,000 acres of the Mayari ore fields and 17,000 acres of ore lands in the Province of Canay, near Nipe Bay, Cuba. Mayari ores are famous in the industry, the steel made from them being of great value in the manufacture of armor plate and ordnance. This steel is a natural chrome-nickel alloy, and when forged it has from 8,000 to 10,000 lb. per sq.in. more tensile strength and elastic limit than the ordinary carbon steel.

There is reason to believe that control of the Cambria Steel Co. will also pass to the Bethlehem in the near future. The Cambria is also controlled by the Pennsylvania R.R. through the ownership of $22,500,000 of the steel company's $45,000,000 stock, but on this stock an option was given some time ago to W. H. Donner at $50 a share. Mr. Donner is understood to be associated with Henry C. Frick.

The Pennsylvania Steel Co. is made up of three steel- and iron-producing companies and several water, coal and power concerns. The main plant is at Steelton with steel-ingot capacity of 750,000 tons and finished-steel capacity of 500,000 tons a year. Its product in finished lines is diversified, including rails and other railway material, bridgework and many structural forms. Its coal mines turn out more than 700,000 tons a year. The iron-ore properties have produced in the last five years approximately 1,500,000 tons annually.

Reserve Corps of Engineers

The joint committee appointed by the five national engineering societies, the purpose of which was outlined in the *Journal* of Sept. 11, is composed of the following men, each chairman of the committee of his respective society: William Barclay Parsons, A. S. C. E.; Henry S. Drinker, A. I. M. E.; William H. Wiley, A. S. M. E.; Bion J. Arnold, A. I. E. E.; Ralph D. Mershon, A. I. C. E.

This committee, officially known as the Joint Committee of the National Engineering Societies on the National Reserve Corps of Engineers, has selected Mr. Parsons as its chairman and is in communication with the War Department.

A plan is being considered whereby a reserve corps of engineers can be formed, for which, of course, legislation by Congress is necessary, the details of which legislation are now being studied by the War Department. While it has not yet been definitely decided to do so, it is under consideration to issue commissions as officers to such engineers as will meet certain professional and physical standards, and who in times of war would be subject to orders from the Secretary of War as other officers of the army, and in times of peace would perform such duty as would not seriously interfere with ordinary work, but would give each officer some military education and experience. In this way it is hoped to have a large body of engineers that could be called quickly for duty.

The separate committees are still in existence to do the necessary work among their fellow members of the several societies as soon as the decision of the War Department is given and a general scheme of organization adopted.

The members of the committee of the A. I. M. E. on the engineers' reserve-corps movement are: Henry Sturgis Drinker, chairman; Arthur S. Dwight, Warren A. Wilbur.

PERSONALS

J. D. Irving, of New York, is in Butte, Mont., on business.

Ben S. Revett has returned from Colorado to San Francisco.

Henry Krumb and F. S. Schmidt, of Salt Lake City, are in Alaska.

D. C. Bard, of Butte, Mont., has been in British Columbia on business.

L. N. Wagner, formerly operating in California, is in Salt Lake City.

J. Dawson Hawkins, who has been on a holiday to Tahiti, has returned to Denver.

J. A. Van Mater, of New York, has gone to the West on professional business.

H. O. Howard, of San Francisco, is investigating the districts around Lovelock, Nev.

Eugene H. Dawson, of New York, is making examinations in Nevada for Boston interests.

George H. Garrey, who has been in California on examination work, was at Goldfield, Nev., last week.

J. E. Johnson, Jr., will address the Pittsburgh Foundrymen's Association, Oct. 18, on "What Is Good Iron."

C. S. Herzig, of London, is interested in the project to build a seven-mile cable tram to the Alta camp in Utah.

Desaix B. Myers has returned to Los Angeles, Calif., after spending about six weeks in Colorado on professional work.

Kirby Thomas, of New York, has been making examinations in the Rochester and Willard camps, near Lovelock, Nev.

Prof. J. F. Kemp, who has been suffering from overwork, will not take up his academic duties until later in the year.

N. Dickerman, general manager of the Pato Mines (Colombia), Ltd., was in New York last week on his way to the Coast.

Nicholas S. Penn, of the Imperial Institute of Technology, at Tomsk, Siberia, is visiting Grass Valley, Calif., on his way back to Russia..

S. W. Cohen, general manager of the Crown Reserve Co. of Cobalt, is examining a mining property in California, with a view to its purchase by the company.

J. D. Connor, metallurgist for the Government of South Australia, reached San Francisco recently. He will investigate the leaching of copper ores in the United States.

T. B. A. Price, of Boston, has gone to investigate the Rice Lake gold area, in Manitoba, where he expects to make extensive investments if satisfied with the country.

William M. Dailey, private secretary to A. C. Dinkey since 1906, has resigned his connection with the Carnegie Steel Co. and will go with Mr. Dinkey to the Midvale company in the same capacity.

G. C. Bateman, who for the past three years has been connected with the Canadian Mining and Exploration Co., has left that company to accept a position as field engineer for La Rose Consolidated Mines of Cobalt.

M. S. Davys, managing director of the Silverton Mines, Ltd., operating the Hewitt-Lorna Doone group of silver-zinc mines and concentrating mill in Silverton camp, has returned to British Columbia from a business trip to New York..

Edward Hamilton, heretofore assistant general superintendent of the Duquesne works of the Carnegie Steel Co., has been appointed general superintendent to succeed Homer D. Williams, elected president of the company.

W. A. Locke is now resident manager of the Taunton-New Bedford Copper Co., in New York, having succeeded William H. Steele, who held that position for the past 20 years. Mr. Locke has been associated with the sheet-copper business for a period of over 25 years.

Dr. Frank D. Adams, of Montreal, has been in the West, where he and W. J. Dick, mining engineer to the Conservation Commission of Canada, have been investigating deposits of phosphate of lime in the Banff National Park in the Rocky Mountains.

George E. Collins and J. V. N. Dorr have been selected by the Colorado Scientific Society to represent it at the convention in Washington, Dec. 16, to impress upon Congress the need for a revision of the mining laws, which convention is to be held under the auspices of the Mining and Metallurgical Society of America.

Henry M. Rives has resigned the secretaryship of the Nevada Industrial Insurance Commission to accept a similar position with the Nevada Mine Owners' Association. Mr. Rives was formerly with the Pittsburg Silver Peak Gold Mining Co., and a member of the Assembly from Esmeralda County at the last session of the Legislature.

J. P. Keane, who for some years was manager of the Caribou-McKinney mine and mill in Camp McKinney, British Columbia, and later engaged in developing the Wonderful silver-lead mine, near Sandon, was in Victoria recently, endeavoring to make arrangements to lease or purchase a concentrating mill in the Slocan, so that he and his associates might resume the custom ore-concentrating business.

OBITUARY

Dennis Sullivan died at Denver, Colo., Oct. 10. He was well known in New York and had long been a business associate of Grant Schley in British Columbia and Mexican mines. He was a heavy investor in the utilities companies of Henry L. Doherty & Co and in other enterprises.

William Watson died in Boston, Sept. 30, aged 81 years. He was for a number of years an instructor in Harvard University and the Massachusetts Institute of Technology and was an authority on mathematics as applied to engineering; he was also the author of several textbooks. He had been secretary of the American Association of Arts and Sciences for a number of years.

Frank B. Blackmar died on Sept. 29 at the Methodist Episcopal Hospital, Brooklyn, N. Y. He came to New York on Aug. 27 from Puerto Andes, Colombia, where he had been engineer for the Chicago mine, was taken ill on the steamer, and after his arrival was operated on for appendicitis. He received his engineer's degree from the University of Kansas, where he was a member of the Phi Kappa Psi. He was also a member of the American Institute of Mining Engineers.

Isaac B. Hammond died at Portland, Ore., Sept. 23, aged 71 years. He was born in Lambs Corners, New York, but removed to the West in early life, where he had been associated with a number of industries and had much to do with the commercial growth of that part of the country. At the time of his death he was president of the Hammond Manufacturing and Electric Co., which he founded more than 25 years ago. Practically all his life had been devoted to the manufacture of mining and electrical machinery. He was president of the Board of Trade of Portland and active in civic affairs.

SOCIETIES

Mining and Metallurgical Society of America—The New York Section will hold a meeting at the Machinery Club, New York, at 6:30 p.m., on Oct. 19. Woolsey McA. Johnson will make an address on the Lungwitz method of smelting zinc in blast furnaces under pressure.

American Institute of Chemical Engineers—The winter meeting will be held in Baltimore, Md., Jan. 12-15. The date selected is somewhat later than usual because summer meeting was held late in August instead of in June as is customary. Baltimore is the center of a considerable number of important chemical industries. Excursions to a number of these will be arranged. The experimental laboratories of the Johns Hopkins University and the Naval Academy at Annapolis, Md., are also of great interest and will be visited. A number of papers on recent and important developments in some of the chemical industries of the United States are being arranged for.

Rice Lake Mining Association of Manitoba—At a meeting held in Winnipeg, Sept. 29, by those interested in the development of the Rice Lake gold fields of Manitoba, an association under the above name was organized with H. R. McTavish as chairman and J. D. Perrin, secretary. Reports compiled from official records were presented showing that 746 claims are in good standing in the Rice and Gold Lake districts and that some $260,000 has been spent in the country. As there are considerable transportation difficulties to be overcome an effort will be made to receive government help in the construction of a road. A committee was appointed to approach the government with the object of securing an amendment to the Sale of Shares Act so as to permit a mining company to offer stock to the public on its having shown that it has a reasonable prospect of securing mineral in paying quantities.

Editorial Correspondence

SAN FRANCISCO—Oct. 6

Apex Litigation between the Empire and the Golden Center mines at Grass Valley has been settled out of court, upon agreement between the owners. Under the terms of settlement the Golden Center may work all ledges within the disputed area having their apex west of Auburn St., south of Main St., and north of Grass Valley townsite line, with an indefinite western boundary. The Empire may work all ledges apexing east of Auburn St., north of Main St., and south of the townsite line. It is further agreed that each company may work in the grounds of the other when following its own ledges. This will provide for both companies working in the same area, one above the other. This provision is especially advantageous to the Golden Center which is operated by a new company reopening an old mine in the center of the town of Grass Valley. Development brought the operators into Empire ground, which caused the litigation. The settlement is also of great advantage to the Empire mine as it will enable development of orebodies which otherwise might have been contested by the Golden Center. This agreement to take the matter out of the courts, it is hoped, will have some influence in providing for the same kind of settlement between the Empire and the North Star, which litigation is now in the federal courts.

Mining Week at the Panama-Pacific Exposition offered the greatest composite attractions that were presented in any period during the life of the Fair. The chief attraction, not only to mining men but to the visitors generally who have taken some interest in the various exhibits of mining industry, was the Third Annual Field Meet of Mine-Rescue and First-Aid teams. The initial contest on Sept. 22 was the first California First-Aid meet, in which nine teams contested. The Mammoth Copper Co. team won the contest with a score of 374 out of a possible 500. The Mine-Rescue elimination contest, Sept. 23, between three teams from Washington and two teams from Utah, was won by the Utah Fuel Co. with a score of 461.5 and by the Roslyn Fuel Co. by a score of 142. The First-Aid elimination contest on the same date between nine California teams, three Nevada teams, two Utah teams, and three Washington teams was won by the Kennedy Mining and Milling Co. team of California by a score of 491; the Utah Fuel Co., 473; Pacific Coast Coal Co., Washington, 476; Nevada Consolidated Copper Co., 488. The First-Aid interstate contest on Sept. 24 was participated in by 13 teams representing Alaska, Arizona, California, Illinois, Montana, Nevada, Oklahoma, South Dakota, Utah, Washington, West Virginia and Wyoming. The contest was won by the Homestake Mining Co. of South Dakota with a score of 495. The second largest score was by the Nevada Consolidated Copper Co. with a score of 493, and the next the Bunsen Coal Co. of Illinois with a score of 180. The Mine-Rescue interstate contest on Sept. 24 was participated in by seven teams representing Arizona, California, Montana, Nevada, South Dakota, Washington and Utah. The contest was won by the Utah Fuel Co., with a score of 480, the next highest being the Roslyn Fuel Co., 477, and Goldfield Consolidated, 468. The resuscitation contest was participated in by the same teams as were in the First-Aid contest. The contest was tied by the Homestake Mining Co. and the Nevada Consolidated Copper Co. with scores of 100%. The Nevada Consolidated won the tie.

DENVER—Oct. 7

The San Juan National Park, proposed by Enos Mills, is causing considerable discussion and uneasiness in Silverton. It is feared that the park would seriously discourage prospecting and interfere with the development of the county's mineral deposits. Any proposal which would result in hampering mining activity by introducing difficulties in obtaining and maintaining title to mineral lands will be strenuously opposed by the citizens of San Juan County. They will no doubt make every effort to prevent their county from being included in such a national park if there is any likelihood of such embarrassing restrictions as are feared.

Cripple Creek District's Production, which is steadily increasing, during September exceeded the production for August by 5,000 tons, having a gross value of about $48,000, according to estimates. Of the total tonnage—89,800—treated by the various mills and smelteries, the Golden Cycle works at Colorado City handled approximately 48% and the Portland company's three mills, approximately 44%. The American Smelting & Refining Co.'s plants in Denver and Pueblo received about 3,900 tons of an average value per ton of $55. The Portland-Independence mill treats about 10,600 tons of $2 ore per month. October is expected to establish another tonnage record.

Economic Mine Dump is being loaded into cars and shipped at the rate of nearly 400 tons daily. No attempt is made to sort the material. Waste rock at present hoisted through the Gold Coin shaft is also shipped with this dump stuff. At the Elkton mine dump, John Sharpe is ready to start operations with his newly installed plant and expects to handle 200 tons daily. A double-drum steam hoist has been mounted above a receiving bin at highest part of the dump and, by means of drag buckets, will elevate the rock from the lowest portions. Grizzlies, trommels, revolving washers and a sorting belt comprise the equipment below the bin.

Another Nug in the Cresson Mine was opened a short time ago and is sufficiently explored to present a rough estimate of its gross value at about half a million dollars.

BUTTE—Oct. 7

The Socialists Imported an I. W. W., who, according to his own statements, was induced to leave Ireland for the good of Ireland, and last Sunday night they attempted to defy the city and county authorities in Butte and resume last year's interrupted soap-box agitation against all things orderly. The imported agitator and the former Butte socialist mayor were denied the use of the city hall and so they advertised by banners that they would hold an open meeting in front of the hall. The banner bearer was arrested and thrown into jail. He said the ex-mayor had hired him to carry the banner. There was a big crowd on the streets at the hour the ex-mayor and the "importation" were to speak. The former, seeing many officers in the crowd, was a bit diffident about starting anything, but the "importation" nudged him and told him to go ahead. The ex-mayor got so far as to say "Folks," to the crowd, and then the chief of police got hold of his coat collar and one arm and told him to move on. The ex-mayor asked for permission to tell the crowd that he couldn't say anything, but even that was not permitted. Then the socialist ex-mayor and the I. W. W. "importation" headed their followers in a search for a hall, but before they found one they ran up against the county sheriff and a bunch of deputies with "night sticks" and when some of the would-be disturbers got loud they were "nudged" with the sticks, their banners were destroyed, and they were given other evidences of the fact that law and order were triumphant in Butte. When they finally secured a hall a few more than one hundred followers were present to listen. All of which goes to show that Butte, without a socialist administration, is not at all the place it was something like a year ago when the I. W. W. and socialists ran riot, property was dynamited and martial law was brought about in the county.

Local Unions Are Protesting against methods of manual training in Butte Public Schools. How far Butte labor unions can go in their assumed jurisdiction was discussed in a most spirited manner at a meeting held by the Butte school board Oct. 6. A communication from the typographical union in regard to the new printing plant installed in the high school and a report from the school superintendent regarding the position taken by the carpenters' union toward carpenter work being done by the manual training department of the junior high school were submitted. The request of the typographical union that no printing should be done in the school shop outside of regular school work, was granted. The other demand that a practical printer from the union should do the teaching, was held in abeyance, pending the appointment of such a teacher. At the Washington school under the direction of the manual training teacher, boys had been engaged in putting in a partition between two rooms. To this the agent of the carpenters' union objected on the ground that this was work carpenters should do themselves and be paid union wages for. The majority of the school trustees took the position that the work was for the purpose of training the boys in actual carpentry problems

and was not in any sense in competition with the union carpenters. Accordingly the manual-training department was instructed to go ahead and to ignore the demands of the carpenters' union. Whether the latter will take further steps to prevent practical teaching of their trade in Butte schools remains to be seen. Under the rules of the unions, limiting the number of apprentices, boys and girls have no chance of acquiring practical experience and the board held that schools are the proper place for them to receive instruction in these lines of work.

SALT LAKE CITY—Oct. 7

In the New Zinc Camp, in the Lake View Mining District, on the south end of Promontory Mountain, 20 miles west of Ogden, there is considerable activity. Six different properties are operating: The Lakeview, Cedar Ridge, Molman-Smith, Jay Hawks, Corey, and Little Valley. The ore in carload shipments averages about 35% zinc. The Lakeview Co., has paid $12,000 to $15,000 to its five principal stockholders since March. This company produced from the grass roots, so to speak; only $700 to $800 in cash having been expended in development, before it was placed on a producing basis.

SEATTLE—Oct. 6

A Big Shipment of Copper Concentrates from the Beatson Copper Co.'s mine at Latouche, consisting of 2,800 tons, was lost recently when the ore shifted in the hold of the steamer "Edith" and the vessel sank in the Gulf of Alaska. The shipment was valued at $150,000.

Farthest North Camp Yields $690,000 this summer according to the last report brought down from the Koyukuk district. This is an average of $115 per day for the 20 days of the mining season for each man of the 300 operating in that district. The camp lies 140 mi. inside the Arctic Circle and while Koyukuk is extremely rich the difficulties in getting into the district and the high cost of provisions have kept back a stampede. One nugget taken out this summer is valued at over $3,000 while several were taken out averaging $600 apiece. The gold of the camp assays $19.72 to the ounce. Lumber at the camp is worth $600 per M, and during 10½ months of the year there is only on mail. The $690,000 output of the camp last summer is considerably better than the season of 1914 when only $400,000 was produced. The mining season is never longer than 25 days.

First Big Tin-Ore Shipment to the tin smeltery in Seattle will arrive from Buck Creek, Nome district, the first part of November, according to the plans of the American Dredge Building and Construction Co., which installed a new tin dredge there this summer. It now has three machines in the same district, two having operated all season on the Anikovik River. The gravel on Buck Creek contains a large percentage of tin ore and small percentages of gold. The new dredge is equipped with a screen and double flumes, so that no time is lost in cleaning up. A 2-ton truck was shipped up the early part of the year to carry the ore to Nome from the dredge. At the same time a shipment will arrive from Walter W. Johnson of San Francisco who also has a dredge on the same creek from which he took out about 100 tons of tin ore last year. Several small shipments of tin have come down from the North to Seattle before but nothing on a large scale and the results of the smelting will be watched with considerable interest by tin operators in Alaska and the mining interests on the Coast.

DOUGLAS, ARIZ.—Oct. 5

Only a Few Properties Are Working in the northern part of Sonora. The mines at Cananea are working in the smallest way possible as no party has complete control and preparations have been made to close down all the properties should conditions get any worse. Nearly every night the town is entered by bandits connected with neither side and the Chinese stores and small Mexican stores are looted and those who resist are murdered. The Americans and foreigners have armed themselves and are prepared to defend themselves should the bandits attempt to molest foreign properties. Nacozari and El Tigre will be unable to work should the threatened invasion of Villa materialize. Nearly all of the men in both of these camps are Carranzistas and at the approach of the Villa forces they will all retreat to some Carranza base, leaving the mine with none but Americans who are in too small numbers to attempt to operate. At the present time all of the Mexicans within 200 mi. of the border, who are financially able, are bringing their families to Agua Prieta; those who are too poor to send their families out, are going out into the hills where they think that they will not be found by the invading army. Agua Prieta, which is across the border from Douglas, has more people now than it has ever had before and the trains into town are always crowded. There are no houses to be had in Agua Prieta so the people are sleeping in box cars and in the stores. The better class has gone to Douglas and it is now impossible to get a house there. Should Villa come into Sonora it is nearly certain that every mining property will be shut down and as even now there are few provisions to be had of the mining companies Villa would have very hard pickings.

ST. PAUL, MINN.—Oct. 2

State's Income from Iron Properties this year from iron-ore royalties will not be so great as last year. The Leonidas, at Eveleth, will lead the state properties with about 650,000 tons for the season. Based on present explorations the state is assured of an average annual income of $1,000,000 for the next 30 years. Twenty-two state employees are maintained on the Mesabi Range to look after the state's iron-ore royalties, checking operations, tonnages, etc. To Oct. 1 these properties have shipped more than 1,800,000 tons.

BLUE HILL, ME.—Oct. 6

A Large Deposit of Rhodonite at the summit of Blue Hill has been acquired, and is being opened up by C. Vey Holman, formerly state geologist of Maine. This deposit formerly furnished the manganese for the Katahdin Iron Works, Maine's pioneer and only iron blast furnace, which for several decades turned out a considerable output of high-grade charcoal iron. When that furnace went out of blast about 1883, this deposit fell into disuse, and has been practically forgotten. Mining, or rather quarrying, will be simple and cheap, as conditions all conduce to easy handling at low cost. Shipments will be from tidewater at the base of the hill. Analysis of the ore gives SiO_2 43.12%; TiO_2 0.12%; Fe_2O_3 17.53%; MnO, 32.93%; CaO, 3.45%; MgO, 3.48%.

LOVELOCK, NEV.—Oct. 7

A Carload of Antimony Ore from the Sutherland property, at Cole Cañon, 15 mi. northeast of Lovelock, has been recently shipped east by Robert Brown, representative of the Magnolia Metal Co., of New York.

A Small Matting Furnace to treat copper-nickel ores south of Lovelock, near the properties formerly operated by the American Nickel Co., is being planned by W. J. Flick and associates, of Lovelock. The district is about 40 mi. south of the railroad. A small copper furnace on the Boyer mine in that locality is idle but may be started up again. The project for the Southern Pacific to build a cut-off which would make these properties more accessible seems to be suspended for the present.

Tin Ore, Occurring in Veins in Granite, has been found near Battle Mountain, Elko County. Samples analyzed in Los Angeles gave upward of 22% tin. The ore is black and was passed by as iron until very recently. So far most of the discoveries have been in narrow veins, a few inches wide. It is claimed now that a 4-ft. vein has been opened. The deposits lie about 20 mi. north of Battle Mountain. Already 140 locations have been made. Several engineers have visited the district recently, but so far no large interests have taken hold of the prospects, which are controlled by ranch holders in the vicinity. George Russel, Jr., of Battle Mountain, is largely interested in the development of these tin discoveries.

TORONTO—Oct. 9

The Ontario Nickel Commission has completed its investigation of the nickel mines of the Sudbury district, in which it was afforded every facility by the companies interested, who submitted their books and records to a thorough examination. The commissioners will inspect other mines in northern Ontario and will afterwards visit the New Jersey nickel refineries. It is understood that they will make no interim reports and their conclusions are not expected to be made public before many months have elapsed.

The Discovery of Large Nickel Deposits in the Fond du Lac country on the northeast side of Lake Athabasca in Northern Alberta was reported some months since. H. V. Dardier, a prospector who then left for England taking with him samples of the ore with a view of interesting British capitalists has returned in charge of an exploration party sent out by Vickers, Maxim & Co., the noted gun manufacturers of London and Liverpool, who will thoroughly prospect the region. The expedition, which left Edmonton, Alta., for Fond du Lac about three weeks ago, comprises 25 experts, including engineers, mineralogists and assayers and a large force of laborers. Seventeen scows were required for the transportation of their equipment and supplies. The machinery cost $50,000 and the supplies $10,000. The party expect to remain in the district over two years. Their destination was kept secret as long as possible and was not generally known until some time after their departure. The total cost of the enterprise will be about $100,000.

The Mining News

ALASKA

GOLDEN (Port Wells)—Five-stamp mill and other equipment installed by Doctor Chase, of Seward, and associates.

KENSINGTON MINE (Juneau)—Superintendent Rogers and gang of men are doing about 40 days' work, drifting in preparation for more extensive work in spring.

GRANITE MINE (Port Wells)—Graphite mine continues big production. Joe Domenzie, discharged miner, is charged with blowing up powder house at this mine and has been arrested and held for trial. Explosion damaged mill, but no one was injured.

YANKEE BASIN-EAGLE RIVER (Juneau)—Present operating company working Eagle River mine, under management of B. L. Thane, will take over Yankee Basin claims worked by Pete Early and John G. Heid. This will consolidate large properties and require installation of large power plant and driving long tunnel to run to orebody.

MOUNT ANDREW COPPER MINE (Prince of Wales Island)—After being closed down for three years owing to low price of copper this mine has resumed shipping and has just sent 1000 tons of copper ore to Tacoma smeltery. Large quantity of ore is now on hand and company will be regular shipper. W. J. Rogers is manager.

CACHE CREEK DREDGING (McDougall Station)—Is preparing to freight its new 7-cu.ft. bucket gold dredge to Yentna district back of Cook Inlet this winter. It will have a capacity of 3,000 cu.yd. a day and will be first dredge to go into that district. E. L. Smith is president of company. E. E. Todd, of Redding Iron Works, Redding, Calif., is also interested in company. Chas. Harris, formerly of Marysville Dredging Co., Marysville, Calif., is superintendent.

GILPATRICK CLAIMS (Seward)—Development work on this property carried on last summer has resulted so satisfactorily that owners, Gus Brown, Felix Brown, of Seattle, and G. Sieffert, William Dashley and others of Seward will install stamp mill and aërial tramway on property next spring. Several tons of ore recently brought down from property gave return of $102.76 per ton. This was taken from cross vein which cuts main body of gold ore which gives average of $22 per ton. A 10-stamp mill will be installed.

ARIZONA

Gila County

PINAL MOUNTAIN MINING (Globe)—Will begin making regular shipments of gold ore to smelter from its mine, 8 mi. southwest of Globe.

ASBESTOS DEPOSITS (Globe)—Messrs. Fisk and Snell who recently discovered large deposits of asbestos on Ash Creek, 40 mi. from Globe are building mill. They recently made shipment of 4 tons of natural product to Japan.

Mohave County

GOLD REED (Oatman)—Reported splendid showing of ore encountered on 375 level. Milling ore in large body has been opened, alongside of which is found considerable rich material. L. L. Moore is manager.

Yavapai County

HAYDEN DEVELOPMENT (Jerome)—Is erecting 200-ton mill at its Copper Chief mine near Jerome. More than 500,000 tons of ore are said to have been blocked out in mine.

BIG LEDGE DEVELOPMENT (Prescott)—Plans have been adopted by company for erection of mill on its Butternut claims recently purchased. Company has also acquired Henrietta mine which was formerly well-known gold producer. Extensive development to be conducted upon newly acquired properties.

ARIZONA CON. SMELTING (Humboldt)—Smelting capacity will be doubled by addition of new reverberatory furnace, necessitated by increased tonnage from copper mines of De Soto company, which totaled 3,200 tons for August and 4,000 tons for September. Daily swing-train service to Middleton will be inaugurated to handle De Soto tonnage and that from other mines at way station. G. M. Colvocoresses is manager.

CALIFORNIA

Amador County

MARSING (Volcano)—Reported that property will be prospected with diamond drill.

CLINTON BAR (Sutter Creek)—Drifting along channel in progress; prospects of pay gravel.

PINE GROVE (Pine Grove)—Reported that installation of mill is contemplated. Good grade of ore being developed.

Butte County

MANGANESE deposits at Clipper Mills being developed under bond by Noble Electric Steel Co., of San Francisco. Reported that ore will be hauled by autotrucks to Heroult smeltery in Shasta County.

UNDINE (Chico)—D. S. Nesmith, of Boston and San Diego, has secured control and will reopen this gravel property on Butte Creek. Reported that Nesmith will arrange for payment of creditors before purchase payment is made.

Placer County

GOULD (Dutch Flat)—Mineral survey being completed. Owner, J. L. Gould, is one of largest owners of mineral ground in district. Property is developed by 2,200-ft. tunnel that can be made to serve as drainage for Dutch Flat basin. Tunnel has been cleaned out and timbered and car track repaired. Blue lead channel, which has been large producer of gold, is said to cross Gould property.

Plumas County

UNITED STATES EXPLORATION (Quincy)—Development of Granite Basin district on large scale is reported to be contemplated in undertaking of which initial work is being done at Robinson mine where shaft will be deepened 100 ft. during winter. The 20-stamp mill is being dismantled and Sears-Smith rotary mills will be installed with capacity equivalent to 40 stamps.

ENGELS COPPER (Taylorsville)—Survey for narrow-gage railroad from mine in Lights Cañon, through Indian Valley and Indian Creek Cañon to the junction with the Western Pacific Ry. near Keddie is reported to be in progress. Mining company is enlarging its concentrating plant. Electric power line between Butt Valley and mine has been completed and property is now being supplied with electricity. About 200 men are employed at mine.

Siskiyou County

HUMBUG CREEK district is being developed by active operation, including Boyle, Spencer, Summit, High Waters, Ideal, Old Flag and Eliza mines. There are three arrastres in operation and some large cleanups are made. There are several of these mines which were worked in early days when no ore was saved under value of $20 per ton. In the '50s Humbug Creek was known as one of richest producing sections in county.

Tuolumne County

RAWHIDE (Jamestown)—Reported that mine has been sold to men at Blair, Nev., and that new owners contemplate expending about $200,000 in development and remodeling milling plant. Property was originally owned and operated by Captain Nevills, deceased, and is said to have produced several million dollars.

Yuba County

WEST POINT (Camptonville)—Large concrete dam to be constructed for impounding débris and tailings from hydraulic operation.

SOLANO WONDER (Challenge)—Installation of mill and other equipment in progress. Mine is an old producer of high-grade quartz. Present operators giving more attention to medium-grade ore.

COLORADO

Pueblo County

COLORADO FUEL AND IRON (Pueblo)—Has added 250 men to its force in Minnequa steel works at Pueblo making its monthly payroll about $50,000. Rod mill works double time on heavy orders that will require until next spring to fill. President J. F. Welborn states that plant is not filling and will not accept any war orders.

San Juan County

KITTIMAC (Silverton)—New mill nearing completion. Huff electrostatic machine has been installed and management will now add flotation machine. Development work will be resumed in several parts of mine, including west heading on Clark vein.

San Miguel County

TOMBOY (Telluride)—Under management of Exploration Company Ltd., of London, return for month of September shows mill ran 28 days; crushed 13,000 tons of ore, yielding $45,000 bullion; concentrates shipped, $40,500; expenses for period, $56,700, operating profit, $28,800.

Teller County

BLUE BIRD (Altman)—Regular operations by Franklin Leasing Co., which has held this property since last December, are temporarily suspended. Plans are under way for erection of cyanide mill at mine.

PORTLAND-INDEPENDENCE (Victor)—Narrow-gage railroad track that has heretofore been sole access to Independence mine is being rebuilt to standard gage and spurs will be laid to every important building.

ROOSEVELT TUNNEL (Victor)—Total progress during September amounted to 326 ft. On Sept. 20 additional flow of water was encountered in heading of tunnel, in territory owned by Raven and Pearson Hill Gold Mining Co. During few days following, total flow was about 12,500 gal. per min. Breast of tunnel is now about 1170 ft. west of main shaft of Elkton Con. Mining and Milling Co. on southwest slope of Raven Hill.

GOLD SOVEREIGN (Victor)—New shaft will be sunk an additional 200 ft. to total depth of 1525 ft. Work will be performed by Union Leasing Co., which operates property under lease from Gold Sovereign Mining and Tunneling Co., and will be under supervision of C. G. Jackson. Crosscutting and raising operations are in progress and 150 tons of milling ore were produced from development during September. Mine dumps are under lease to Edwin Gaylord, owner and operator of Gaylord mill. Construction of aërial tramway is under consideration, to transport dump material to mill.

IDAHO

Elmore County

BOSTON-IDAHO DREDGING (Featherville)—Operating on Feather River has only worked on small scale this season, owing to lack of water. It is proposed to build 35-mi. ditch to provide more water. Captain Rupert Winters is in charge.

Idaho County

GRANGEVILLE MINE (Elk City)—Under lease and bond to J. J. McKim, H. Cone and Andrew Prader has just completed mill run on ores from 115-ft. level. Results satisfactory. Lessees propose installing compressor. Will carry on extensive development work this winter. There is a 5-stamp mill on property; several hundred tons of ore have been mined and milled since first of year.

MINERAL ZONE (Elk City)—Work on removal of 3-stamp mill from Elk City Reduction Co.'s plant to this property is nearly completed and erection of mill on new site is well under way.

Shoshone County

GUELPH (Wallace)—A 200-ft. shaft will be sunk on this property, which lies north of Hercules. Compressor has been installed and hoist ordered.

EAST CALEDONIA (Wardner)—Has made promising strike in drift on 200 level, where two shifts are driving. Mine has recently been cleaned of debt and is said to be in shape financially for considerable further development.

KILL BUCK (Wallace)—Constructing electric-power line to compressor at portal of Vulcan tunnel and will start driving for Kill Buck vein as soon as power is available. Vulcan tunnel is in 3500 ft. and has about 400 ft. to go to reach vein.

IMPERIAL (Wallace)—Directors of this company have inspected mine and announce that work will be resumed. Winze will be sunk on promising oreshoot in upper tunnel and crosscut will be driven from lower tunnel to prospect body of ore discovered by diamond drilling.

COPPER PRINCE M. & M. CO. (Wallace)—Capital stock of this company has been reduced from 4,000,000 shares to 400,000, par value $1. On Copper Prince claim winze is sinking from 500-ft. adit. On Gold Ridge claim three crosscuts show ore in vein. Property is equipped with compressor and air drills. Samuel B. Holbert is president and general manager.

FRISCO (Wallace)—This mine, now owned by Federal M. and S. Co., has been started up after short shut-down for purpose of making alterations in mill. Mine was reopened to recover zinc ore left in old workings but exploration at depth has proved large quantities of ore carrying lead and zinc. Owing to difficulty of separating lead and zinc, recovery at 400-ton mill has never been satisfactory.

MICHIGAN

Copper

ESTIMATED PRODUCTION OF LAKE SUPERIOR COPPER MINES for the month of September, based on rock tonnage and known averages of refined copper is as follows: Tamarack, 561,600 lb.; Osceola Consolidated, 1,755,000; Ahmeek, 2,225,000; Wolverine, 711,000; Mohawk, 1,359,000; Franklin, 381,600; Centennial, 53,000; Allouez, 818,000; Mass, 486,000; Superior, 326,000; Hancock, 159,800; La Salle, 177,000; South Lake, 21,600; Isle Royale, 900,000; Copper Range Consolidated, 4,600,000; Quincy, 2,000,000; Calumet & Hecla, 6,500,000; White Pine, 491,000; Lake, 280,000; Winona, 220,000.

WHITE PINE EXTENSION (White Pine)—Management, both in Michigan and in east, will be in hands of Stanton interests who became associated with Smith interests some months ago. Frank Stanton will arrive in few days to visit other mines of Stanton interests in this district and likewise to go over work already done at White Pine Extension and to map out plans for future.

OSCEOLA CONSOLIDATED (Osceola)—Average rock for all mines in this corporation for September ran close to 14 lb. Old Osceola shipped 24,000 tons and Kearsarge branches 99,000. No. 3 shaft, old mine, goes into commission this week, adding to low-grade rock tonnage. Shaft has been repaired and cleaned down to 8th level. Rockhouse equipment is permanent and in good condition

Iron

OHIO (Michigamme)—Small pile of ore that has been in stock for years is now being shipped. No mining is being done.

MINNESOTA

Mesabi Range

WEBB (Hibbing)—Mine will be reopened within few days. Has been idle for two years. Mining will continue all winter. It is large underground property. Employs between 400 and 500 men when working full force.

LA RUE (Nashwauk)—M. A. Hanna Co. has reopened this mine. One hundred men have been given employment. One shovel is working two shifts. Pipe line five miles in length is being built from O'Brien Lake to the washing plant. Fifty cars of ore will be shipped daily until end of season.

QUINN-HARRISON (Nashwauk)—Five shovels and three merry-go-rounds are working days in pits. All five shovels are working nights. Rapid progress is being made with stripping. Washing plant is now working one shift. About 30 cars of wash ore are shipped daily. About 85 cars of merchantable ore are going direct from pit. Machine shop 200x50 ft. is to be erected. An addition is being made to office.

Missouri—Kansas

VAN BIBBER & CO. (Joplin, Mo.)—Has made strike on Block City land, west of Joplin. Encountered run at 127-ft. level, and now has 12-ft. face of 15% ore and is still sinking in good ore.

JUMBO MINING (Alba, Mo.)—Fire of unknown origin destroyed concentrating plant of Company northeast of Alba. Cost of plant $25,000; insurance about $7,500. Property owned by Carthage men. Mill had been running about 1½ years.

STANLEY MINES (Galena, Kan.)—John McLaren and associates have taken lease of 40 acres on what is known as Stanley mines, and are installing pumps and 60-hp gas engine. Expect to have machinery in place in about three weeks and have water out in from six to eight weeks. This tract of land was formerly owned by Ex-Vice-President Adlai Stephenson, of Bloomington, Ill. Was formerly large producer, but has been idle for several years.

MONTANA

Silver Bow County

ANACONDA (Butte)—Has completed installation of surface plant at Emma mine, of Butte Copper and Zinc Co., taken over under lease and bond recently. Pumping will be started in few days and as soon as water is out of mine sinking and mining will be started.

BUTTE & LONDON (Butte)—Cole-Congdon interests are also about to start sinking in Butte & London; big electric pump having been installed at station on 1,100. Water is practically all out of mine, and sinking will be started at once to depth of 1,600 ft., at which point entire ground of company will be crosscut and explored both north and south.

RAINBOW DEVELOPMENT (Butte)—Shaft has reached depth of more than 1,450 ft., and station will be cut at 1,500. After station and sump are completed company will crosscut to big Rainbow lead, according to present intentions. It is anticipated that ore will be found in vein at that depth, but if it is not of commercial character shaft will be sunk deeper.

DAVIS-DALY (Butte)—Is developing Hesperus vein, which has been opened on 2,500-ft. level distance of 150 ft. In all that distance vein is about 12 ft. wide, containing 1½ to 5 ft. of commercial ore well sprinkled with copper glance, bringing average grade up to 5½% copper. Colorado is so poorly ventilated that work on 2,500 level is slow. New orebody has appearance of permanency.

NEVADA

Clark County

BULLION (Goodsprings)—New dry-concentrating plant has been in operation for last few weeks, successfully treating low-grade lead ore. Plant has a capacity of 50 tons per day and uses Stebbins dry-concentrating tables.

ANCHOR (Goodsprings)—New dry-concentrating mill is nearing completion. R. W. Moore is in charge of property. Mill was designed and erected by Ore Concentrator, of Los Angeles. Plant will use crusher, rolls and Stebbins' tables, and will be of 50-tons capacity.

YELLOW PINE (Goodsprings)—Mill is operating two shifts daily, producing full contractual allowance of 1,500 tons zinc-carbonate ore monthly, also 200 tons of lead concentrate. A dividend of 1c. per share, amounting to a total of $100,000, has been declared, making total of $230,000 paid by this company during current year.

Esmeralda County

CHAMP DOR FRENCH GOLD (Hornsilver)—William Dunphy lease on Orleans group now shipping 25 tons of $35 ore per day. Haul 16 mi. to railroad is done by autotrucks at contract price of 20c. per ton-mile.

GOLDFIELD CON. (Goldfield)—Estimated production for month of September, 1915, is: Total tons mined, 32,500; gross extraction, $269,000, operating expense, $159,000; net realization, $110,000.

JUMBO EX. (Goldfield)—Production approximately 80 tons of $45 ore per day. No. 2 shaft, a 4th compartment shaft on the Velvet claim, projected to 1,000-ft. level to facilitate operations in present workings and development of northern portion of ground, now down 525 ft.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 2 amounted to 9,496 tons, valued at $196,888, compared to 9,629 tons week previous. Producers were Tonopah Belmont, 2,756 tons; Tonopah Mining, 2,800; Tonopah Extension, 1,850; West End, 851; Jim Butler, 1,100; and miscellaneous leasers 139 tons.

ROUND MOUNTAIN MINING (Round Mountain)—Hydraulicking suspended Sept. 1 on account of lack of water. Now cleaning bedrock and preparing races for next season's run, which begins about March. Cleanup so far indicates value of about $2 per yd. for gravel handled this season.

Storey County

COMSTOCK PUMPING ASSN. (Virginia)—Repairing and equipping main south drift from Ophir-Mexican winze on 2,700 level.

UNION CON. (Virginia)—Saved from No. 1 stope north drift 36 cars of ore, averaging $17.10 per ton; from No. 2 stope southwest drift, 8 cars, averaging $15.73 per ton; from stope No. 3, near Sierra Nevada line, 86 cars, assaying $21.67 per ton.

MEXICAN (Virginia)—On 2,500 level started southwest drift from south drift No. 3, showing 3 ft. of quartz of low assay. East crosscut No. 3, 2,700 level, shows porphyry and stringers of quartz. Mill crushed 248 tons of ore, assaying $9.66 per ton

CROWN POINT-BELCHER (Gold Hill)—Water 6 ft. below 1,600 station of joint incline; 1,600 level drained, repairs started in east crosscut. Saved 11 cars mill rock from Belcher 1,300 raise. Jacket mill received 966 tons of dump rock.

CON. VIRGINIA AND OPHIR (Virginia)—Equipment and winze between 2,500 and 2,700 levels completed. Small station cut on 2,700 level for starting west crosscut. Ophir discontinued raise on vein from 2,500 level southwest drift; prospecting vein below sill floor. Central mine extended north drift on 2,500 level distance of 12 ft., 5 ft. of quartz assaying $5 to $11 per ton. Extracted 21 cars of ore and milled 220 tons.

NEW MEXICO

Grant County

HARDSCRABBLE (Pinos Altos)—Lease has been granted on property and several shafts will be opened up. Property has been offered for sale.

EMPIRE ZINC (Hanover)—Company has practically completed erection and installation of machinery at new powerhouse. Will generate electricity for mines and mill soon to be constructed.

85 MINING (Lordsburg)—Company has bought Atwood mine from Atwood Copper Co. Consideration reported in neighborhood of $100,000. Diamond-drill work now being done on Atwood. The 85 Mining Company now controls most important property in Virginia District. During month of September 232 carloads of ore were shipped from camp.

Lincoln County

ROBERTS MINES (Oscura)—Mines of D. W. Roberts have been leased to A. Chavez. Leaser has commenced work on property.

NAYLOR MINES (Tularosa)—Bismuth is being mined in San Andres mountains by Joe Naylor. Payment of 75c. per lb being received.

Luna County

ROYAL JOHN MINING CO. (Deming)—Company has filed articles of incorporation. J. C. Watson, agent. Capital $250,000. Mines are at Lake Valley, N. M.

AMERICAN SPELTER CO. (Deming)—Company is being incorporated by J. S. Vaught and D. S. Robins, of Deming, N. M. Will do general mining and milling.

SADDLER MINE (Cook's Peak)—Messrs. Hohlmeyer and Gunther, of El Paso, have bought mine from G. M. Sadler and W. O. Grace. Zinc ore will be shipped to Oklahoma from Spaulding Siding.

Santa Fé County

SANTA FE GOLD AND COPPER (San Pedro)—Company produced 289,766 lb. copper in August. $74,130 profits reported for past quarter.

Taos County

MEMPHIS RED RIVER MINING (Red River)—Mill and machinery of Trinidad Mine and Milling Co. acquired by company. Plant being put in condition for operation.

TEXAS

Culberson County

GEORGE A. PLUMMER (Port Arthur)—Plans to install large plant for extracting and refining sulphur from big deposit situated in northern part of Culberson County. Proposed improvements will cost about $370,000, it is stated.

UTAH

Beaver County

CREOLE MINING (Milford)—Articles of incorporation for this company were filed Oct 4. Capitalization is 1,000,000 shares, par value 10c. on 600,000 shares issued. Norman W. Maire is president. Several hundred tons of copper ore are said to be exposed. Further development and shipments are to be started in near future.

Juab County

TINTIC ORE PRODUCTION for month of September amounted to 506 carloads, estimated at 25,300 tons, valued at $830,000. This compares with 648 carloads in August and 817 in July. The producers for month of September, 27 in number, were as follows: Chief Consolidated, 107 cars; Iron Blossom, 78 cars; Centennial Eureka, 78 cars; Mammoth, 52 cars; Eagle & Blue Bell, 48 cars; Gemini, 29 cars; Grand Central, 17 cars; Dragon Consolidated, 16 cars; Gold Chain, 11 cars; May Day, 11 cars; Beck Tunnel, 11 cars; Sioux mill dump, 10 cars; Victoria, 7 cars; Lower Mammoth, 6 cars; Beck Tunnel, 6 cars; Colorado, 3 cars; Carisa lease, 3 cars; Uncle Sam, 3 cars; Minnie Moore lease, 2 cars; Opohongro, 1 car; Eureka Hill, 1 car; Ridge & Valley, 1 car; Tintic Standard, 1 car; Utah Consolidated lease, 1 car; Cliff lease, 1 car; Utah Mining concentrates, 1 car; Utah ore sampler, 1 car.

KNIGHT-DERN MILL (Silver City)—It is understood that this plant will treat large tailings dump at Eureka Hill.

RIDGE & VALLEY (Eureka)—Since lowering of water level to 1,700, work has been done between that level and 1,600. Ore carries lead, silver, copper and gold. On 1,600 and 1,500 levels development work is being done toward north.

GEMINI (Eureka)—Leasers shipped 150 tons of ore in September. New work is being done on company account on lower levels, where water has recently been lowered to 1,700 level. This will allow development of orebodies, opened some time ago, and later covered by water.

CHIEF CONSOLIDATED (Eureka)—Good progress is being made in building new wagon-road between Scotia mine under lease and bond to this company, and loading station at Jericho on S. P. L. A. & S. L. R.R. Ore will be hauled by traction engine, capacity being 15 tons per trip.

Salt Lake City

UTAH COPPER (Bingham)—The August production was the largest in the history of the company, amounting to 15,966,543 lb.; 9 steam shovels are being worked on ore, and 11 shovels on stripping and waste; 30,000 tons of ore are being mined daily, and the shovels on waste are handling more material proportionally, per shovel.

Summit County

PARK CITY ORE PRODUCTION for month of September amounted to 7,835 tons, valued at $313,400. Shipments made by the principal mines in September were as follows, according to weekly shipment records: Silver King Coalition, 2,960 tons; Daly-Judge, 2,000 tons; Silver King Consolidated, 1,323 tons; Daly West, 945 tons. Ontario, 52 tons; D. W. Quincy, 45 tons; others (estimated) 500 tons.

NAILDRIVER (Park City)—Work is to be started at this property in eastern part of camp.

WISCONSIN

Ashland County

SOO LINE (Ashland)—New concrete-steel dock is to be erected at Ashland, to replace wooden structure that is in bad shape. Work will be started as soon as navigation closes. It will cost about $3,000,000 and will be one of largest docks at the head of Lake Superior. Old dock will be torn down. Work will be rushed with all possible speed in order that there will be no loss of time in spring. Soo line will handle over 1,000,000 tons from Gogebic range this year.

Zinc-Lead District

VINEGAR HILL ZINC (Platteville)—Site has been staked out for new mill equipment on Graham land at Millbrig.

FRONTIER (Galena, Ill.)—This company has started shaft sinking and will assemble Baxter mill equipment on the Treganza property just west of Benton.

UTT-THORNE (Platteville)—Rich strike of high-grade zinc ore has been made by churn drill ahead of Lawrence mine on Lawrence land northeast of Cuba City.

WISCONSIN ZINC CO. (Platteville)—Steel construction work on new 75x100 roaster at New Diggings has been completed. Skinner type of roaster and Cleveland-Knowles separating machines will be used. Shaft sinking has been begun on C. A. Thompson land and shafts will be started soon on Longhorn and Birkbeck leases which have been proven by churn drill.

CANADA

British Columbia

RAMBLER-CARIBOO (Three Forks)—After suspension of payment for about 12 years, will resume dividend disbursements Oct. 15, when 1c. per share will be distributed. Second payment of equal amount will be made Dec. 15. Total of two payments will be $38,500.

Ontario

DOME (South Porcupine)—Monthly statement for September shows bullion production of approximately $139,000 making new high record. Tonnage treated was 28,500 of average value of $4.87 per ton.

DOMINION REDUCTION (Boston Creek)—This company is operating property adjoining Papapassmakes claims, on which there is an orebody 10 to 15 ft. wide in places carrying low gold content. Putting down a 200-ft. shaft.

KENZIE (Boston Creek)—This property, one of claims controlled by John Papapassmakes, has been worked all season. Vein having paystreak 12 in. wide rich in free gold is being developed. It has been stripped for 450 ft. and two shafts are being put down.

MUNRO CONSOLIDATED (Munro Township)—This company recently organized owns six claims, operations on which are in charge of George Leyson. Sinking has been begun on vein carrying free gold, which was 4 in. wide at surface and at 70-ft. level had widened to 14 in.

HOLLINGER (Timmins)—Regular 4-weekly statement for period ended Sept. 9 shows gross profits of $149,936 from treatment of 28,172 tons of ore of average value of $9.03 per ton. Working costs $3.17 per ton. Mill also treated 11,559 tons ore from Acme mine. Total surplus on hand was $1,331,461.

Quebec

A DISCOVERY OF MOLYBDENUM is reported by J. D. Kennedy, of Sherbrooke, Que., on the river Metabetchasuan, near Chambord. The property is crossed by the Canadian Northern Ry. and offers good facilities for transportation.

CANADIAN CHINA CLAY (Huberdeau)—Kaolin property and plant at Huberdeau have been closed down for winter. It is expected that railway will be built to property by spring and in meantime additions and alterations will be made to plant to permit of steady output.

MEXICO

Sonora

THE ORE SHIPPED FROM MEXICO through the port of Agua Prieta for the month of September was as follows; from Nacozari, 7,736 tons; Montecristo, 22; La Caridad, 24; La Bellota, 101; Minnesota, 111; Crestoncita, 31; San Ygnacio, 55; Archipelago, 14; Belen, 22; Silver Snake, 23; Cobre Parado, 36; Palacio de Hierro, 18; Los Metalles, 16; Maria, 5; Santa Maria, 32; Rosario, 6; Mexico, 37; San Pablo, 50; La Coqueta, 68; San Jose, 47; Esperanza, 20; La Cruz, 14; El Tigre, 257. Total, 8545 tons. El Tigre also shipped 100 sacks of silver and gold precipitates weighing 19,459 lb. and 99 bars of silver and gold bullion weighing 18,205 lb. Estimated value of shipments in Mexican gold, or at the rate of 2 for 1 American dollar is, copper, $1,176,500; silver, $410,800; gold, $264,300; total, $2,551,600.

MONTECRISTO SONORA MINING (Moctezuma)—Thirty tons of ore that will average nearly 300 oz. silver have been shipped to Douglas smelters.

ARCHIPELAGO (Cumpas)—Three feet of 15% copper ore have been exposed in cleaning up old workings and men are now at work breaking ore. About three tons daily are being shipped from mine and dump.

NACOZARI CONSOLIDATED COPPER (Nacozari)—New body of ore has been encountered in what is thought to be ancient Spanish workings. Ore is silver glance and native silver. First car of concentrates shipped since railroad has been re-opened between Nacozari and Douglas netted $2,356.

AFRICA

Rhodesia

THE GOLD OUTPUT OF RHODESIA in August was $2,545 oz., being 1,876 oz. more than in July. This brings the production for the eight months ended Aug. 31 up to a total of 601,954 oz. or $12,442,389. Other production in August was 16,830 oz. silver, 321 tons copper, 3 tons lead, 26 tons asbestos, 4,271 tons chrome ore and 38,143 tons coal.

The Market Report

Metal Markets

NEW YORK—Oct. 13

All of the principal markets were quiet during the last week without material change in prices. Copper and spelter exhibited drooping tendencies, while lead was a little stronger in tone.

Copper, Tin, Lead and Zinc

Copper—The outstanding feature of the last week was the continued pressure to sell Lake copper which was offered on even terms with electrolytic. The domestic demand was light. The relatively small business reported was done at 17.82½@17.87½c., regular terms, delivered in Connecticut. Some half-million and million-pound lots were sold on that basis, the deliveries being for November and December. Copper for any delivery was available in large quantity at the same price.

There was a good demand for copper from Europe and excellent prices could be realized by anybody who could find the freight room. The deficiency of the latter continued to be an obstacle to this business.

The domestic consumption of copper appears to be improving, this being indicated by the inquiries from concerns that have nothing to do with the ammunition business.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19½@19¾c. per lb. at mill. The chief maker does not quote base price.

Imports of Copper for the week ended Sept. 25 as reported by the Department of Commerce were 3,706,464 lb. metal and 3,089,314 lb. in ore and matte; 6,795,778 lb. in all. The chief imports were from Peru, Cuba, Canada and Chile. Exports for the week were 8,273,826 lb., the chief items being 5,257,786 lb. to France, 1,368,899 lb. to England and 1,273,266 lb. to Italy.

Visible Stocks of Copper in Europe on Sept. 30 are reported as follows: Great Britain, 20,995; France, 4,163; afloat from Chile, 825; afloat from Australia, 3,000; total, 28,983 long tons, or 64,921,920 lb. This is a decrease of 3,169 tons from the Sept. 15 report.

Tin—This market was dull and quiet, the price sagging off when the excitement over the prospective British export duty waned. The New York Metal Exchange on Oct. 8 passed a resolution to the effect that its existing form of contract was clear upon the point that any such duty that might be levied must be paid by the buyer. Nothing more definite respecting the imposition of such a duty appears yet to be known.

Tin production of the Federated Malay States eight months ended Aug. 31 was 33,075 long tons in 1914, and 30,908 tons in 1915; decrease, 2,167 tons.

Visible Stocks of Tin on Sept. 30 were: Great Britain, 5,120; Holland, 5; United States, excluding Pacific ports, 10,066; total, 15,191 long tons, an increase of 64 tons during September. The figures include 6,968 tons afloat.

Shipments of tinplates from the United States to Great Britain are unusual. Shipments from Baltimore for the past week, however, included 2,476,768 lb. tinplates to Glasgow.

Lead—This market stiffened upon the appearance of some fairly large orders from abroad which developed into business. The quotations at St. Louis improved a little, but in New York business was done at the old price, at which supplies of lead appeared to be freely available.

Spelter—This market dropped right through the week, there being no general demand worth mentioning from domestic consumers. On the other hand, the big demand from Europe continued and many thousands of tons were sold for export far ahead, most of the principal producers participating in this business. These contracts were made generally to run through long periods beginning in October or November, and running to March or April. The stock of spelter available for immediate delivery appears to be increasing, but smelters are naturally more interested in selling their prompt supplies in conjunction with distant futures than they are in selling for early months alone. The demand for early spelter is, however, so light, that producers who are willing to sell in that way have been obliged to offer the metal down and toward the close of the week prompt spelter was liberally offered at 13c., with the probability that any firm bids of 12¾c. would be snapped up. As has been noted above, the bulk of the transactions were for export, on long-running terms. One large domestic contract, on such terms, was reported, but this appeared to be an isolated transaction, the domestic interest having by no means been general. The galvanizers continued to be conspicuous by their absence.

Zinc Sheets—Business has been active, sales good but with no material change in quotations. The base price for carload lots is $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

In this table of prices the figure for sterling exchange of Sept. 22 was given at 4.470, through a typographical error. The correct figure was 4.700 for that date.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
Oct	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			17 65			4 37½	11 50
7	4 7050	49⅛	@ 17 75	32½	4 50	@ 4 42½	@ 13 50
			17 92½			4 37½	11 25
8	4 6975	49⅜	@ 17 67½	32½	4 50	@ 4 42½	@ 13 25
			17 92½			4 37½	11 25
9	4 6938	49½	@ 17 67½	32½	4 50	@ 4 42½	@ 13 25
			17 92½			4 40	11 00
11	4 6775	49½	@ 17 67½	32¼	4 50	@ 4 42½	@ 13 00
						4 40	10 50
12						@ 4 45	@ 13 00
			17 62½			4 40	10 50
13	4 6725	49½	@ 17 67½	32½	4 50	@ 4 45	@ 13 00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies, and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper			Tin		Lead		Zinc	
		Standard		Electrolytic						
Oct	Silver	Spot	3 Mos	£ per Ton	Cts. per Lb.	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
7	23⅛	72	73	ss	18 48	149½	150½	23½	4 96	69	14 56
8	23⅛	72½	73	ss	18 45	149½	150½	23⅜	4 95	68¼	14 24
9	23⅛										
11	23⅛	72½	73⅛	ss	18 37	149¼	150⅝	23⅛	4 90		
12	24	74	74½	ss	18 37	149¼	150½	23¼			
13	24	73⅛	74	ss	18 35	149	150½	23⅛			

The above table gives the closing quotations on London ... All prices are in pounds sterling per ton (2240 lb., except s... per troy ounce of sterling silver, 0.925 fine. Copper quotations ... copper, spot and three months, and for electrolytic, spot ... subject to 3 per cent discount. For convenience in compa... in pounds sterling per 2240 lb., with American prices in ce... ing approximate ratios are given, reckoning exchange at ... £20 = 4.20c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.8... 0.21.5c.

Other Metals

Aluminum—The scarcity of metal for early delivery is still the main feature in the market. For such deliveries prices are firmer and as high as 55@57c. per lb. has been paid for No. 1 ingots. For futures no quotations are available.

Antimony—Business has been rather more active, with some fair-sized transactions. Prices remain about the same, 28@29c. per lb. for Chinese and other ordinary brands; 45@46c. per lb. for Cookson's. A large shipment of Chinese metal is held up by the trouble in the Panama Canal.

Nickel—Quotations for ordinary forms are nominally 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—The market has been active and is strong, on account of the scarcity of stocks, which are very low. In New York quotations are $92@94 per flask of 75 lb. for both large and small orders. San Francisco reports by telegraph quotations $87.50@92 per flask, with brisk demand and stocks low. London price is lower, £15 10s. per flask, with no discount from second hands.

Gold, Silver and Platinum

NEW YORK—Oct. 13

Gold receipts of $6,000,000 from Australia at San Francisco are reported this week.

Platinum—The market continues uncertain and no new supplies have been received. Prices remain high, and we quote $51@55 per oz. for refined platinum, and $55@59 per oz. for hard metal.

Our Russian correspondent writes under date of Sept. 8 that the market has shown an extraordinary increase in activity and prices. This has been mainly due to the scarcity of foreign bills and the high rates of exchange. In Petrograd these rates have stood as high as 14 rubles to £1 and 3 rubles to $1—the normal rates being 9.40 and 1.94 rubles. Speculators have bought large quantities of platinum for export to secure the bills, which can be sold on the Stock Exchange at a high profit. The advance has been as much as 6,000 rubles per pood. The current quotations for crude metal, 83% platinum, are 10@10.50 rubles per zolotnik at Ekaterinburg; 38,000@40,000 rubles per pood at Petrograd; equal to $38.54 and $38.22 per oz., average.

Silver—The market continues steady with slightly upward trend, but the decline in sterling exchange has reduced the New York price from 49¾c. on Oct. 7 to 49½c. on Oct. 13.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Oct. 9

The base price paid this week for zinc ore was $76@80 per ton for 60% grades; medium grades sold at a base price of $72@75 per ton. The base price paid for 80% lead ore was $53@55 per ton. The shipment this week was the largest on record for the Wisconsin District. The net tonnage of zinc ore for the first nine months of 1915 exceeded the figures for the corresponding period of last year by 31,539,810 lb.

SHIPMENTS, WEEK ENDED OCT. 9

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,643,370	214,500	620,580
Year	152,849,410	4,996,120	21,114,770

Shipped during week to separating plants, 7,123,460 lb. zinc ore.

JOPLIN, MO.—Oct. 9

Blende, high price, $89.50, base per ton of 60% zinc, premium ore, $87.50; medium grades, $87@85; lower, $84@80; calamine base per ton, 40% zinc, carlots, $60; average, all grades of zinc, $81.99 per ton. Lead, high price, $56; base per ton 80% metal content, $55@50; average, all grades of lead, $50.53 per ton.

	Blende	Calamine	Lead	Values
Total this year	414,689,820	33,707,780	69,506,010	$19,560,050
Total this week	11,684,410	62,000	1,784,130	$526,640

Blende value, the week, $479,700; 41 weeks, $16,968,210.

Calamine value, the week, $1,860; 41 weeks, $768,920.

Lead value, the week, $45,080; 41 weeks, $1,822,920.

An entire week with very light rainfall encourages a belief that the excess is past and lends promise of a possible moderation for some time. Water is very heavy in the mines and the strain on pumping machinery causes frequent trouble, it is generally under control in all the large mines, but some small mines are still idle. The lighter shipment of this week added approximately 600 tons stock in the bins. Buying was lighter to the close, with a feeling among buyers of an easier market next week.

MONTANA ZINC ORE

In September the Butte & Superior mills treated 40,400 tons ore saving 11,600 tons concentrates, containing a little over 13,000,000 lb. zinc.

Iron Trade Review

NEW YORK—Oct. 13

Export orders continue large and domestic business is growing steadily. Structural work is the slowest end of the market, but is improving.

Orders for rails are coming in quite freely, and many companies are making up their orders for next year. More orders for cars are also noted.

Steel companies are rather holding back on orders for 1916 business, at any rate beyond the first quarter. Most of the mills are so full that they are not able to guarantee early deliveries. Price advances are being firmly held and some more are expected to be made before long.

Pig iron is in greater demand and quotations are firm, notwithstanding the increased production. It is to be noted that a good share of the larger make in September was from the steel works furnaces. There has been no considerable buying for next year thus far, and not much is expected this month.

The United States Steel Corporation reports unfilled orders on its books on Sept. 30 at 5,317,618 tons of material of all kinds. This is an increase of 409,163 tons over the statement for Aug. 31, and is the highest figure reported for many months.

Pig-Iron Production again increased in September. The reports of the furnaces, as collected and published by the "Iron Age," show that on Oct. 1 there were 268 coke and anthracite stacks in blast having a total daily capacity of 97,535 tons of iron; an increase of 6,460 tons over Sept. 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in the United States in September was 2,882,500 long tons; for the nine months ended Sept. 30, it was 20,518,500 tons. Of this total 15,072,575 tons, or 73.5%, were made by furnaces owned and operated by the steel companies. Production in September was at the rate of about 35,000,000 tons a year.

PITTSBURGH—Oct. 12

Week by week the steel mills find themselves more oversold, with respect to deliveries they should be making currently, and with respect to specifications booked for forward shipment. In bars, plates and shapes specifications on open contracts are coming in so freely that Jan. 1 will probably find the large mills with specifications on books for three months of solid work. That will not mean that buyers will necessarily be inconvenienced through delay in delivery, as much of the tonnage now being specified is being placed because buyers realize the delivery will be slow. The condition greatly strengthens the market as the mills have little occasion to sell for first quarter, and prices are going up. With such slow deliveries the small mills, which do not sell ahead, are reaping a harvest on prompt business, at premium prices, as high as 1.60c being paid for plates for early delivery. On bars, plates and shapes the large mills are generally quoting 1.40c. on specific orders for delivery at mill convenience, and 1.45c. on first-quarter contracts, in case they quote at all.

Sheets are stiffened rapidly, with 2.00c. as minimum on 28-gage black, for bessemer, and 2.05@2.10c. for openhearth, with no selling for first quarter, except specialties and at advanced prices. The wire mills have very little to offer in plain wire and in barb wire they are filled solidly for at least three months.

Railroads have already contracted for at least 400,000 tons of rails for next year, and they are eagerly buying plain steel and track material both for early and for extended delivery.

The scarcity of steel is due in large part to the war demand, which diverts much steel to forging shops and also curtails the supply available for finishing mills by the specifications requiring heavy cropping from the ingots, 30% very commonly.

It is now quite generally predicted that steel prices will advance more sharply in the next three months than they have in the past three, owing to the physical conditions as to demand and supply, coupled with the new idea among steel mills that little if anything is to be gained at this juncture by endeavoring to keep prices within bounds, when higher and higher prices are evidently to be obtained without difficulty.

Pig Iron—The market continues very quiet. Some of the merchant stacks that recently went into blast are but indifferently supplied with orders, even for early deliveries, and buyers show no anxiety about the future. Evidently they are convinced that whatever shortage there may be of steel there will be ample supplies of pig iron. With recent advances the less well positioned furnaces should be able to make profits, and there remain a fair number of merchant stacks idle. While Lake Superior ore is expected to be about 50c. higher for next season, and Connellsville coke has advanced somewhat, all the advances accomplished or in prospect in blast-furnace raw materials are covered by advances that have already occurred in pig iron. The foundries as a class are not really busy. If their condition should change materially for the better advances in pig iron might easily be resumed. We quote: Bessemer, $16; basic, $15; malleable, $14.50@15, according to analysis; No. 2 foundry, $14.50@15, according to delivery, all f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market continues rather uneventful, with foreign on contract quoted at $100, Baltimore, for indefinite delivery and domestic at $115, for assured delivery, prompt lots commanding intermediate prices.

Steel—The demand for special steel for forging shells and for rolling large rounds for shrapnel has taken up all available openhearth capacity, with an insistent demand left. Mills are securing $140@45 for billets for rolling shrapnel rounds, under special specifications that are not difficult and make very profitable business, to the entire neglect of ordinary soft-steel openhearth billets. There are occasional offerings of openhearth sheet bars, at $27@27.50, Pittsburgh. Consumers are likely to turn more to bessemer, which has lately been neglected. It is understood that occasional lots of bessemer might be obtained at $25@25.50. Youngstown, for billets and $25.50@26 for sheet bars. Rods are nominal at $31, Pittsburgh.

FERRO-ALLOYS

Ferromanganese is quoted at $110@$115 per ton for domestic 80% material. **Spiegeleisen** has been sold at $27 per ton for 20%, at furnace.—**Ferrosilicon**, 50%, is quoted at $75 per ton at Pittsburgh. Bessemer ferrosilicon is from $20 per ton for 10% up to $24 for 14%, all at furnace.—**Ferrotitanium** is $@12½c. per lb., according to size of lots and delivery.—**Ferrovanadium** is $2@2.25 per lb. of contained vanadium.—**Ferrotungsten** is quoted in London at 7s.@7s. 6d. per lb.—$1.68@1.80—for alloy 75@80% tungsten.—**Ferro-molybdenum** is quoted in London at 18s.—$4.32—per lb. for 75% alloy.

IRON ORE

Shipments of iron ore from the Lake Superior regions in September were 7,863,146 long tons, the heaviest September shipments on record. For the season to Oct. 1 the total shipments were, in long tons:

Port.	1914	1915	Changes
Escanaba	3,019,651	4,011,682	I. 992,031
Marquette	1,385,718	2,313,532	I. 927,815
Ashland	2,741,917	3,829,582	I. 1,087,665
Superior	9,478,253	5,937,023	D. 3,481,230
Duluth	5,278,800	11,807,219	I. 6,528,320
Two Harbors	4,804,975	6,710,528	I. 1,905,553
Total	26,709,413	34,669,566	I. 7,960,153

Shipments from Superior decreased on account of the light work this year on the Hill ore lands.

Some additional sales of Lake ore for this season's delivery are reported, a furnace company in the Mahoning Valley having taken 100,000 tons. October shipments are being rushed. A severe storm on the Lakes delayed shipping last week.

The total iron ore mined in New Jersey in 1914 is reported by the State Geological Survey at 350,135 long tons. The quantity sold was 346,820 tons.

OTHER ORES

All production of molybdenite, of wolfram ore and of scheelite in Australia has been requisitioned by the Commonwealth. The prices fixed for molybdenite are 105s.—$25.20—per unit for molybdenite and 55s.—$13.20—per unit for wolfram or tungsten ore. Australia supplies a considerable part of the demand for these ores. Burma is also a considerable producer.

Molybdenite. 90% MoS_2 is quoted in London at 120s.—$28.80—per unit.—**Tungsten** ore is high. wolfram, 65% WO_3 being quoted at 55s.—$13.20—per unit.

COKE

Coke production for the week in the Connellsville region is reported by the "Courier" at 397,589 tons. Shipments, 395,243 short tons. Production of Greensburg and Upper Connellsville districts, 44,715 tons. The "Courier" states the Connellsville production for the third quarter at 4,063,811 short tons, for the nine months ended Sept. 30, at 12,300,358 tons.

Anthracite shipments in September are reported at 5,535,771 long tons. For the nine months ended Sept. 30 the total shipments were 50,067,589 tons in 1914, and 47,379,111 tons in 1915; a decrease of 2,688,470 tons, or 5.8%, this year.

Connellsville—Contracting for furnace coke for 1916 delivery is proceeding at a moderate pace, and at prices a shade lower than operators expected a month ago they would be able to obtain. Contracts closed thus far on the movement amount to between 125,000 and 150,000 tons a month, somewhat more than half being for the full year rather than the half year, buyers being tempted by the fact that operators will sell at as low a price for the year as for the half year, and sometimes at a shade lower. One contract recently made at $2.35 for six months has been revised, at the request of the buyer, at $2.25 for the entire year, the operator being well satisfied to make the change, and these prices represent the markte quite closely. Operators are more inclined to sell at such flat prices than on the sliding-scale basis, which generally gives $2.25 coke on $15.50 pig iron, $2.35 on $16 pig iron and so on, when the market basis now is only $15, making a settling basis for coke at $2.15. Spot furnace coke has stiffened fully 5c. and is now quotable at $1.85@1.90. Foundry is quotable $2.30@2.60 for prompt and $2.40@2.60 on contract.

Fuel Exports of Great Britain eight months ended Aug. 31, in long tons:

	1914	1915	Changes
Coal	44,257,161	29,522,179	D 14,734,982
Coke	694,061	576,218	D 117,843
Briquettes	1,324,937	864,503	D. 460,434
Steamer coal	13,249,027	9,657,927	D 3,591,100
Total	59,525,186	40,620,827	D 18,904,359

Steamer coal is that furnished to steamships in foreign trade. The heavy decrease shown this year is due to the war conditions.

Chemicals

NEW YORK—Oct. 13

The general markets show little change, but there is a slight gain in business in several lines.

Arsenic—The market is quiet and rather dull. Prices are unchanged. Quotations are $3.50 per 100 lb. for large lots, and up to $4 for smaller orders.

Copper Sulphate—Business is steady and no change can be reported. Quotations are $6.75 per 100 lb. for carload lots and $7 per 100 lb. for smaller orders.

Nitrate of Soda—The market for this article continues strong and business has been on a fair scale. Prices are firm and 2.45c. per lb. is bid for both spot and futures.

Production in Chile is improving and is expected to increase still further. That for August was 4,961,580 quintals, or 23,125 tons.

Pyrites—Arrivals at Baltimore for the week included 5,822 tons of pyrites from Huelva, Spain.

Imports and Exports of Fertilizing Chemicals in the United States, seven months ended July 31, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Kainit	291,875	6,646	.	.
Manure salts	135,422	12,647	.	.
Other potash salts	170,091	66,821	2,228	600
Nitrate of soda	341,480	436,944	5,862	12,771
Sulphate of ammonia	45,383	23,519	.	1,186
Phosphates	.....	.....	878,147	111,703

Exports include reëxports of foreign material. Some phosphates are imported, but are not reported separately in the returns.

Imports and Exports of Raw Material for Chemical Manufacture, seven months ended July 31, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Sulphur	9,432	13,121	81,2	7
Pyrites	577,489	450,321		
Chrome ore	42,071	18,555		
Magnesite	82,741	16,911	1	0

Exports include reëxports of foreign material. The sulphur sulphur contents of pyrites the total imports of sulphur this year were 193,341 tons.

PETROLEUM

Exports of mineral oils from the United States in August were 232,224,014 gal. For the eight months ending with July 31 the total exports were 1,443,937,331 gal. in 1914 and 1,718,884,770 gal. in 1915; an increase of 24,947,439 gal. this year.

Assessments

Company	Delinq.	Sale	Amt.
Aetna, Ida.	Oct. 16	Nov. 15	0.001
Argenta, Ida	Oct. 11	Nov. 13	0.001
Buffalo, Mont	Sept. 10	Oct. 10	0.003
Cash Boy, Nev	Sept. 29	Oct. 30	0.01
Central Eureka, Calif	Oct. 8	Oct. 9	0.05
Coeur d'Alene Explor., Ida	Sept. 14	Oct. 14	0.002
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah	Oct. 10	Oct. 30	0.025
Comstock, Ida	Sept. 30	Oct. 30	0.001
Con. Virginia, Nev	Sept. 28	Oct. 19	0.05
Copper Mt. M. & D., Ida	Oct. 28	Dec. 1	0.002
Diam'field Black Butte, Nev	Oct. 4	Nov. 4	0.01
Eagle Mt., Ida	Oct. 15	Nov. 15	0.0005
E. Hercules Ext., Ida (post.)		Oct. 11	0.0015
Enterprise, Ida	Oct. 15	Nov. 15	0.002
Exchequer, Nev	Oct. 4	Oct. 25	0.02
Four Timbers, Wash	Oct. 4	Nov. 4	0.001
Friend, Wash	Oct. 18	Nov. 10	0.002
Gethin Le Roy, Utah	Sept. 25	Oct. 13	0.01
Giant M. & D., Ida	Oct. 7	Nov. 8	0.003
Goldstrike M. & L., Utah	Oct. 1	Oct. 20	0.01
Great Bend Reinc., Nev	Sept. 10	Oct. 10	0.01
Hancock Cons., Mich	Jan. 3		1.00
Idora, Ida	Oct. 11	Nov. 11	0.005
LeRoy, Ida	Sept. 25	Oct. 25	0.002
Lewis & Clark, Ida	Oct. 15	Nov. 15	0.001
M. & P. Gold, Utah	Sept. 15	Oct. 12	0.0025
Mount Pleasant Con., Calif	..	Oct. 7	0.08
Nabob, Ida	Oct. 25	Nov. 15	0.005
Naildriver, Utah	Oct. 9	Nov. 8	0.02
Nevada Cooperative, Nev	Sept. 15	Oct. 15	0.01
Nevada-Douglas, Nev	Sept. 27	Oct. 20	0.10
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0.50
Northern Light, Ida	Nov. 2	Dec. 2	0.004
Ophir, Nev	Oct. 12	Nov. 2	0.05
Phedora, Ida	Sept. 21	Oct. 21	0.0005
Phoenix, Mich	Jan. 1		1.00
Pioche Metals, Nev	Oct. 20	Nov. 20	0.00½
Rainbow, Ida	Oct. 15	Nov. 20	0.002
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Rockford, Ida	Oct. 4	Oct. 30	0.005
Silver Moon, Ida	Oct. 15	Nov. 18	0.005
Silver Pick Cons., Nev	Oct. 16	Nov. 23	0.01
Snowstorm Ext	Sept. 16	Oct. 18	0.003
Sunset M. & D., Nev	Oct. 18	Nov. 22	0.02
Sunshine, Ida	Oct. 15	Nov. 15	0.0006
Temple, Ida	Sept. 20	Oct. 20	0.002
Union Cons., Nev	Oct. 25	Nov. 15	0.05
Wisconsin, Ida	Oct. 19	Nov. 19	0.003

Stock Quotations

Sales at auction: Boston, 21,146 Davis-Daly Copper, 1⅛ to 1.20; Philadelphia, 23 Reading Iron Ore, $2 lot; 50 Nevada-Utah M. & S., par $10, $1 lot

COLO SPRINGS Oct. 11 Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	‡.008
C. K. & N.	‡.02
Doctor Jack Pot	.09
Elkton Con.	.23½
El Paso	.70
Findlay	.03½
Gold Dollar	.01
Gold Sovereign	.08
Golden Cycle	1.80
Isabella	.16½
Jack Pot	.06½
Jerry Johnson	.04½
Lexington	‡.005
Mary McKinney	.35½
Pharmacist	.008
Portland	1.60½
Raven B. H.	.02
Vindicator	1.50

SALT LAKE Oct. 7 Name of Comp.	Bid.
Beck Tunnel	.06½
Black Jack	.05
Colorado Mining	.06
Crown Point	.01½
Daly-Judge	6.65
Emma Cop.	.20½
Gold Chain	.16
Grand Central	.50
Iron Blossom	.72
Lower Mammoth	.04
May Day	.18
Opohongo	.00½
Prince Con	.55
Seven Troughs	.01½
Silver King Coal'n	3.30
Silver King Con	2.07½
Sioux Con.	.02
Uncle Sam	.08
Yankee	.42

TORONTO Oct. 4

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.04½	Dome Exten.	.26
Chambers Ferland	.14	Dome Mines	21.75
Coniagas	4.00	Foley O'Brien	.30
Peterson Lake	.21	Hollinger	25.00
Right of Way	.03	Imperial	.05
Seneca Superior	.78	Jupiter	.11
Silver Queen	.01	McIntyre	.47
T. & Hudson Bay	20.00	Pearl Lake	‡.00½
Timiskaming	.38	Porcu. Crown	.75
Trethewey	.16	Preston E. D.	.04
Wettlaufer-Lor	.07	Rea	‡.00

SAN FRANCISCO Oct. 11

Comstock Stocks		Misc. Nev. & Cal.	
Alta	.05	Belmont	.50
Andes	.09	Jim Butler	.75
Best & Belcher	.05	Lone Star	.04
Caledonia	.65	MacNamara	.02
Challenge Con	‡.04	Midway	.13
Chollar	.02	Mont.-Tonopah	.27
Confidence	.16	North Star	10.00
Con. Virginia	.16	Rescue Eula	.09
Gould & Curry	.03	West End Con	.56
Hale & Norcross	.04	Atlanta	.27
Jacket-Cr. Pt.	.14	Booth	.12
Julia	‡.03	C. O. D. Con	.04
Mexican	.32	Comb. Frac.	.05
Occidental	.79	D'field Daisy	.03
Ophir	.20	Jumbo Extension	‡.32
Overman	.09	Pitts.-Silver Peak	‡.06
Potosi	.03	Round Mountain	.30
Savage	.06	Sandstorm Kendall	.15
Sierra Nevada	.28	Silver Pick	.07
Union Con	.55	Central Eureka	.04

N. Y. EXCH. Oct. 11 Name of Comp.	Clg.
Am.Sm.&Ref.,com.	92
Am. Sm. & Ref., pf.	109½
Am. Sm. Sec., pf. A	87
Am. Sm. Sec., pf. B.	81½
Anaconda	76½
Batopilas Min.	1½
Bethlehem Steel	449
Bethlehem Steel, pf.	165
Chino	49½
Colo. Fuel & Iron	58½
Crucible Steel	93½
Federal M. & S., pf.	53
Great Nor., ore., ctf.	49½
Guggen. Exp.	68½
Homestake	120
Inspiration Con.	45½
International Nickel	221
Miami Copper	35
Nat'l Lead, com	66½
National Lead, pf.	110½
Nev. Consol.	15½
Ontario Min	3½
Quicksilver	2½
Ray Con.	27
Republic I&S, com.	52½
Republic I&S, pf.	104
SlossShefl'd, com	60½
Tennessee Copper	64
Utah Copper	71½
U. S. Steel, com.	83
U. S. Steel, pf.	115

N. Y. CURB Oct. 11	
Alaska Juneau	13
Alta Con	20
Beaver Con	‡.26
Big Four	.05
Blue Bell	.02
Braden Copper	9⅞
Buffalo Mines	¾
Can. Cop. Corpn	‡¾
Cashboy	.05½
Chile Cop.	22
Con. Ariz. Sm	1$\frac{5}{16}$
Con. Coppermines	1½
Con. Nev.-Utah	‡.25
Dia. Black B.	.06
Florence	.45
Goldfield Con.	1⅜
Goldfield Merger	.19
Greene Cananea	43
Kennecott Cop.	55
Kerr Lake	3⅝
La Rose	.50
Magma	14½
McKinley-Dar-Sa	.30
Mines of Am.	2½
Mother Lode	.36½
Nevada Hills	.17
New Utah Bingham	3½
Nipissing Mines	7
Oro	.07
St. Joseph Lead	12½
South Utah	.35
Stand'd Oil of N. J.	488
Standard S. L.	1$\frac{9}{16}$
Stewart	$\frac{21}{32}$
Success	.90
Tonopah	5$\frac{5}{16}$
Tonopah Ex	2⅛
Tonopah Merger	.34
Tribullion	$\frac{5}{16}$
Tularosa	‡⅛
Yukon Gold	2¼

LONDON Sept. 28	
Alaska Tre'dwell	£6 12s 6d
Burma Corp	1 11 6
Cam & Motor	0 12 6
Camp Bird	0 5 0
El Oro	0 7 0
Esperanza	0 7 0
Mexico Mines	3 12 6
Nechi, pfd	0 13 0
Oroville	0 15 0
Santa Gert'dis	0 6 6
Tomboy	1 0 0
Tough Oakes	0 7 3

BOSTON EXCH. Oct. 11 Name of Comp.	Clg.
Adventure	.82
Ahmeek	397
Alaska Gold M.	34
Algomah	2½
Allouez	55
Am. Zinc	60½
Ariz. Com., ctfs.	8½
Bonanza	.40
Butte-Ballaklava	3½
Butte & Superior	61
Calumet & Ariz	65
Calumet & Hecla	555
Centennial	17
Copper Range	58
Daly West	2½
East Butte	13½
Franklin	10
Granby	86½
Hancock	17
Hedley	‡27
Helvetia	.70
Indiana	6
Island Cr'k, com	45
Island Cr'k, pfd	86
Isle Royale	30
Keweenaw	2½
Lake	11½
La Salle	5½
Mason Valley	2
Mass	12
Mayflower	4½
Michigan	2½
Mohawk	79½
New Arcadian	11½
North Butte	32½
North Lake	1½
Ojibway	‡1½
Old Colony	4½
Old Dominion	54
Osceola	87
Quincy	85
Santa Fe	3½
Shannon	7
Shattuck-Ariz.	27½
Superior	29½
Superior & Bost	2½
Tamarack	57
Trinity	13½
Tuolumne	.50
U. S. Smelting	43½
U. S. Smelt'g, pf.	46½
Utah Apex	3½
Utah Con	12½
Victoria	3½
Winona	3½
Wolverine	61½
Wyandot	1½

BOSTON CURB Oct. 11	
Bingham Mines	7½
Boston Ely	.23
Butte & Lon'n Dev	.32
Calaveras	1½
Calumet-Corbin	.02
Chief Con.	.93
Cortez	.42
Crown Reserve	.35
Davis-Daly	1½
Eagle & Blue Bell	1½
First Nat. Cop	7
Houghton Copper	2½
Iron Cap Cop., pf	5
Majestic	.70
Mexican Metals	.24
Nevada-Douglas	.75
New Baltic	3½
New Cornelia	9½
Ohio Copper	.11
Oneco	.85
Raven Copper	.10
Rex Cons.	.51
Smokey Dev.	.15
So. Lake	6
Tonopah Victor	.25
United Verde Ext	5½
Utah Metal	7½

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654		28.083	23.199	..
November	58.995	49.082		27.263	22.703	..
December	57.760	49.375		26.720	22.900	..
Year	59.791	54.811		27.576	25.314	..

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

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Electrolytic 1914	London Electrolytic 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*		‡		‡	
November	11.739		53.227			
December	12.801		56.841		*	
Year			....		.....	

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284		‡	.
November	33.304	.	139.391	.
December	33.601		147.102	..
Av. year	34.301		....	.

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	.....	3.384	..	‡	
November	3.683	.....	3.585		18.500	.
December	3.800	.....	3.662		19.097	..
Year	3.862	....	3.737	....	....	.

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	.	4.750		‡	.....
November	5.112	.....	4.962	.	25.016	.....
December	5.592	.....	5.430	...	27.369	......
Year	5.213		5.06		....	.

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.81		13.75	.	13.97	.
November	14.59		13.43		13.83	..
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	

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Moving Ore in Flat Stopes

By E. M. Weston*

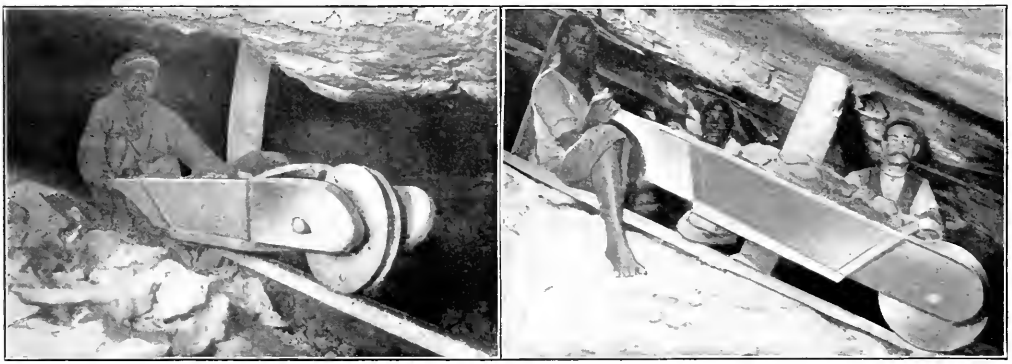
SYNOPSIS—Methods devised on the Rand for moving ore in flat stopes. Shallow wheelbarrows with grooved wheels running on a monorail prove efficient. Sharp curves and grades changing quickly from flat to 25° are no obstacle, but slightly smaller barrows are used. Is better method for Rand conditions than shaking chutes, is far cheaper than shoveling, and suits habits of native laborers admirably.

A serious problem has always existed in working small ore or coal deposits having a dip of from 5 to 20°, where the deposit is irregular, or where the timbering necessary is such that rails cannot be laid into the face; also where shaking conveyors are either too expensive to install or the dip too flat to render them effective.

The problem has been to avoid the amount of hand shoveling necessary to bring the ore either to the nearest tram line or to some central installation of "shakers" or other conveyors. Recent articles in the *Journal* dealing with such cases have described the use of small trucks running on rollers, as in the North Star mine, California, or an arrangement of a fixed iron chute to facilitate shoveling.

The question in some parts of the Witwatersrand is a most important one. Shoveling a "lashing," as it is called, is generally most inefficiently done. The native, unless well-taught, prefers to use his shovel like a hoe and to scrape the ore along instead of lifting and throwing it. There is often far too much of lashing down 100 or 200 ft. of stope on the Rand. I was given charge of reclamation work in an area of a mine consisting principally of stopes of the grades mentioned, where comparatively small quantities of rich ore in pillars and overlooked foot- and hanging-wall sections were spread over considerable distances from tram lines and where the stopes were often narrow. Ore had sometimes to be brought through places not more than 30 in. high.

I was compelled to consider some method of avoiding the excessive amount of shoveling that would have rendered much of the ore too costly to remove. I finally decided that the solution of the problem lay in adapting the old Cornish barrow to new conditions. The plan was to use a combination of a monorail truck, a Cornish barrow and a sled. The construction of a wooden model is shown in the photographs.



NEW SYSTEM OF CONVEYING ORE FROM FLAT STOPES OF THE RAND

The 2-cu.ft. wooden stope barrows shown above were used in the lower stopes and a 3-cu.ft. steel barrow in higher stopes

When the barrow had to be taken around curves and when there were changes of grade from flat to 25°, I found that a barrow having a capacity of 2 cu.ft. was the most economical size to use. Where there was a regular slope not exceeding 18° and where straight lengths of rail could be used, a 3-cu.ft. steel-plate barrow, such as is shown in the drawing (p. 666), could be easily handled. However, the right capacity may easily be found by experiment.

From the illustrations the construction and method of use of these barrows are easily seen. The wooden barrow is made of 1-in. or 1¼-in. boards, held together with strap iron along the back of the [illegible]. There is

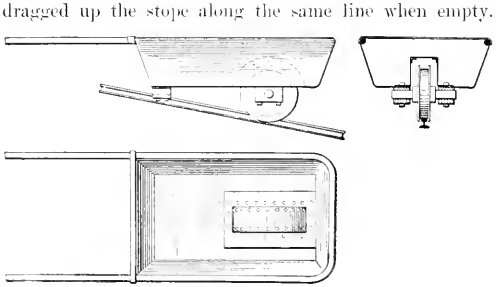
*Mining engineer, Union Club of South Africa, Johannesburg, Transvaal, Union of South Africa.

at the back a removable wearing piece of harder wood about 4x2½ in., with a slight groove cut in the center for the top of the rail to slide in. This is gradually cut through by the friction and is renewed underground as required.

The barrow as a whole suffers little wear from rock shoveled into it, and I had not renewed a single bottom during the course of a year in consequence of this wear. The wheel is made from a circular piece of hardwood board about ½ in. thicker than the rail upon which it has to run. On each side of it is bolted a circular disk of ⅛-in. steel plate, having a diameter about ¾ in. longer than that of the wooden disk. These form flanges that keep the wheel upon the rail. The disks are cut out to receive a wooden hub 1 in. square, turned down on each side to a 2-in. pin. In the latest design, this pin or axle works in blind bearings cut in blocks of wood, screwed or bolted to the inner sides of the side pieces of the barrow, so that the wheel can easily be changed by unscrewing. The flanges are strong enough so that the barrow can be wheeled along a plank or along the bottom rock of a stope when necessary.

In taking a load of ore down a narrow stope, the barrow is pushed forward and slides along on the wheel and on the back wearing piece, while the operator holds the handles and thus prevents a capsize. In a difficult or flat place, the method of progression is by a succession of pushes, but in easy places it is really a gentle advance on the slide with the operator, half crouching, following it.

It suits the habits of the natives admirably, and they soon take to the use of it when shown. It is of course dragged up the stope along the same line when empty.



WHEELBARROW FOR USE IN FLAT STOPES

In rounding curves, the native soon learns to swing the rear of the barrow so that the wheel does not jam.

The great advantage of this system is the simplicity and speed of track laying. The track consists of a single length of old or new rail, which can quickly be bent to avoid timbers or packs in a stope. The rail is supported upright in the simplest manner with old pieces of timber larger than 6 in., secured by nails or spikes, or by old iron sleepers cut in half and attached so that they project on opposite sides of the rail. With a few pieces of timber, some nails and perhaps some coupling plates and bolts, any unskilled man can lay a line without trouble in a few minutes and take it up again if necessary to preserve it from the blast at the end of the shift.

This is not the only advantage—a main line, single or double, can be laid into a face, and from it branch lines can be laid off to various parts of the stope. The junctions of the rails are simply the ends or sides laid together; the operator of the barrow simply lifts its front wheel from one rail to the other and continues on his way. Several barrows can run on the same line in opposite directions, as the empty barrow is simply tipped off the rail when meeting occurs and put on again in a short time.

The saving in capital expenditure is obvious. The barrows cost only 30s. or less and last a long time. They are easily moved away from the area of blasting, and any repairs can be cheaply made. The various items of the equipment are found in any mine and may be used over again many times.

The next question to be answered is—what is the efficiency over other forms of conveyors and over shoveling? I have already stated that such a method makes no claims of superiority to regular stope tracks or regular conveyors in handling large tonnages. It may be useful in feeding them. Its place is apparent when the regular methods are not suitable. For moving broken rock it is more efficient than shoveling, if the distance the rock has to be moved is more than about 30 ft., but in the case of the barrow there must be a place where the rock can be tipped with ease or it must be removed as soon as tipped. This means that the rock cannot be efficiently piled up in a heap with a barrow.

In the flatter stope shown in the photographs, one native without close supervision loaded and moved three tons (30 barrows) every shift over a distance of 300 ft. Another moved five tons in a higher stope. With larger barrows two natives loaded and moved enough rock down 100 ft. of line in a 15° stope to keep two other natives employed shoveling it into a 14-cu.ft. truck, tramming it 200 ft. and tipping it. These two natives with barrows did the work of six or eight natives by the old shoveling method. The native must be taught how to use the barrow, but he soon takes to it as the change of work appeals to him. It is easier with this method than with shoveling to get definite results from a given gang of natives under a boss boy, as each native has a definite task to do and need wait on no one. A tally of the barrows moved can be kept and a contract system arranged.

Several engineers who saw the system at work endeavored to introduce it in other mines, but it is quite impossible to introduce any new system on the Rand, however good it be, without first starting on a small scale and gradually training men and natives in its use. Otherwise it is at once voted a nuisance and the first opportunity is taken of leaving the apparatus in the stope to be blasted. This is a true picture of Rand conditions as many can testify from bitter experience.

Nature of Title to Mine Claims

By A. L. H. Street*

A comprehensive statement concerning the nature of mining claims and the method of their acquisition, made by the United States Circuit Court of Appeals, Ninth Circuit, in the late case of Trinity Gold Dredging and Hydraulic Co. vs. Beaudry (233 Federal Reporter, 739) appears in the following concise paragraph:

Congress has provided how a mining claim can be acquired. In general, it may be acquired by discovery of mineral, par-

*Attorney, Security Building, Minneapolis, Minn.

ticularly of gold, silver or copper and the like, upon the public lands and by staking the same off or marking it upon the ground so that the boundaries may be plainly designated and readily ascertained. The right of continuous occupation may be maintained by keeping up the assessment work prescribed by law, and this without incurring the obligation toward the Government of buying and paying for the land. When an individual entitled to the benefit of the statute has made location in accordance therewith and gone into possession, he is said to be the owner and in possession of the mining claim thus located. Such a claim, when perfected, is declared to be property in the highest sense of that term, which may be bought, sold and conveyed and will pass by descent. . . . It has been held, further, that the words "mining ground," used in a deed, have a technical meaning and refer to that interest which a mere occupant of the mine has in the same; and that a purchaser of a mining claim only acquires such right or title from his vendor as the latter had at the time of the purchase. . . . A mining claim is therefore possessory only in character, where held by location simply and the performance of the annual work necessary to entitle the locator to continue in possession.

*

Drift Mines of California

By John D. Hubbard*

The lava-capped sluice boxes of nature, known as the Tertiary or ancient river channels of California, have had a remarkable history of gold production, and it seems surprising that more attention has not lately been given to them. The result of a vast period of erosion, these ancient channels have proved their superiority over the later Quaternary channels in point of actual gold production. In fact the Quaternary channels derived by far the larger part of their gold from the sluicing or erosion of the others. The record of the Tertiary channels, approximately 300 mi. of which were worked, is a production of $300,000,000 in gold, or $1,000,000 per mile of channel worked. The remainder of California's vast gold production—approximately $1,650,000,000—came from the quartz veins and the Quaternary "diggings" of the Argonauts.

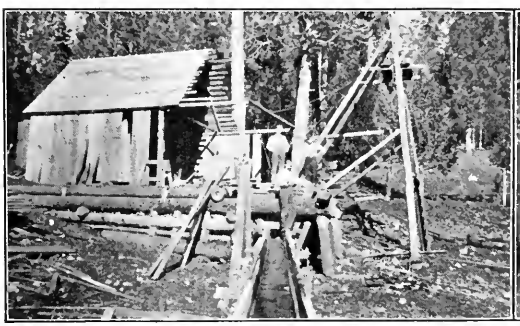
An idea seems to prevail that California has been pretty well worked over and that not much is left. This is not true. Of the Tertiary channels alone there remains over 1,000 mi. of unworked main channel, to say nothing of the tributaries. There is every reason to believe that the averages of production will continue to hold good, this source alone supplying more than $1,000,000,000. Besides, the quartz veins are to be reckoned with, and will continue to pour their riches into the world for many years.

*Mining engineer, San Francisco, Calif.

The heyday of hydraulic and drift operations in the Tertiary gravels passed away in the '70s of the last century. Since then, owing to the anti-débris laws, hydraulic mining has practically ceased in the watersheds of the navigable rivers of California, although still carried on in the non-navigable river districts, as the Klamath. Although the anti-débris laws do not apply to drift mining, a stagnation in this industry followed the closing down of the hydraulic mines. The main problems in the drift mines are to extract the gravels without damaging other property with the débris and to reduce the cost of drift mining so as to permit the exploitation of the less remunerative deep gravels, such as lie along the ancient shore line of the Neocene-Cretaceous contact.

Most of the Tertiary channels lie in a favorable position for gravity working, especially in the lower reaches of the Sierras. Where the old river bed may be tapped by a lower tunnel and the gravel mined out on a gravity system the costs are greatly reduced. The débris from these mines may also be retained in a small area by the proper disposal of the water used in washing through the sluice boxes. The débris or gravel being heavy has a tendency to "stay put" with but little encouragement.

The cost of drift mining varies greatly, depending on conditions. At the Mayflower mine in Placer County, according to F. Chappellet, the mining cost is $1.19 per ton, and milling with steam power, 25c. per ton, or a total of $1.44 per ton. This was in cemented gravel. At the Big Dipper mine, which is of the same class as the Mayflower, the total cost, according to G. B. Hobson, was $1.85 per ton. At the Hidden Treasure mine, where the gravel is not milled and the work is done on a large scale, the cost per ton is as low as 92c. At the Mineral Slide mine, near Magalia, in Butte County, where the face is blasted down and the gravel washed out by water under pressure, the cost is as low as 65c. per ton. This is about the lowest figure recorded, but even that can be lowered. At the Nugget mine in Butte County, where the gravel was worked through an incline and water had to be pumped, the cost was $1.37 per ton, increasing to $1.73 per ton as greater depth was obtained. It would be a great benefit to the mining fraternity if the costs of such extensively worked drift mines as the Magalia and Indian Springs in Butte County were available, but the owners took the gold out so fast that they could not be bothered with costs.



HEAD OF INCLINE ON DRIFT MINE STARTING WORK, BUTTE COUNTY, CALIF.

NUGGET MINE, BUTTE COUNTY, CALIF., SHOWING SLUICE AND UNDERCURRENTS

Because of the prevailing harder bedrock and greater fall of the ancient river, the gravel in the California mines, in contrast to many Australian drift mines, rarely contains much clay. Consequently the Australian methods of puddling or comminuting the clay by revolving drags in pans are practically unknown in California. There are many localities in California where plenty of clay has been found in the Quaternary gravels, but the ancient channels of the Tertiary are remarkably free from this objectionable material.

Like everything else, drift mining must be attacked with skill and "horse sense." It is an attractive game. Once touched by the sight of beautiful shining yellow gold under clear water in the sluices and by the sensation of handling it before it becomes "tainted," a man is apt to forget quartz mining and the methods which call for expensive reduction plants. Getting the pure article at first hand is so much more satisfactory.

One phase of the situation as regards future exploitation is the unsatisfactory and wholly erroneous way of placing the value or selling price on a gold mine. To the miner gold stands for copious perspiration. To the business man it is something else. But gold and perspiration are rarely associated in the mind of the landowner when there is a prospective buyer. Without a considerable showing in development work it is impossible to place a price with any reason on a mine. Owners can seldom tell you anything about reserves, but never slip a heart-beat in naming a price. This means to the operator that in case of acceptance he is betting his time, skill and development money against nothing that the price asked is right. No wonder the industry has languished.

But things have changed. Owners now court activity on any reasonable terms. They have eaten crow long enough. Many are disposed to meet the operator half way, and to do it on a percentage basis. By this method both sides take their risk like good sports, which is good business in the end.

New Flotation Installations

SPECIAL CORRESPONDENCE

A new flotation installation in successful operation at the Mary Murphy mine, near St. Elmo, Colo., consists of a 12-cell non-acid machine treating slimes from the wet crushing mill. The ore is a gold-silver-lead-zinc combination, and heretofore the values in slime have been difficult to recover. The flotation product from the 12-cell machine is re-treated on tables to separate the lead from the zinc, thereby making a higher-grade product than could formerly be secured with the system of wet milling and static concentration. The latter process is still handling the coarse material.

At the Oneida Stagg Mining and Milling Co., at Freeland, 5 mi. from Idaho Springs, Colo., there is an 8-cell machine of special design which has replaced the cyanide treatment. The cyanide plant contained four Dorr thickeners, three Dorr agitators, melting room, zinc boxes, filter press, air compressor and Dorr sand classifier. The present installation requires but one man per shift, the Dorr classifier and one thickener being used. The treatment is also non-acid. Feed to the machine is a gold-silver slime, carrying values in gray copper, chalcopyrite and pyrite. The flotation system recovers a high percentage of the feed, which is valued between $1.50 and $2 per ton.

An installation is being made now at Montezuma, Colo., of a non-acid system of flotation. The ore has been heretofore rather hard to treat on account of the heavy barite gangue, which is hard to separate by gravity from the mineral.

Cinnabar in Western Nevada

Two stray steers caused the discovery of a deposit of cinnabar in the Pilot Mountains of western Nevada, according to the United States Geological Survey. On the day of the discovery Thomas Pepper and Charles Keough had been tracking the two steers, when, near nightfall, the trail led over an old prospect in which a face of limestone traversed by small veinlets of red mineral was exposed. The red mineral was recognized by Keough as cinnabar. After finding the steers and taking them to Mina, the two discoverers returned to Cinnabar Mountain, as the hill on which they had made the find has since been named, where they spent 10 days in careful search and located 17 claims. They later went back to Mina and made known their find, causing intense excitement, and that afternoon almost every citizen of the town left for the site of the discovery by automobile and by other less expeditious conveyances. A large number of claims were staked by the first comers and many more were afterward staked by claimants from Tonopah.

The discovery was widely heralded as the rediscovery of the "lost Hawthorne quicksilver mine," named for Judge Hawthorne, in whose honor, it is said, Hawthorne, the seat of Mineral County, was named. According to local report, in the '70s Judge Hawthorne discovered a rich quicksilver deposit, which is believed to have been situated at the site of the recent discoveries. In returning from the mountains, so it is said, Hawthorne lost his bearings, and although to the end of his life he attempted annually to find the "quicksilver mine," he remained unsuccessful.

This tradition seems highly improbable. The original discoverer—who he was is unknown—had done some very substantial exploratory work on the prospect. In his efforts to prove his find he had blasted out a considerable mass of solid limestone, and as further tokens of his activity, sticks of powder, fuse and picks lay abandoned at the prospect. That this energetic prospector lost his way and was unable to find the prospect at which he had labored is not easily credible. It is more likely that he abandoned the prospect as, in his judgment, not sufficiently valuable. The newcomers have found considerably richer deposits than the unknown pioneer did and have shown that the cinnabar extends along a considerable belt.

Antimony in Hunan, China

United States Vice-Consul Horace Remillard at Hankow, China, reports that 11,156 tons of antimony, valued at $575,790, were exported from Hankow in 1914, a gain of 3,363 tons (11%) in quantity and $180,729 (46%) in value over 1913. Direct exports to the United States in 1914 amounted to 2,707 tons, valued at $319,966, a gain of 1,032 tons over 1913.

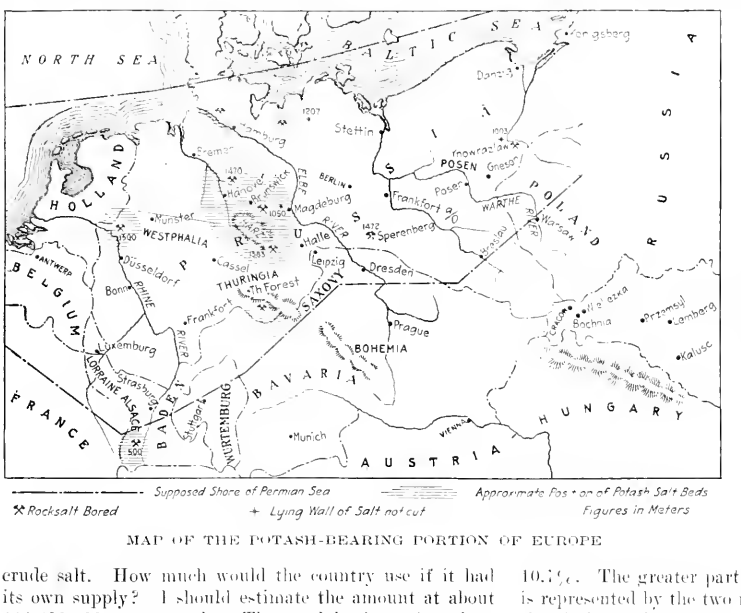
Potassium Salts: An Economic Geological Study—I

By E. Mackay Heriot*

SYNOPSIS—The great importance of the potash industry and the grip of the German monopoly upon the world's supply combine to make the subject of vital interest. The occurrence of the great deposits of potash is discussed, together with the probability of its discovery in other countries.

The potassium industry is of world-wide importance. I estimate that about 1,250,000 tons of pure potash (K_2O) are consumed in a year, or say a total of 12,000,000 tons of crude material with a value of $55,000,000. These figures, although they show great values and enormous tonnages, do not give any idea of what the world really needs. This sentence must be explained. Today Germany has a natural monopoly of potassium salts and is the only country which can produce them in great quantities. Germany uses over one-half of her potash output for domestic purposes.

Aside from Germany, the largest consumer of potash is the United States. It uses about 600,000 tons of the crude salt. How much would the country use if it had its own supply? I should estimate the amount at about 100,000,000 tons yearly. The exploitation of such a quantity should give employment to 370,000 men.



MAP OF THE POTASH-BEARING PORTION OF EUROPE

Uses and Derivation of Potassium Salts

Potassium salts have many more uses than as a fertilizer. There are few industries that do not need them in some form or other. Potassium arsenite is employed in the manufacture of cloth prints; potassium bromide, in photography, medicine and aniline dyes; potassium carbonate, for soap works, bleaching, dye works and glass; caustic potash, for bleaching, dyeing, soap-making and surgery; potassium chlorate, for fireworks, matches and dyes; potassium chloride, for freezing-mixtures and medicine; potassium chromate, for aniline dyes, electricity; potassium cyanide, for dyeing, making Berlin and Prussian blue, manufacturing cloth prints, hardening steel, galvanoplastic photography, and the extraction of gold; potassium iodide, for aniline colors, medicine and photography; manganate and permanganate of potassium, for dye works, coloring wood, disinfectants, bleaching works; potassium nitrate, for explosives, medicine and preservation of meats; potassium silicate, for painting, sticking-mixture, printing, water-glass, artificial stones, incombustible materials; potassium sulphate, for alum, glass, potash, caustic compounds. Thus potassium has become indispensable to trade and industry.

Potassium salts are derived from various crude materials, such as leucite, alunite, phonolite, greensand marls, kelp and dried salt lakes and underground deposits. Leucite is a metasilicate of aluminum and potassium, sometimes with small amounts of sodium when unaltered. Its formula is $KAl(SiO_3)_2$, and it contains 21.5% K_2O. It is found in igneous rocks, being chiefly developed in lavas of Tertiary and more recent ages, and but rarely in older rocks. It is met with in many parts of the world. As an example the rocks of the Leucite Hills, Sweetwater County, Wyo., consist of fine-grained, rather earthy-looking lavas, composed chiefly of a mixture of mica, diopside and leucite with a variable amount of orthoclase (potash feldspar). With the exception of diopside, all these minerals contain a considerable quantity of potash, the amount in leucite being about 21.5%; that in the orthoclase, 16.9%; and that in the mica, 10.7%. The greater part of the potash present, however, is represented by the two minerals, leucite and mica. The chemical samples show that the amount of potash (K_2O) varies in amount from 8 to 12%. It is calculated that these hills contain not less than 197,000,000 tons of potash;[1] but extraction is not yet commercially possible.

Alunite, $K(AlO_2H_2)_2(SO_4)_2$, is a hydrous sulphate of aluminum and potassium, with 11.4% K_2O. It is a secondary mineral in feldspathic rocks altered by means of sulphurous vapors. It occurs in altered rhyolites, dacites,

*Mining engineer, Rio Tinto, Huelva, Spain.

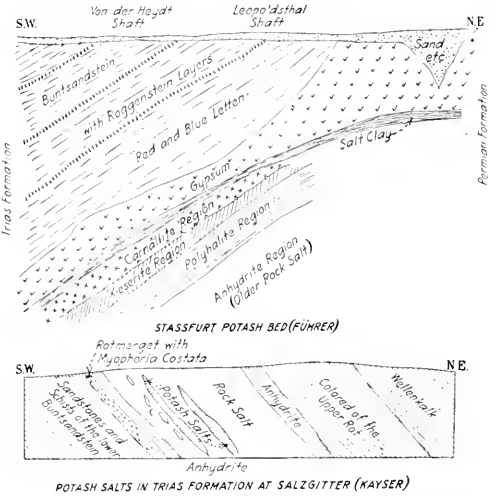
[1]Bull. 512, U. S. Geol. Surv., 1912.

trachytes and andesites. At Rosita Hills, Colo., it is found in andesite; with hyalite and opal at Queretaro, Mexico, and in many other localities.

Phonolite is a fine-grained volcanic stone containing from 9 to 10% potash. Germany, Iceland, Italy and other countries manufacture potassium salts from phonolite. One great advantage of this fertilizer is that it does not contain any chloride and should be suitable for potatoes, tobacco, grapes and fruit trees. There is said to be a very large supply in the Eifel, in Germany, where it is sold at $35.70 per car. Its merits seem to have been exaggerated.

The greensand marls of New Jersey are rich in glauconite formed by taking up potash from waters. The marl ranges from 3.5 to 6.3% potash. It cannot compete with concentrated fertilizers. Kelp is a source of potash. In Scotland, Norway and Japan potash and iodine are made from it.

According to "The Mineral Industry," vigorous work has been carried out in the United States, prospecting in the salt lakes for potash salts; but manufacturing seems



CHARACTER OF THE STASSFURT AND SALZGITTER BEDS

only to have been done on an experimental scale. American experts think that the most probable source of potash in America is Searles Lake, California. It is estimated that natural evaporation of the lake amounts to from 0.25 to 0.50 in. per day. Since the level is constant it follows that the lake is fed by an underground flow from the surrounding mountains and that the brine in the crystal body acts as an equalizer to the incoming water. The surface of the crystal body is predominately common salt. Below this are layers in which carbonate and sulphate of soda predominate and the potash seems mainly to lie on the border line. The crystal body is 70 ft. deep and the salt muds extend to at least 700 ft. The daily output of the complete plant is calculated as follows: Borax, 225 metric tons; soda ash, 508; salt, 1,507; sulphate of soda, 593; potassium chloride, 189. In other dried lakes prospecting is still going on in the Western states. In India crude soda has been obtained from the Loaur dried lake for centuries. Nitrate deposits in India, Chile and Africa furnish potash salts in relatively small amounts. From India and Chile about 30,000 tons of potash salts are exported annually.

I come now to the world's source of potash salts—the German deposits. They occur in the Permian formation. After discussing these I will then draw attention to potash deposits met with in non-Permian formation.

There are about 150 works now in the potash syndicate, and about as many more will be ready to produce in a few years.

In 1913 the total shipped was 5,212,651 tons.

	Tons
Carnallite and bergkieserite	68,217
Kainite and sylvinite	3,509,049
Potash manure salt, 20, 30 and 40%	906,212
Potash manure salt, to 80% KCl	37,873
Potassium chloride, 80%	484,254
Potassium sulphate, to 90%	110,784
Potassium-magnesium sulphate, to 48%	58,269
Potassium-magnesium sulphate, to 40%	119
Kieserite in blocks	36,708
Kieserite calcined and crushed	1,116

The principal product is potassium chloride, which serves as a basis for the manufacture of most of the other salts.

CONSUMPTION OF POTASSIUM CHLORIDE AND SULPHATE

	Potassium Chloride, Tons	Potassium Sulphate, Tons
Germany	130,889	2,865
England and Scotland	14,979	9,242
United States	230,214	41,818
Other countries	108,172	56,859
	484,254	110,784

CONSUMPTION OF KAINITE AND SYLVINITE IN 1913

	Tons
Germany	2,440,342
England and Scotland	74,352
United States	493,547

CONSUMPTION OF FERTILIZERS WITH MINIMUM 20, 30 AND 40%

	Tons
Germany	513,347
England and Scotland	15,307
United States	212,143
Holland	167,922

In the data I have given to show the output of the different classes of products I have mentioned some of the potassium minerals, and before going further will say something concerning these.

Carnallite, KCl, $MgCl_2$, 6 H_2O, is the mineral which forms the basis of the chemical industry. Chemically pure it contains 26.8 KCl or 14 K; 34.2% $MgCl_2$, 39% H_2O. In nature it is almost always associated with more or less rock salt, kieserite and other minerals through which the KCl is reduced by less than 50%. It is generally of a reddish color and easily soluble in water.

Sylvite, KCl, contains 52.48% K, and is usually of secondary origin, being derived from the decomposition of carnallite. In the Hanover region it is a primary mineral. When mixed with rock salt it is called sylvinite.

Kainite, KCl, $MgSO_4$, 3 H_2O, is formed by the decomposition of carnallite. It is usually mixed with a considerable amount of rock salt, and is called "hartsalt." This name is also applied to potassium-magnesium salts containing rock salt but no magnesium chloride. These require chemical treatment before they are commercially valuable. Schoenite (pieromerite), K_2SO_4, $MgSO_4$, 6 H_2O, is a secondary product of caruallite. Polyhalite, K_2SO_4, $MgSO_4$, 2 $CaSO_4$, 2 H_2O, occurs in the form of bands in the so-called polyhalite region. It has no commercial value. Kieserite, $MgSO_4$, H_2O, is the most important of the magnesia salts.

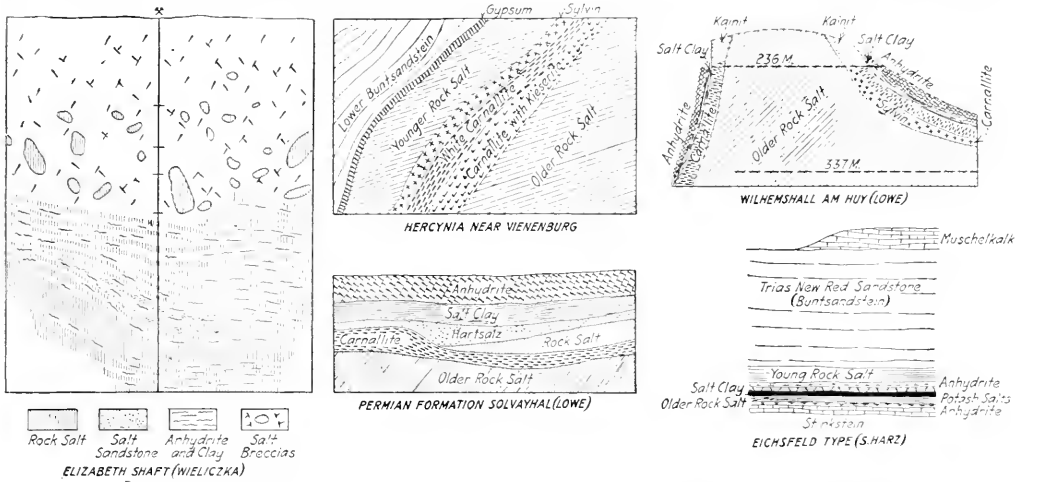
Other potassium salts found in the German deposits are glaserite, krugite, bischofite, tachydrite, astrakanite and douglasite. They have no commercial value. Boracite,

$Mg_7B_{16}O_{30}Cl_2$, occurs in the form of nodules in carnallite.

In order to get a good idea of the German potash deposits we must take ourselves back to the Permian era. I give a map of the world showing the relation of land to water at that time. It will be observed that what is now practically the whole of the Atlantic Ocean, including North America and Greenland, was a huge continent; the whole of Russia and Siberia was another; while Africa east and west to Australia and South America constituted a third—perhaps in this latter case not quite joined. Germany, it will be seen, was under a sea somewhat resembling the Mediterranean. This today is the so-called North German plain, under which are enormous deposits of salt. The map on page 669 shows the German Empire, and I have outlined as nearly as possible what is considered to have been the Permian Sea. On the east it enters Russia and on the west it most likely reaches England. At certain points I have marked with crossed hammers places where salt has been met with in deep borings. At the East Prussian frontier there is Ynowrazlaw, where at 1,003 m. the foot wall of the rock salt had not been pierced. In the south I show the celebrated borehole of Sperenberg, 1,472 m. deep and practically the whole way in salt. Up in the north near Hamburg lies the well-known salt mine of Jassenitz, the shaft of which took nearly 20 yr. to sink. A hole here had not got through the salt at 1,207 m. depth. To the west I show Munster, with a borehole 1,300 m. deep. Thus, it seems, we may say that without a doubt the North German plain is one vast salt area. However, it must not be thought that potassium salts are found everywhere. This is by no means the case. I have marked with horizontal lines the approximate situations of the potash fields.

In order to understand the geology of these salt deposits it is necessary to say something as to how they originated. There are two theories, but whichever one be right each gives a good insight into the geology and therefore should be mentioned.

Sea water contains 3½% of saline constituents, of which 2½% is sodium chloride. The remainder consists of magnesium compounds, calcium sulphate, potassium chloride, sodium bromide and small quantities boron, iodine and lithium salts. The open sea precipitates no salt, but in bays partially cut off from it there is precipitation. In a deposition of this class, gypsum forms the base and anhydrite the top of the salt deposit. Dr. Ochsenius, the great authority on the genesis of the German salt fields, says such a deposition is possible if we take a bay cut off from the sea by a bar so that only as much sea water runs over it as is compensated by evaporation from the surface of the lagoon, and the partially separated portion receives no large additions of fresh water. The sea water running in evaporates, and by the amount of salt it adds, the solid constituents are increased. Against this theory the question is asked why no fossils have been found in the salt formations. The answer Dr. Ochsenius gives is that such organisms, possessing free locomotion power, crossed the bar when the water became too salty for them. This to me does not seem a sufficient answer, as we shall see when describing other fields, such as Wieliczka, where many marine fossils are encountered. However, in the German salt mines not a single fossil has been found.



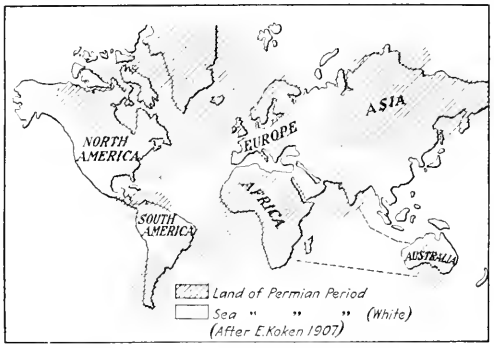
DIAGRAMS SHOWING THE CHARACTER OF THE GEOLOGY OF SOME POTASH DEPOSITS

Deposition of Saline Beds

First of all, gypsum is deposited forming the base. As soon as the saline solution has increased its weight content of salts eleven times, its specific gravity reaches 1.22 and the precipitation of sodium chloride begins. Dr. Ochsenius goes on to say that as the depositing process continues, the greater part of the deliquescent salts remains dissolved in the upper layers and constitutes the mother liquors which contain, along with sodium chloride, the potassium and magnesium compounds; that in the course of the continual growth of the rock-salt beds, and likewise of the mother liquors, the latter attain the level of the bar and commence flowing seaward as soon as their specific gravity can overcome the current of the inflowing sea water. After this stage is reached ordinary sea water can only have access through the upper portion of the bar mouth, the lower part being occupied by the outgoing mother liquors. At this point the last stage of the process begins; that is, the deposition of the uppermost bed of

calcium sulphate in the form of an anhydrite cap. After this the whole character of the bay changes. The dust caused by the disintegration of the neighboring rocks is blown onto it, causing the salt clay to be formed—a material generally to be found covering the potash salts. A case in point is the great bay of Adschi Darja, the narrow mouth of which is partially cut off from the Caspian Sea (Russia) by a bar. The bottom of the lake is covered by a thick salt layer. An analysis of the bed showed no potassium, but on the other hand the water contained 1% of potassium chloride, and in all 28.5% of salts.

Against the bar theory, which allowed of a periodical inflow of the ocean water without allowing the mother liquors to flow back over the bar, Walther says one would have to be able to find organic remains of such life as had flowed in with the water. Such would have been well preserved in the anhydrite or the salt. Out of the 150 mines at work not a single fossil has been found. To the paleontological difficulty of the bar theory must also be added a chemical one; if you evaporate salt water, at first a thin lime sediment is precipitated, then a sediment of gypsum and then rock salt. If, on the other hand, not sea water but another mixed solution of calcium sulphate and chloride is evaporated to dryness, anhydrite is precipitated



LAND AND SEA DIVISION OF PERMIAN PERIOD

and afterwards rock salt. The so-called "stinkstein" may represent the lime precipitated, but above this there is in reality no gypsum, but anhydrite from 50 to 100 m. in thickness.

From this it would seem that the North German Permian Sea was not in open communication with the ocean, but absolutely cut off from it and surrounded by a desert. Which theory be right is not of much importance in the present article: both give us a sound geological knowledge of these Permian salt deposits.

Such depositions are not necessarily limited to tropical places where there has been no rain. It is merely necessary that the evaporation should have been greater than the inflow of fresh water. The polyhalite rings show the changes of the year, and one may reckon that the older rock salt took about 10,000 years to deposit.

(To be concluded)

Dissociation Temperature of Ferric Oxide—C. S. Kinnison "Trans. Am. Ceram. Soc.," 1913, p. 136, states that ferric oxide at atmospheric pressure cannot exist above 1350° C., at which temperature and pressure it dissociates into oxygen and magnetic oxide. When fluxes are present the dissociation temperature is 1210 to 1220° C.

Coal Mining in Spitzbergen

A communication from United States Commercial Attaché Henry D. Baker, at Petrograd, gives some interesting particulars of the coal mining carried on in the island of Spitzbergen, articles on which appeared in the *Journal* of Mar. 20 and June 5, 1915. As the island is about 100 miles north of the northern coast of Norway and in about 80° north latitude, these operations constitute the farthest-north organized industry in the world.

The Coal Mines of the Island

Spitzbergen has a population of about 400 persons, mostly Norwegians, but including several Americans. Practically all the population is engaged in coal mining, the most important operations being conducted at Advent Bay by an American company, which has been working its claims for 10 years and now takes out about 50,000 tons per annum. All this coal, which is said to be of exceptionally high grade, is shipped to Tromsö, in northern Norway, and sold to the Norwegian Government for use on the State railways. There are also three Norwegian companies working claims in Spitzbergen—one at Advent Bay and two at Green Harbor.

To carry out the project of combining all the coal properties in operation under one company, there has been preliminary organization of a syndicate of Russian capitalists in Petrograd, which, at a cost of over $20,000, has already bought options for the right to purchase before Jan. 1, 1916, all the properties and claims in Spitzbergen, including that of the American company. A well-known mining expert engaged by this syndicate sailed in August from Tromsö for Spitzbergen, to spend several weeks in investigating all the claims and properties there. If his report corroborates the present understanding concerning these coal lands, it is the intention to organize in Petrograd a company capitalized for over $4,000,000 to purchase and develop the mines and claims.

Absence of Government at Spitzbergen

The conditions at Spitzbergen are unique, in that this is probably the only inhabited and promising part of the world that is under the sovereignty of no country, has no government of any kind, and no police force, courts, laws or regulations. No person or company can expect to hold or own any property or claim in Spitzbergen unless it is actually worked or occupied. In case of any claim or property being usurped by newcomers, there could apparently be no redress or damages except by the use of force or through negotiations between the governments of which the two claimants might be subjects. In June, 1914, Norway, Sweden, Denmark, Russia, Netherlands, Germany, France, Great Britain and the United States sent representatives to Christiania to organize some form of administration for the island, but they adjourned on July 30 without completing their labors. The proposed resumption of their work in February of this year was prevented by the war.

Communication with Spitzbergen is effected chiefly by means of a steamer which belongs to the American coal company and makes the distance of 100 miles between Tromsö, Norway and Advent Bay, Spitzbergen (one-third of the distance between Tromsö and the North Pole), in about 18 hr. The passage between Spitzbergen and Norway is made only during June, July, August and September, the ice around the island rendering it inaccessible

during the rest of the year. The steamer mentioned can carry a load of 3,400 tons, and makes enough passages during the four months to take away from Spitzbergen the entire annual output of coal from the American mines, as well as to bring to the island needed supplies and equipment.

Mining Conditions on the Island

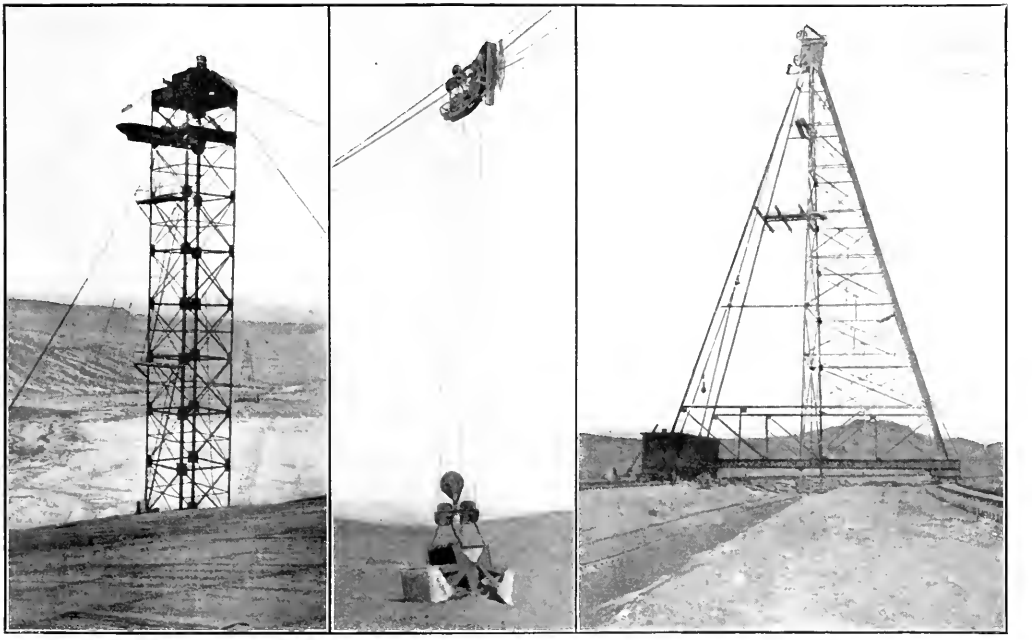
While Spitzbergen is not mountainous, the surface is broken up by hills 400 ft. to 700 ft. high. All the coal so far exploited is found above sea level. Two seams are known and worked. The mining has been so far entirely by adits, and the workings have been allowed to cave as the coal is taken out. As the seams are above sea level and the mining is through adits, there is no hoisting required and the coal can be carried to the shipping docks by gravity. The cost of mining is said to be low, notwithstanding the unfavorable conditions of climate.

As there is no timber on Spitzbergen, all the timber used for dwellings or for mining purposes has to be brought from Norway. Most of the food also is imported but there is a fairly plentiful supply of fish, seal, reindeer and white bear. The climate, notwithstanding its extreme cold, is said to be remarkably healthful, and there is little or no sickness there. Moreover, the conditions of mining are exceptionally safe, owing to the fact that explosions of gas never occur; the mines are free from water or dampness. The frozen condition of the ground and the location of the mines above sea level account for the absence of moisture. Although Spitzbergen has never been carefully explored or carefully studied except near the coast, surface indications point to the presence of many hundred million tons of coal in this remote northern part of the world.

Temporary Traveling Cableway for Tailings Reclamation

A radial traveling, electrically operated cableway of 1,290-ft. span, erected last year, according to *Engineering News*, Oct. 14, 1915, is now in operation at the Goldfield Consolidated Mines Co., Goldfield Nev., for the transportation of tailings from a large dump to the mill for re-treatment. The tailings have been dumped at the present location since 1909 and cover 75 acres.

The radial traveling tower of the cableway is 125 ft. high, and the head tower is 160 ft. high. The tail tower travels through an arc of 109° 10′ about the head, or pivot, tower. Owing to the uneven nature of the ground over which the tail tower travels, it has been found necessary to build a steel trestle in some places to carry the trackway. In the remaining portion the tracks are laid on the ground. The cableway operates a 4-line, 3-yd. Andresen-Evans bucket, weighing 9,800 lb. The cableway is operated 16 hr. per day in two shifts and delivers 1,000 tons to the mill, which runs continuously to handle this amount.



CABLEWAY FOR RECOVERING TAILINGS AT THE GOLDFIELD CONSOLIDATED MILL, GOLDFIELD, NEV.

The grab bucket digs the deposit, conveys and dumps it into a receiving hopper in front of the pivot tower, at a considerable elevation above the tower base. This hopper is mounted to move radially with the cableway travel. From this first receiving hopper a trough on a radial line delivers to the final receiving hopper.

The three-drum hoist is of the same style as three electric hoists built for the United States Reclamation Service, for use on the Rio Grande project, Elephant Butte, N. M. Each drum is 53 in. in diameter and the motor is of 300 hp., for three-phase 60-cycle current at 440 volts. The main cable is $2^{3}/_{4}$ in. in diameter.

Newfoundland's Mineral Resources

By P. B. McDonald*

SYNOPSIS—Besides important iron mines, Newfoundland has given evidences of having a wide variety of minerals. Conditions under which they may be located are easy but there has been comparatively little development, except in iron, copper and pyrites mining. The last two have been decadent until recently, but the iron mines of Bell Island, which extend under the sea, have been actually exploited by the Dominion and Nova Scotia Steel companies for over a decade.

The island of Newfoundland, which is a British colony separate from Canada, contains 42,000 sq.mi., is the tenth island of the world in size and has a population of a quarter of a million. The bulk of the people live between St. Johns and Notre Dame Bay inclusive, on the extensive coast and numerous islands of Conception Bay, Trinity Bay and Bonavista Bay. There are a few settlements on St. Marys, Placentia and Fortune Bays on the south coast, but most of the western half of the island is a barren solitude. The Reid-Newfoundland Ry., built and operated by the Reid family of St. Johns, which received enormous land grants for this construction, maintains almost daily service across the island, 546 mi. from St. Johns to Port-aux-Basques in the southwest corner, where connection is made with the Reid steamers plying across the Gulf of St. Lawrence to North Sydney, Nova Scotia—a sea voyage of nearly a hundred miles. A convenient means of travel to St. Johns from New York is by the steamers of Bowring & Co.'s Red Cross Line; steamers can also be taken at Halifax or Montreal. The sea voyage in the summer is pleasant and cheaper than by the rail route. From St. Johns to the northern bays there is good coastal-steamer service; to the south-coast ports there are occasional steamers.

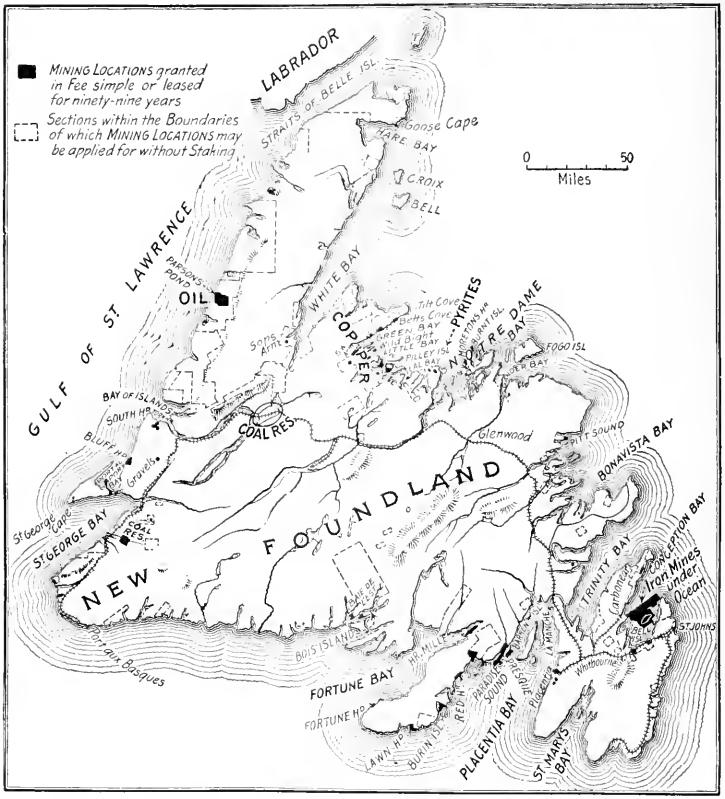
Since the European war began, both English and American mining men have taken increased interest in the opportunities for securing staple and minor minerals in Newfoundland. The principal regulations governing the taking up and operating of mining claims are:

Anyone (not necessary to be a resident) can prospect, stake or take up claims.

A claim is 1x½ mi. and is marked by one discovery stake.

Payments to the government at the Crown Land Office in St. Johns are—$10 per claim on staking and recording; $20 in one year; $30 per year for the next five years; $50 per year for the next five years; $100 per year thereafter. The expenditure of $6,000 on mining during the first five years of the lease entitles the holder of a claim to a grant in fee simple.

The workmen's-compensation law requires an operator to arrange with an insurance company to indemnify workmen in case of accidents, or satisfy the government officials of his ability to pay any liabilities incurred.



MAP OF NEWFOUNDLAND, SHOWING IMPORTANT MINING LOCATIONS

Operators should report to the government engineer in St. Johns to conform to the reasonable provisions of the mine-inspection acts.

Nearly all the minerals found in the Appalachian region have been observed in Newfoundland. Iron ore, coal, copper, oil, gold, pyrites, barytes, chrome-iron, talc, asbestos, gypsum, zinc, antimony, silver-lead and other ores have been reported, practically all close to the coast.

*Mining engineer, North Scituate, Mass

With the exception of the operations of an English company or two in copper mining in Notre Dame Bay, the iron mines of Bell Island constitute the only mineral development of any size or permanence. Since 1861, copper ore to the value of $20,000,000 has been exported. The extensive coal deposits in the southwestern part have been reported by engineers to be of excellent quality and quantity, but they have never had opportunity to prove it on a commercial scale. The petroleum fields of the west coast are believed to be valuable but attempts to drill them were mismanaged.

Bell Island and Submarine Iron Mines

The famous submarine iron-ore mines of Bell Island in Conception Bay, operated by the Dominion Iron and Steel Co. and the Nova Scotia Steel and Coal Co., can only be compared in method of occurrence and extent of resources to the slightly dipping ore seams and tremendous reserves of Red Mountain in the Birmingham Valley of Alabama, with the difference that the Newfoundland ore is of much higher grade than the Southern ore. Between 1,000 and 2,000 miners are employed in good times at these iron mines and the Nova Scotia company ships to Europe, Canada and the United States. Equipment, labor conditions and transportation facilities are first-class.

The first iron ore was shipped from Bell Island in 1895 when the Nova Scotia Steel and Coal Co. commenced work. In 1899 this company sold a part of its holdings to the Dominion Iron and Steel Co. Both companies possess large ore reserves. The latter company uses the ore in its works at Sydney, N. S. The Nova Scotia Steel and Coal Co. uses some of its own ore at Sydney and also sells ore extensively in Europe and America. J. P. Howley, government geologist of Newfoundland, estimates the Conception Bay iron ore at over three billion tons. There are in all 12 seams of ore interstratified with shales and sandstones. The maximum height stoped in the mines is 30 ft.

Copper and Other Minerals

Copper mining began in earnest in 1864 when the Union mine at Tilt Cove was opened; in 1875 the Bett's Cove mine and in 1878 the Little Bay mine were opened. All three are in Notre Dame Bay. English and Cornish miners were brought over by the Cape Copper Co. At one time this company operated a smelting plant at Tilt Cove, but it did not succeed. Much of the copper ore was shipped to Swansea, Wales, to be smelted. Other copper prospects have been worked at York Harbor on the west coast, at Bay of Islands by the Western Copper Co., and at Goose Cove in Hare Bay near the northern extremity of the island by an English company.

Gold was prospected at Mings, north of Cape St. John, in 1904-5-6; and at Sops Arm in White Bay in 1903. Several thousand dollars' worth of gold was produced at these two places. A few thousand tons of antimony ore (stibnite) was mined at Moreton's Harbor on New World Island in Notre Dame Bay several years ago. Manganese in low-grade deposits has been prospected along the south side of Conception Bay near the Reid-Newfoundland Ry. Over half a million tons of pyrites running better than 50% sulphur was taken from Pilley's Island in Notre Dame Bay between 1883 and 1907 and shipped to New York for the manufacture of sulphuric acid. Chromite was mined from 1895 to 1899 to the extent of 6,000 tons of good-grade ore near Port-au-Port Bay on the west coast; other deposits of chromite are known to exist at the headwaters of the Bay d'Est and Gander rivers, but are far inland. A lead mine at La Manche, Placentia Bay, produced 18,000 tons of ore in 1893; other operations for galena were at Lawn and Little Placentia on the same bay. In 1902-3-4, Newfoundland produced 6,000 tons of barytes; in 1904-5 talc to the amount of 6,000 tons was shipped from near Manuels, Conception Bay, to Portland, Maine. Several hundred barrels of petroleum have been pumped from the Parson's Pond oil fields on the west coast on one or two occasions since 1904.

Interior of Island a Wilderness

The interior of Newfoundland is a succession of stunted forests, desolate "barrens" and masses of rock of all shapes and sizes; it is very poorly drained and much of the surface is covered by water in one form or other. The coast line has been compared to that of Norway, being much indented by fiords and coves, which sometimes extend for surprising distances inland. The scattered population does little to alter the natural conditions of the country. The inhabitants take things as they find them and road-making, draining and building are neglected.

The drawbacks to mine developments in Newfoundland include: Lack of roads, wildness and lonesomeness of the interior, absence of interest on the part of the people in everything except fishing. The advantages are: Ocean freights, good labor conditions, nearness of the coal mines at Sydney, Nova Scotia.

How a Utah Mining Contract Was Interpreted

By A. L. H. Street*

A contract for driving a tunnel in a Utah mine gave rise to a dispute as to its proper interpretation on two points—one relating to the number of men required to be kept at work, and the other as to the right of the contractor to ore encountered in the undertaking. (Arkoosh vs. Sorrenson, 150 Pacific Reporter, 959.)

The defendant was the contractor, and his agreement obligated him to employ in the construction of the tunnel at least four men per day, working 20 days each calendar month. The plaintiffs, the mine owners, terminated the contract on the ground that men to the required number were not kept at work. The defendant, in denying breach of the contract on his part, admitted that at times fewer than four men were working, but made the ingenious claim that since an 8-hr. shift constituted a day's work it was sufficient that 80 shifts be worked in the 20 days. But the Utah Supreme Court holds that this was not sufficient, saying: "It requires no argument to show that four men who are competent miners working 8 hr. each day in a mine will accomplish more in the long run than two men working 16 hr. each day in the same mine, and especially in forcing a tunnel through solid rock." Accordingly, it is held that the plaintiffs were justified in terminating the contract for the defendant's failure to keep four men at work.

*Attorney at law, Security Building, Min[illegible]

As to the ownership of ore removed in the process, the contract provided that ore forming part of the cubical contents of the tunnel should belong to the defendant, as contractor; but he was not permitted to stope any veins, lodes or ledges without the written consent of the plaintiffs, as owners. By another provision of the contract the defendant was given "the right to drive other and smaller tunnels in any and all portions of the" claims. Under these provisions the court decided that ore taken by the defendant from an old tunnel or stope, which had existed for a long time on one of the claims, belonged to plaintiffs and not to him.

The Kenai District, Alaska

SEWARD CORRESPONDENCE

Projecting southward into the Gulf of Alaska between Prince William Sound and Cook Inlet, the Kenai Peninsula is approximately 175 mi. in length, with a maximum width of about 100 mi. Over one-half of its area is occupied by the Kenai Mountains, which rise to an average height of 4,000 ft. above sea level. The valleys are deep and relatively narrow, but in general are well timbered up to an elevation of 1,200 ft. Inasmuch as the divide is near the eastern side of the peninsula, the longer streams flow west and north, emptying into Cook Inlet or one of its arms. East of the divide the streams are frequent but short, the largest being but about 25 mi. in length. Waterfalls are numerous and water power abundant. The country rock is mainly slate or graywacke.

REGION INCOMPLETELY PROSPECTED

The Alaska Northern R.R. (now taken over by the Government), extending northward from Seward to Kenai Lake and beyond to a distance of 71 mi. from its terminal at the head of Resurrection Bay, renders accessible a region incompletely prospected as yet, but which promises to be the scene of greatly increased mining activity during the coming year. Along the route of the railroad many valuable quartz claims have already been located.

A group of claims located 4 mi. north of Seward and about 1 mi. west of the railroad has veins 2 ft. and over in width, besides many narrow stringers rich in gold. The development work consists of about 200 ft. of tunnels. Some ore has been shipped with good results. The mine has been idle this season, but the owners contemplate the erection of a small stamp mill next spring.

A group of claims located 13 mi. north of Seward and 2 mi. west of the railroad has a vein of high-grade ore between 2 and 3 ft. wide. A 100-ft. tunnel has been driven.

The Primrose mine, located 16 mi. north of Seward and 4 mi. west of the railroad, has a vein of high-grade ore with a maximum width of 7 ft. Development work consists of about 450 ft. of tunnels with connections between the upper and lower workings. There is a Little Giant stamp mill upon the property, but it has not been in operation this year.

The Blue Belle mine, adjoining the Primrose on the north, has a vein of ore similar to that in the latter mine. Tunnels have been driven to the extent of about 350 ft. A Little Giant mill has been in operation during the summer.

A group of claims located near the southwest end of Kenai Lake, about 2 mi. west of the railroad, has a vein averaging 3 ft. in width. The development work consists of opencuts and about 200 ft. of tunnel.

A group of claims located 18 mi. north of Seward, near the railroad, has a 2-ft. vein of high-grade ore. Opencuts and about 100 ft. of tunnel constitute the development.

A group of claims located 21 mi. north of Seward, near the railroad, has a vein from 2 to 4 ft. in width, which has been uncovered on the surface for a considerable distance. A 200-ft. tunnel has been driven.

The Skeen-Lechner mine, located 25 mi. north of Seward, 3 mi. east of railroad, has a vein of good ore from 2 to 6 ft. wide. There are about 1,500 ft. of tunnels, stopes and shafts. A battery of four stamps and a Lane mill have been idle this season, the property having been in litigation.

The Kenai-Alaska mine, located on the same mountain as the Skeen-Lechner, has a vein from 2 to 4 ft. wide. There are about 1,700 ft. of tunnels and stopes. A five-stamp mill has been in operation all summer, the ore being conveyed from the mine by a 6,000-ft. aërial tram.

A group of claims located 27 mi. north of Seward, 4 mi. east of railroad, has a vein of rich ore from 2 to 4 ft. in width. Development work consists of between 150 and 200 ft. of tunnels. A few tons of ore have been shipped with profitable results.

The Gilpatrick group of seven claims, located 29 mi. north of Seward, 15 mi. west of the railroad, between Slate and Summit Creeks, has several veins of rich ore from 1 to 5 ft. in width. About 600 ft. of tunnels have been driven. An arrastre on the property has been used at intervals during the present summer. Felix Brown, of Seattle, who has an option on these claims, has taken out some exceptionally rich ore recently and proposes to erect a stamp mill and tramway next season.

An extension of the Gilpatrick claims was located this season by Messrs. Skeen and Stevenson, who subsequently gave an option to J. Ronan. The vein, while narrow, is extremely rich as far as it has been exposed.

DREDGING ON SIX-MILE CREEK

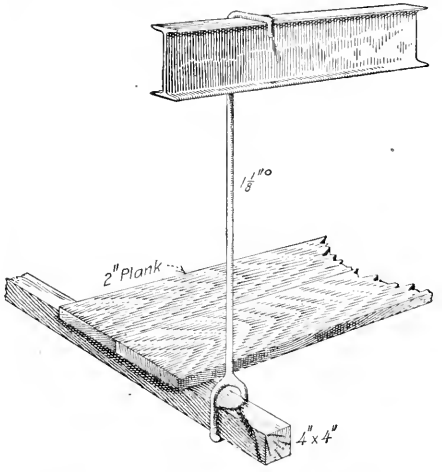
Most of the placer operations on the peninsula have been confined to the northern portion west of the divide. Charles Herron has been dredging on Six-Mile Creek near Sunrise, but has been bothered considerably by the presence of large boulders. On Resurrection Creek near Hope, several small hydraulic plants have been in operation. Among other operators might be mentioned the Matheson Bros., who have recently brought in a steam shovel for the purpose of excavating a ditch to increase the water-supply, and Gus Seiffert, who has been operating with good results upon the ground adjoining the Mathesons' property. Numerous small operators have been working upon the streams mentioned, on Bear Creek, on Cañon Creek, on Cooper Creek and on various streams draining the Kenai Lake area. The quality of the gold recovered varies considerably, that secured from Bear Creek running about $15 per oz., while that taken from Cooper Creek runs as high as $17.50 per oz.

Venezuelan Mineral Exports in 1913 have been officially reported as follows: Asphalt, 81,651,224 kg.; copper ore, 15,358,602 kg.; gold, 732 kg. The increase in asphalt exported was more than 30,000,000 kg. over the previous year.

Details of Practical Mining

Staging Hangers for Riveters on Structural Work

Slinging a staging for riveters on structural ironwork is too often done with ropes, which are both unsatisfactory and unsafe. A cheap and convenient hanger, shown in the accompanying sketch, is made of 1⅛-in. round iron, with a large eye at the lower end and a hook at the upper end to hook over the I-beams or other structural members. Through the eye is inserted a 4x4 timber on top of which



STAGING FOR STRUCTURAL-IRON WORKERS

2-in. planks are laid, and the result is a perfectly safe, convenient and satisfactory staging. The cost of these hangers is small, they are light and can be handled easily, and they are not liable to destruction and can be used on any subsequent work.

Electric Squibs for Igniting Black Powder*

Electric squibs for black powder, as manufactured by the Du Pont company, consist of a paper shell, in one end of which is fastened the igniting composition and the insulated copper or iron wires, the other end being open. The paper shells are made in the shape of a truncated cone, in order that a blasting cap may be inserted in the shell and be more tightly wedged the farther it is inserted. It is therefore not necessary to crimp the blasting cap in the shell.

Without the blasting cap these squibs are used to ignite blasting powder electrically, but they can be used to detonate dynamite by using them with a blasting cap. By their use, it is possible to ignite a charge of blasting powder in the center, the ideal position, which secures the maximum efficiency of the explosion, impossible with either fuse or miner's squibs.

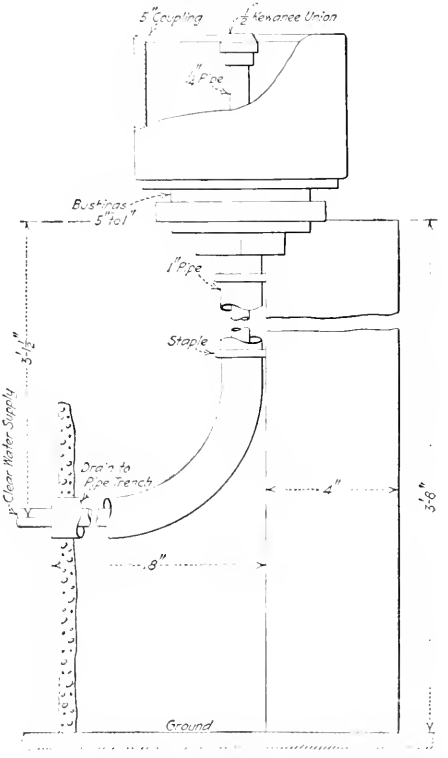
Several charges can be ignited at the same time if desired, with a considerable saving of explosives. Then, too, the charges can be ignited at the time desired and when everyone is in a safe place. They are as cheap as fuse and said to be far superior.

*From information furnished by the manufacturers.

Drinking Fountain for a Mine

By D. E. Charlton*

The fountain illustrated herewith is simple in construction, applicable for underground or surface use and may be made from material generally on hand at the



A SIMPLE DRINKING FOUNTAIN

mine. The cup is made of a 5-in. coupling, although smaller sizes may be used. This is fitted with bushings at the lower end and reduced to connect with a 1-in. pipe which acts as a drain, taking care of the overflow of water. The fresh water enters through the ¼-in. pipe that passes

*Mining engineer, Virginia, Minn.

through the 1-in. pipe, as shown in sketch. The male end of a Kewanee union will serve as a suitable nozzle if placed on the end of the ¾-in. pipe. The apparatus is firmly supported and held to a wooden post by means of staples.

Scheme of Diamond Drilling at White Pine

The extensive drilling campaign at the White Pine Extension is rapidly nearing completion. Some months ago the company let a contract for 75,000 ft. of diamond drilling, the largest single contract for drilling ever let in the copper country.

The work was laid out on broad lines and this plan has been strictly adhered to. It consisted of one line of holes, spaced 1,000 ft. apart, to cut the copper-bearing beds at a depth of about 400 ft. from the surface on their dip; a second line of holes, spaced 1,000 ft. apart, to cut the beds at a depth of 800 ft.; and a third and final line of holes, 1,000 ft. apart, to cut the beds at a depth of 1,200 ft. The second line of holes was located halfway between the holes of the first, and the holes of the third line were placed 250 ft. from the second. When this drilling is completed, therefore, it will give lines of holes along the strike at intervals of 250 ft., 250 ft. and 500 ft., then repeating this sequence, cutting the formation at depths of 400 ft., 800 ft. and 1,200 ft., respectively.

To date, the lines of 400-ft.-deep and 800-ft.-deep holes have been completed for a distance of 15,000 ft. (nearly three miles) along the strike. In all these holes not a single one failed to disclose commercial copper rock. The first hole on the 1,200-ft.-deep line is completed and shows the same character of formation with the same copper content. In this hole the copper-bearing shale bed shows an increase in thickness of 33⅓%, but with no noticeable difference in copper assay.

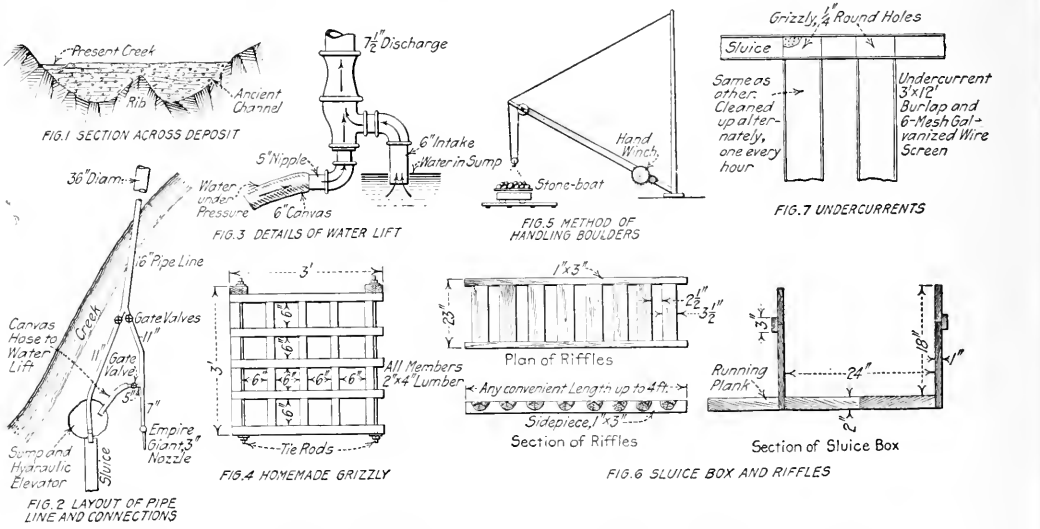
The drilling will be completed when the remaining 1,200-ft.-deep holes are finished. There are four drills working two shifts each on these deep holes at present. There are six drills altogether working on the property. Including the time lost in moving, the drills make about 50 ft. each per day of 24 hr.

Within 60 days the drilling will be completed. Active mining operations will then start with the sinking of one large four-compartment shaft.

Gold Bar Hydraulic Mine

By Hubert I. Ellis*

Gold mining in the state of Washington, outside the Republic district, has never attained great importance. Blewett, Swauk and certain deposits in the Cascades proper have made small productions from time to time, but the industry has been at a standstill for a number of years, with no prospect of immediate improvement. The Blewett district, with a total production variously estimated at three quarters of a million to two million dollars, is practically dead at present, except for the Gold Bar hydraulic mine.



FIGS. 1 TO 7. DETAILS OF EQUIPMENT AT GOLD BAR HYDRAULIC MINE, BLEWETT, WASH.

To cut the beds at a depth of 800 ft.; and a third and final line of holes, 1,000 ft. apart, to cut the beds at a depth of 1,200 ft. The second line of holes was located halfway between the holes of the first, and the holes of the third line were placed 250 ft. from the second. When this drilling is completed, therefore, it will give lines of holes along the strike at intervals of 250 ft., 250 ft. and 500 ft., then repeating this sequence, cutting the formation at depths of 400 ft., 800 ft. and 1,200 ft., respectively.

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The Gold Bar group includes four placer claims on Peshastin Creek, extending downward from the town of Blewett, which is reached by an 18-mi. stage road from Leavenworth, a station on the Great Northern Ry. A large proportion of the gravel consists of big boulders that interfere greatly with hydraulicking. Work has been started at the lower end of the group of claims, where the gravel deposit is divided by a central "rib" of rock, as shown in Fig. 1. It is planned to work the ground on the right-hand side of this rib first and then to divert the creek into the worked-out portion and mine the other half.

*Mining engineer, Kellogg, Idaho.

Water is obtained from Peshastin Creek, which has rather a high gradient, and is carried by flume along the left limit of the creek to the upper end of the pipe line, which is 1,600 ft. long. The diameter of the pipe at the intake is 36 in., decreasing to 16 in. where it branches, as shown in Fig. 2. The head is very low for the heavy gravel, being only about 75 ft.

During spring and early summer, when there is an abundance of water from melting snow, it is planned to use a 3-in. Empire giant and a hydraulic elevator for raising the material to the sluice boxes. After the cut has been started, small sluice boxes will be placed in it when water is low and the gravel will be shoveled in by hand. A rough wooden grizzly with 6-in. spaces (Fig. 4) is placed before the elevator intake to prevent clogging by boulders too large to pass the neck. A small water lift, details of which are shown in Fig. 3, has been installed in the cut to remove excess water. Large boulders are removed by means of a 3x4-ft. "stone-boat" and a truck running on a wooden track. The stone-boat is loaded in the cut and swung on the truck by the hand winch and boom shown in Fig. 5. Larger boulders are lifted by chains without the stone-boat.

The main sluice consists of seven boxes and two undercurrents. The boxes are 24 in. wide and 18 in. deep, and are set with a grade of 5 in. to the box length, 12 ft. Transverse riffles hewed from round poles, 3½ to 4 in. diameter, are employed. Details of boxes and riffles are shown in Fig. 6. The undercurrents, Fig. 7, are of the usual transverse type and are 3 ft. wide by 12 ft. long. The grizzlies are of sheet iron punched with ¼-in. round holes. For saving fine gold the undercurrents are fitted with burlap held down by 6-mesh wire screen.

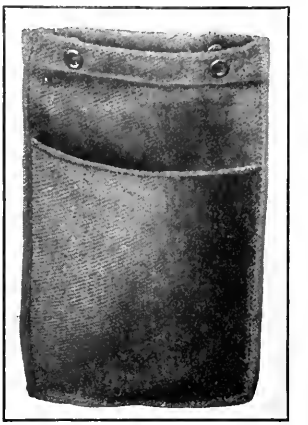
The success of this enterprise—the management of which has shown considerable ingenuity in dealing with local conditions in such manner as to limit the capital outlay as much as possible—depends of course on the gold content of the gravel. Owing to lack of preliminary prospecting, made difficult by the nature of the material and the abundance of water, the operators considered it advisable to go ahead on a small scale, doing all their own work, as far as possible, until the feasibility of working the ground at a profit has been demonstrated. The small extent of the deposits, the abundance of large rocks, the uncertainty of the water supply, the low head at present available and the necessity of shutting down during winter are the chief difficulties in the way of successful operation. George Dennison, one of the partners, is the manager.

Peculiar Accident at an Old Butte Mine

Overcome by foul air, the presence of which he did not suspect, and falling from a ladder when not more than 8 ft. from the surface, Frank Romaldi was killed Aug. 24. He recently went to Butte to go into the leasing business with two partners. They heard that the Little St. Lawrence mine in Northwest Butte was to be had and went out to investigate the shaft. Romaldi concluded to try the ladder while his partner watched him descend. Romaldi's candle went out when only 8 ft. below the surface; he let go his hold and with a scream for help shot into space. Realizing that the shaft was full of foul air, Romaldi's partner called for help, and a first-aid team was sent from Anaconda mine. Two men equipped with Draeger helmets descended the shaft, tied a line around Romaldi's body and brought it to the surface. The body was only slightly injured, showing that death was caused by suffocation.

Bag for Dynamite and Fuse

Wallace McKechan, safety inspector of the Copper Queen Consolidated Mining Co. and a leading member of the American Mine Safety Association, with the approval of the central safety committee of the company, recently designed the bag here illustrated for the carrying of powder and fuse. The sack is made of heavy jute and is sewn with flax thread, so that it is exceptionally durable. From 50 to 70 sticks of dynamite can be carried in the bag proper, the fuse being placed in the outside pocket. Large brass eyelets are fastened into the top of the sack for convenience in handling and carrying. It was noted by the management of the Copper Queen mines that all dynamite when handled in quantities of less than a box was carried in any way which would suit the convenience of the miner, it generally being tied together with a piece of fuse. Capped fuse was carried in the miner's hand or wrapped around his hat or thrust loosely in his shirt front. All these methods were exceedingly dangerous, and since the bag has been introduced these bad practices have ceased. The sack is made by the Bemis Bros. Bag Co., St. Louis, Mo., and sells for 35c. in 100-bag lots. The size of the bags is 15x22 in. outside measurement.



BAG FOR EXPLOSIVES

Shoveling and Tramming in the Joplin District*

In the zinc-lead mining district at Joplin, Mo., broken rock or dirt is shoveled into buckets of from 1,000- to 1,650-lb. capacity. Most of the dirt is small enough to be handled with a shovel. Boulders that cannot be broken with a sledge are broken with powder, this practice being called "boulder topping." The shovelers, or "cokeys," as they are called, are paid by the bucket, and they load all the way from 30 to 70 or 80 buckets in 8 hr. There are some records of 90 and 100 buckets per shift. The average for all of the sheet-ground mines is 22 tons per 8-hr. shift per shoveler. Usually the shoveler trams his buckets or small trucks to a switch or lay-bye, where they are later collected and hauled to the shafts by mules.

*From a paper entitled "Sheet-Ground Mining in the Joplin District, Mo.," by Edwin Higgins, presented at Lake Superior Mining Institute, September, 1915.

Details of Milling and Smelting

Zinc in the Cyanide Mill

By A. Dorfmann*

The high price of zinc, in both shaving and dust form, has been causing cyanide operators considerable anxiety since the breaking out of the European war. Since it is fairly well-known that a great deal more zinc is used than is theoretically required for precipitation of gold and silver contained in solution, some method of economizing it has been made the object of a great deal of study. Some have attempted to accomplish the same result by recovering the zinc from precipitate. This article gives the result of some experiments that I carried out at the McIntyre-Porcupine mill in the Porcupine gold district of Ontario. While it does not point toward a remedy for the difficulties encountered, it does show what is actually taking place in the mill. I refrain from comment or suggestion, but merely put these facts in the form of tables and as briefly as possible, hoping that they may suggest some scheme of improvement to those who may be considering the subject.

EXPERIMENT DATA ON ZINC IN CYANIDE SOLUTIONS

Period of experimenting	June 1st to 7th, 1915, inclusive
Ore treated	2,040 tons
Solution used in Hardinge ball mills	2,040 tons
Solution used in closed circuits, tube mills and classifiers (overflow being 71.36% moisture)	5,013 tons
Solution used in agitators	5,013 tons
Pregnant solution sent to precipitation	4,703 tons
Solution sent to decantation units: 1,098 tons solution, primary-thickener underflow, 35% moisture; 4,703 tons barren solution	5,801 tons
Solution discharged with tailings (35.7% moisture)	729 tons
Zinc dust used (dried at 212° F.)	984 lb.
Precipitate (dried at 212° F) recovered	735 lb.

Samples of solution were taken every 24 hr. in proportion to the quantities treated, and at the end of 7 days combined and mixed thoroughly. All zinc determinations were made by potassium-ferrocyanide titration with uranium nitrate as indicator.

ANAYLSIS OF SOLUTIONS USED IN EXPERIMENTS

	Zn. per Ton of Solution
Storage	0.213 lb.
Hardinge discharge solutions	0.157 lb.
Classifier overflow	0.157 lb.
No. 2 Agitator	0.147 lb.
Pregnant solution	0.158 lb.
Barren solution	0.308 lb.
Tailing solution	0.125 lb.
Au precipitated from each ton of solution	$3.658
Or 832.31 oz. or	57,400 lb.
Ag precipitated from pregnant solution	17,393 lb.
Theoretical amount of zinc necessary to precipitate total gold	19 lb.
Theoretical amount of zinc necessary to precipitate total silver	6,178 — 25,178 lb.
Commercial zinc dust used contains	95.04% zinc
Zinc content in 984 lb. used	935.19 lb.

CONSUMPTION OF ZINC IN VARIOUS DEPARTMENTS

1. According to Solution Analysis:		
Barren solution shows an increase of 0.150 lb. per ton of solution. As 4,703 tons was precipitated, the amount of zinc dissolved in press was	705 lb.	
Zinc wasted through secondary reactions	75.4%	
2. According to Precipitate Analysis		
Precipitates contain 32.5% total zinc. As 735 lb. was recovered, the amount of zinc left in press	239.38 lb.	
Zinc dissolved in press (935.19—239.38)	695.81 lb.	
Zinc wasted through secondary reactions	74.4%	
3. According to Zinc Precipitated from Solutions in Mill Operations:		
Zinc precipitated in Hardinge mills (2020x0.231)—(2040x0.157)	150.96 lb.	16.14%
Classifier overflows, 5,013 tons, composed of 2,040 tons Hardinge-mill discharge solution at 0.157 and 2,973 tons of storage at 0.231, equals 5,013 tons at 0.2009 lb. (5,013x0.2009)—(5,013x0.165)	179.96 lb.	19.24%
Zinc precipitated in agitators (5,013x0.165)—(5,013x0.147)	90.234 lb.	9.65%
Zinc precipitated in decantation* system: 4,703 tons barren solution at 0.308 lb. and 1,098 tons at 0.158 lb.—5,801 at 0.2796 (5,801x0.2796)—(5,801x0.231)	281.928 lb.	30.15%
	703.082 lb.	75.18%

* Includes amount of zinc (91.12 lb.) discharged as soluble zinc salt

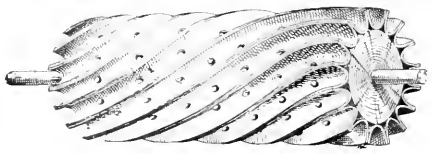
*Mill superintendent, McIntyre-Porcupine Mines, Ltd., Schumacher, Ont.

A New Conveyor-Belt Brush

By K. S. Clarke*

The conveyor belts in a Dwight-Lloyd sintering plant treating flue dust, ore fines and flotation concentrates gave trouble because of material adhering to them. Bristle brushes wore out quickly and were unsatisfactory, but after cutting off the bristles and tacking on strips cut from old conveyor belting, as shown in the sketch, we had no more trouble.

The belting should be stiff enough to spring well, so the blades will be stiff and remain in position. The spiral curve is short, and at least three blades are in contact



DEVICE FOR CLEANING CONVEYOR BELTS

with a 16-in. belt at once. The height of the blades—2 in.—and the distance apart—2 in.—allow for wear, necessary flexibility to save belt wear, and self-cleaning of the brush. The drive is by sprocket and chain from the head pulley.

Converting Leady Copper Matte at El Paso, Tex.

The direct conversion of the high-copper matte made in the lead furnaces of the El Paso Smelting Works, El Paso, Tex., has been carried out for some time in the copper department of this plant. The concentrated matte was formerly shipped to Omaha where the lead contents could be recovered in the baghouse, but the expenses for freight and treatment were higher under certain conditions than the value of the lead recovered. With the installation of a large oil-fired settler for the lead furnaces at El Paso, the collection of the matte was facilitated and the economy of direct conversion greatly increased.

High copper in the leady copper matte—Cu 19.8%, Pb. 12.1%—is characteristic of the usual conditions at the El Paso plant. It had long been customary, according to H. F. Easter,† to set aside matte of this grade until a sufficient amount had been accumulated to make worth while a concentration run. The matte produced during these campaigns usually averaged about 10% Pb and 35

*Coniston, Ont.

†Excerpts from a paper entitled "Lead Smelting at El Paso," presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

to 40% Cu. It was drawn off in handpots, cold dumped, broken by hand and resmelted through the copper-blast furnaces. All this involved considerable expense and it became evident that much of this could be saved if some means were provided for getting this molten leady copper matte direct to the converters. The oil-fired settlers offered a convenient reservoir in which to collect the matte in fairly large quantities, and a pit 10 ft. wide and 8 ft. deep was dug directly in front of the settlers in order to allow the approach of the 5-ton matte ladles serving the converters of the copper department.

The direct conversion of the leady copper matte proved to be such an economy that since the introduction of this system matte has been converted that is much lower in copper than formerly. At the time of writing it was customary to figure the value of the lead contained in the leady copper matte, and therefore lost in converting, as against the cost of roasting and resmelting in the lead furnace, taking into consideration the fact that each unit of copper present means the loss of a certain amount of lead even on a concentration run. Each day's production of leady copper matte is thus disposed of according to its assay, either direct to the converters or poured on the ground in beds, to be picked up, crushed and roasted. As the matte has recently been rather low in lead, most of it has gone direct to the copper converters even though it may not run higher than 20% copper.

Condensing Silver-Refinery Fume by Cottrell Process

In a recent paper before the American Electrochemical Society, Charles H. Aldrich described the experience of the Raritan Copper Works, Perth Amboy, N. J., in using the Cottrell process in the treatment of silver-refinery furnace gases. The gases pass from the doré furnaces to a 4-ft. sheet-iron flue about 40 ft. long, then into a brick flue 6x7½ ft. by 20 ft. long. From this a centrifugal fan driven by a 40-hp. motor delivers the gases tangentially into a settling chamber 16 ft. in diameter by 17 ft. high. An iron flue leads thence to a brick flue, which in turn leads to scrubbers, the Cottrell treater being attached to the scrubber outlet. This Cottrell treater had for its electrodes lead plates and bars (sharpened on the edges).

In this treater a product was recovered assaying: Se, 6.5%; Te, 6%; As, 19%; Sb, 28%; Pb, 9%; Bi, 2%; Cu, 0.9%; Ag, 800 oz. per ton; Au, 1 oz. per ton. The silver condensed amounted to 29.2% of the entire dust-system recovery; the gold to 6.6%. Of the silver treated in the furnaces it was 0.24%; of the gold, 0.022%.

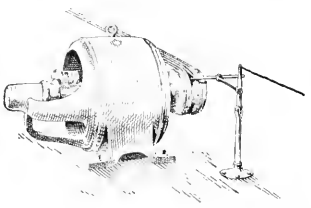
The volume of gas was about 6,000 cu.ft. per min., which required 2.5 kw. at 35,000 to 40,000 volts. One man for two or three hours a day is required to look after the treater. Results on the dry gases coming direct from the furnaces have not been so satisfactory as when the scrubbers were working. The gas temperature with the scrubbers is about 150° F. and about 300° F. without them. The presence of suspended moisture seems to be a very desirable condition but the injection of steam did not give satisfactory results.

However, in building a new treater Mr. Aldrich decided that better results would be obtained in a pipe-shaped treater with a central lead electrode, this metal withstanding both the chemical corrosion due to the gas and fume and electrolytic action. The pipes were 18 in. in diameter by 12 ft. long, made of lead. The discharge electrodes were ⅞-in. steel shafting covered by extrusion with a star-shaped layer of lead. With this apparatus and a voltage of 85,000 to 90,000, over 99% precipitation efficiency has been obtained at a gas velocity of 4.5 ft. per sec. As the remainder of the flue and scrubber system was not changed when the Cottrell treater was added, it appears that the savings given are all a net gain, after deducting costs of working the Cottrell apparatus and the cost of re-treating the fume.

A Failing-Rope Indicator

Machines at the Bunker Hill & Sullivan Mining and Concentrating Co.'s mill at Kellogg, Idaho, are driven by electric motors, most of which are equipped with rope drives. The experience has been that often a rope will commence to fail and unstrand, and before anyone notices it, the loose strand has become wound up in the pulley or shafting and serious damage results.

In order to avoid catastrophes of this sort, a simple scheme has been devised to indicate instantly the beginning of failure of any of the ropes. The scheme is shown in the accompanying sketch. Just back of the motor pulley is placed a stand with a vertical rod hinged so as to be movable backward. An adjustable arm is held by this rod and pedestal and is placed near the revolving pulley. Should one of the rope strands come loose, it will strike the arm a sharp blow, bending it backward at the hinge and loosening the string which is attached to a switch controlling the current. This bending back immediately opens the circuit, cuts off the current and stops the motor. In this way an entirely automatic safeguard is provided, so that no danger is incurred through rope failures.



AN INDICATOR OF FAILING ROPES

Separating Nickel and Copper Electrolytically

In one of N. V. Hybinette's recent patents on the electrolytic separation of nickel and copper, he declares that the inconvenient cathode reactions resulting from the presence of ferrous and ferric salts may be avoided by putting the cathode in a porous cell, and conducting the circulation entirely through the anode compartment (U. S. Pat. 1,123,299). This cathode compartment has a diaphragm of so loose a texture as to be rather a filter than a diaphragm, for instance, a double-walled lead screen having a filling of asbestos. The current is led into and out of the anode compartment. The rate of plating out the copper and of circulating the electrolyte must of course be regulated according to the porosity of the diaphragm.

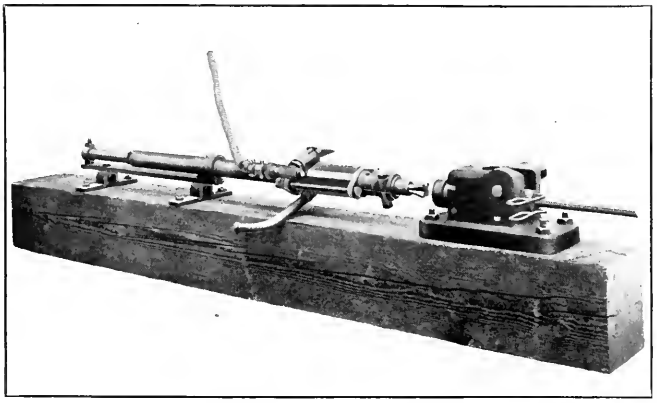
Another patent (U. S. Pat. 1,128,315) designed to lower the amount of circulation required feeds the circulation into the cathode cell, but alternately to its top and bottom.

Mining & Metallurgical Machinery

Machine for Collaring Hollow Drill Steel

The greatest drawback to the use of collared drill steel by the small mine has been the difficulty experienced in forming the collar on new steel. The small user of collared drills has been forced to have his steel made up outside or has been driven to the unsatisfactory expedient of welding a collar on the outside of his steel, which gave indifferent service. The Denver Rock Drill Manufacturing Co. is putting out a collaring machine, so-called, which is really a small and inexpensive device to be used in connection with a stoping drill, both of which are mounted on a piece of large timber by lagscrews, as shown in the accompanying illustration. Any size of drill steel can be used by securing the proper-sized dies.

The drill steel, after being heated for about 6 in. on the end, is placed in a solid movable die and is held in the machine in a split die by a vise wedge. Having gripped the steel firmly in the split dies, the operator by means of the stoping drill mounted in front of the device, gives repeated blows upon the head of the movable die until the shoulder comes up against the face of the machine, when the collar is completed.



DRILL-STEEL COLLARING MACHINE

The device is so simple and so well within the means of the smallest mine that it should find a broad field.

An Improved Vacuum Pump

A new and improved vacuum pump has been designed and built by the Ingersoll-Rand Co., following in general the principles of the "Imperial" air compressors. The principal details are the valves, which in this machine are of the mechanically-moved corliss type; the clearance, which has been reduced to the minimum by making the valve partly fill the port in the cylinder head; and extremely complete water jacketing. The manufacturers claim that these refinements of design enable the maintenance of a vacuum within ½ in. of barometer.

The device occupies less floor space than machines of the straight-line type of similar capacity, because of duplex operation and higher speed. They are built in capacities from 798 to 7,048 cu.ft. per min., both for atmospheric and low-pressure (5 lb.) discharge.

Jeffrey Quad Truck at Victor*

The Portland Gold Mining Co., of Victor, Colo., has recently taken over Stratton's Independence and uses a Jeffrey Quad and a 5-ton truck of another make for haulage. The work consists principally of hauling shipments (less than carload) of miscellaneous supplies from the freight depot in Victor, Colo., up a considerable grade to the various plants on different parts of Battle Mountain in the Cripple Creek district. The grades are heavy, and except for a few months in the summer, the road conditions are as a rule bad.

The operating costs of the Jeffrey Quad for June and July, 1915, were as follows: June, 1915—Gasoline and oil, $42.56; blacksmith labor, $1; miscellaneous labor in maintenance, $22.63; supplies, $1.13, or $67.32. July, 1915—Gasoline and oil, $48.97; supplies, 25c.; miscellaneous labor in maintenance, $10.69, or $59.61.

These figures are for a period during which the Jeffrey truck was doing practically all of the hauling at the mine. There is no record available at the present time of the cost per mile for tires and gasoline, but under Victor conditions both would be heavy.

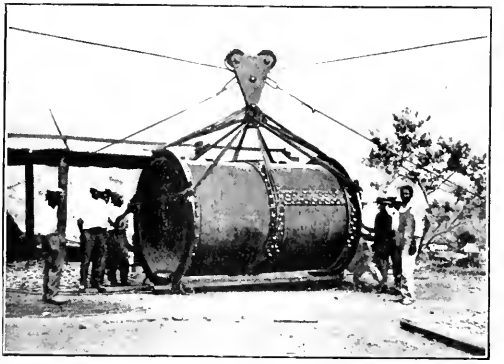
The other truck, which the company has had for several years, has given remarkably good service, considering the conditions under which it has had to operate. However, at the mine the sentiment seems strongly in favor of the Jeffrey Quad for the following reasons:

The Quad truck will carry its rated capacity and deliver it in places where the other truck will not go at all, whereas the latter, with a rated capacity of 5 tons, cannot carry over 2 tons up the hills at the mines. The Jeffrey truck has not been laid up for repairs during working hours for more than 20 min. at a time from Jan. 1 to the middle of August. It is also found that the Jeffrey machine will make faster time than the other car, and further, that it will operate in deep snow at times when the other machine cannot be used at all.

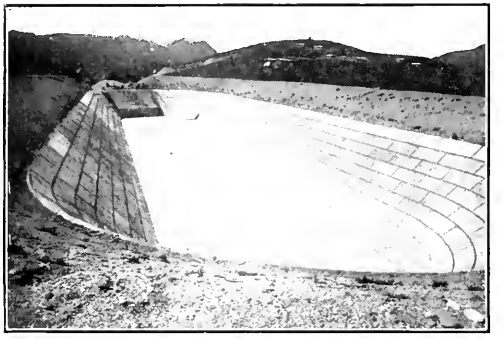
A New 15-Ton Heroult Electric Steel Furnace is to be installed by the United Steel Co. in its works at Canton, Ohio, where it already has a 6-ton furnace in operation.

*From information furnished by H. V. Holman, purchasing agent of the Portland Gold Mining Co

Photographs from the Field

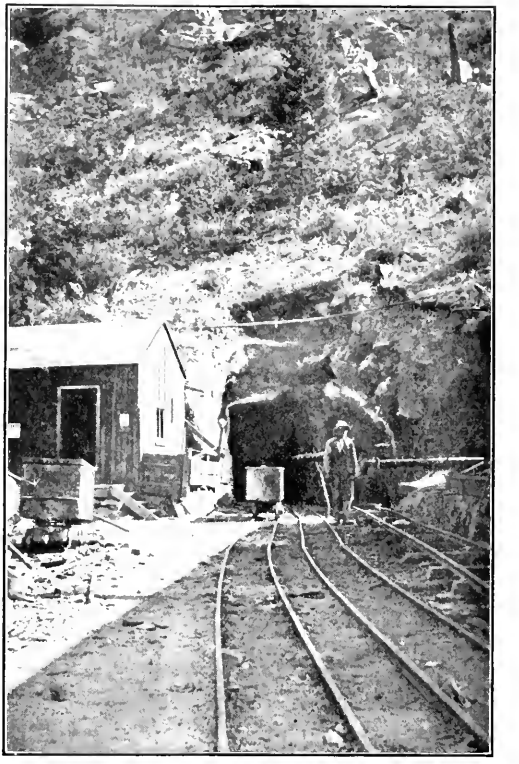


TUBE-MILL SHELL, 6x10-FT., AT ANTIMOK, BENGUET PROVINCE, P. I.



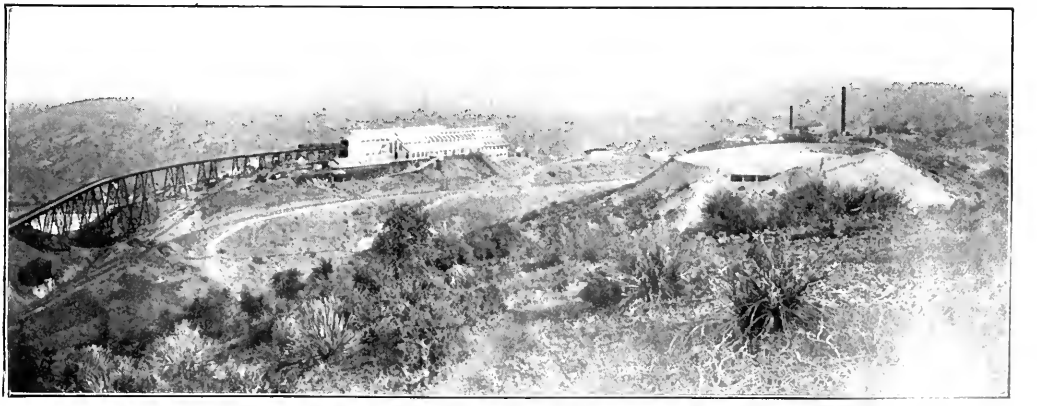
CLOSE VIEW OF THE INSPIRATION RESERVOIR

This large tank is one of the essential features of the Inspiration plant. It has a capacity of 5,000,000 gal.

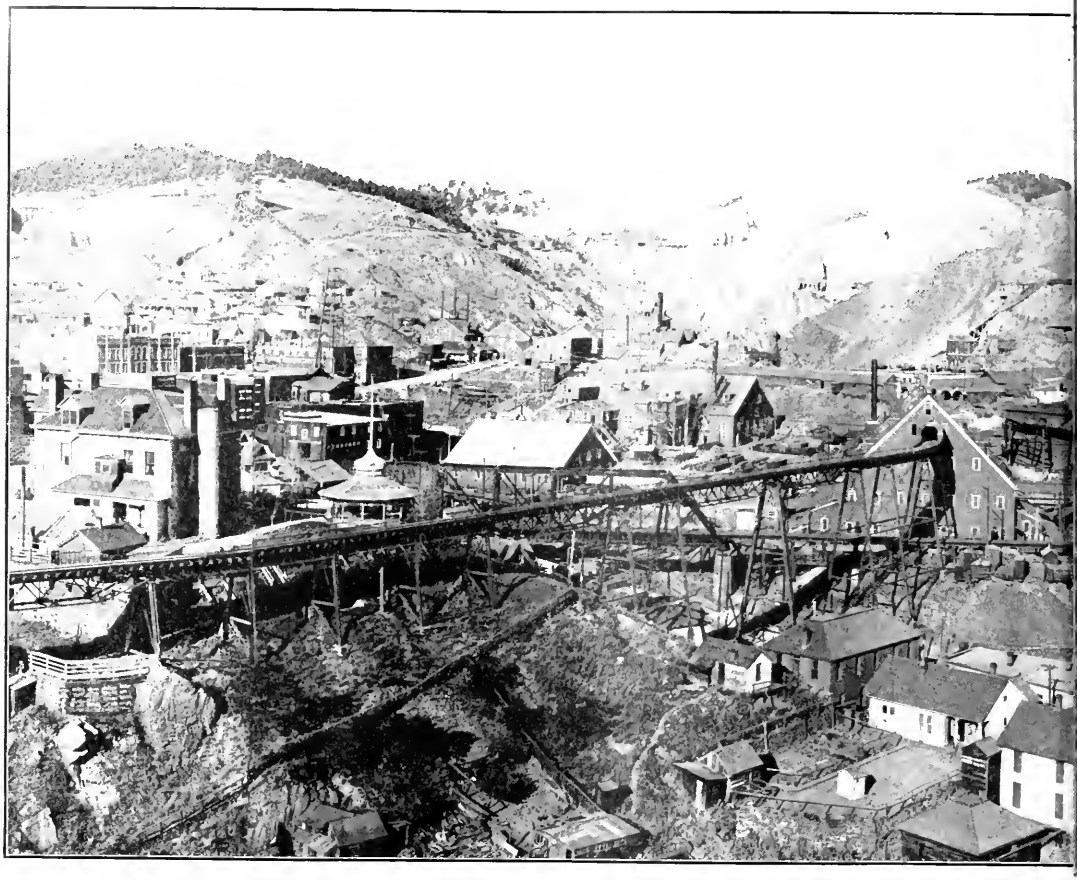


PORTAL OF ROOSEVELT DEEP-DRAINAGE TUNNEL

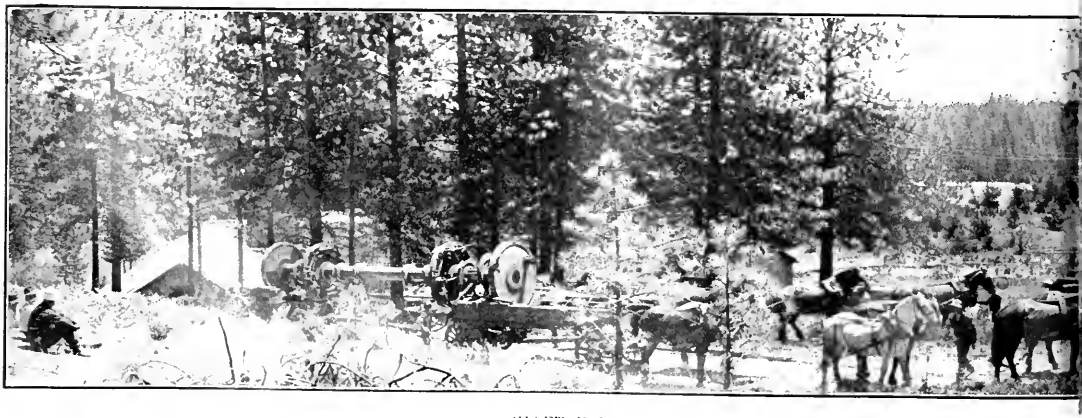
An illustration showing the tunnel at work appeared in the Journal of Oct. 2, 1915



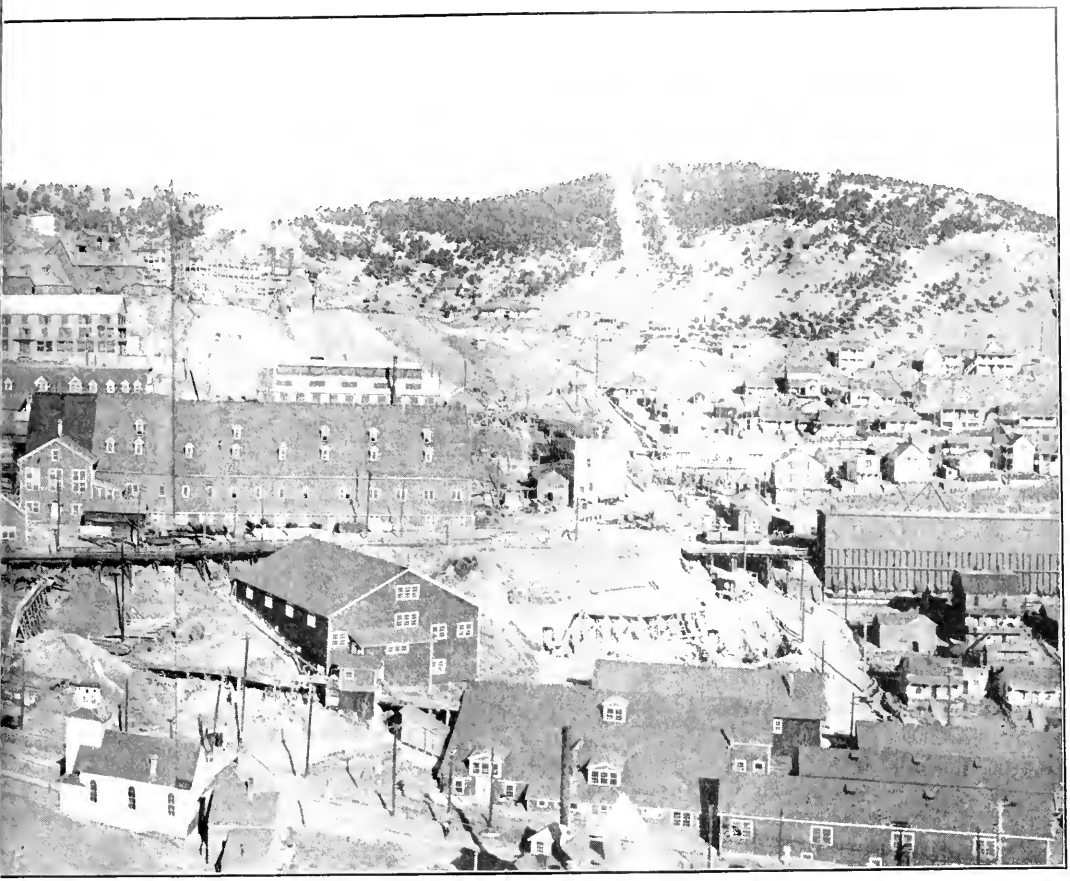
INSPIRATION CONSOLIDATED COPPER CO.'S MILLING PLANT AND RESERVOIR AT MIAMI, ARIZ.



A VIEW OF THE CENTRAL PLANT OF THE HOMESTAKE MINING CO., LEAD, S. D., SHOWING PART OF THE
This well-known property is one of the most important gold-mining operations in the United States. Professional
boiler plant, generator, air compressor and hoist at the B.

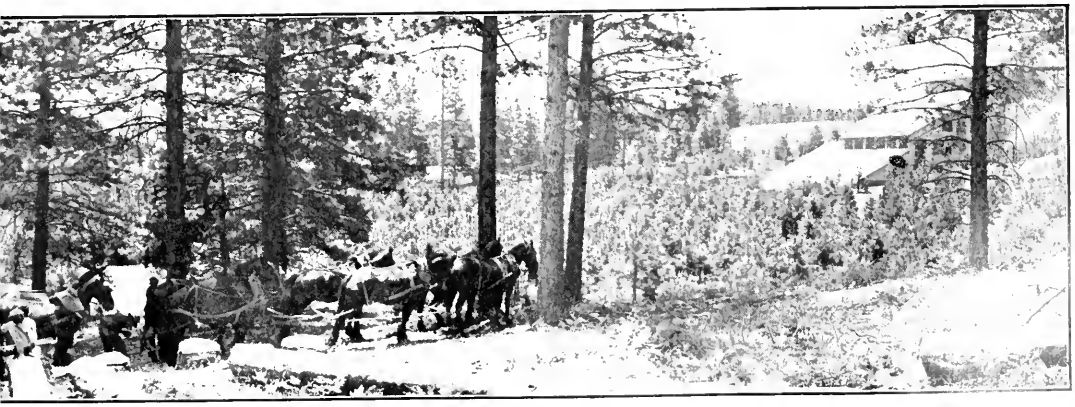


SHAFT FOR THE NEW NORDBERG HOIST AT THE CENTRAL
The shaft had two disks and two clutches attached and weighed a total of 23 tons. It was 30 ft. long,
drivers and six men required. The total cost



TOWN OF LEAD, THE HOMESTAKE OPENCUT AND THE MILLS AND ADJACENT SURFACE EQUIPMENT

attention is periodically directed to it because of important improvement, just now through the installation of a new & M. shaft, which is equipped with a new steel headframe.



SHAFT OF THE NORTH STAR MINES CO., GRASS VALLEY, CALIF.

The trip from Grass Valley station to the mine, 1½ mi., required two days. There were 24 horses, three of handling and wagon haulage was $250.

Correspondence and Discussion

Timbering in New York Subway

In reference to Percy E. Barbour's article in the *Journal* of Oct. 2, on subway timbering in connection with the recent accidents on Seventh Ave. and on Broadway, I agree with Mr. Barbour that the employment of mining engineers in subway work would be advantageous. Their experience would qualify them to meet conditions arising in this class of work. But to quote from the article:

> These subways are being constructed with as little interference to surface traffic as possible. This is accomplished by digging up the surface of the streets, laying heavy timbers and on top of these placing heavy planking, and then, in effect, stoping out the ground underneath these timbers and catching them up on vertical bents or sets with long vertical legs. These excavations vary in depth, and in the two sections where these accidents have occurred they were from 30 to 36 ft. below the surface of the street. Were it not for the fact that street traffic is allowed above excavations, it would simply be an opencut proposition, but with the load being carried on the timbers above it is strictly analogous to underground stoping, with the hanging wall flat but offering very little weight, not nearly so much as would be the case in any ordinary mining operation requiring timbering. The height of this excavation would not be greater than an ordinary four- or five-set stope.

Farther along in the article is a sketch of the timbering at the scene of the Broadway accident and the following comment:

> The timbering as shown in Fig. 2 cannot be said to approach square-set timbering in any way, but it does indicate that square-set timbering could have been used without any inconvenience to subsequent construction—in the way of putting in concrete piers or erecting the steelwork for the permanent structure. This would have afforded complete security against the fall of rock which caused the second accident and would have prevented the collapse of the entire structure if it had been used at the scene of the first accident. Thus two serious accidents causing much damage and loss of life have occurred through overlooking the precautions taken by the miner in his everyday work when confronted by similar problems.

While I do not understand from the foregoing that Mr. Barbour recommends square-set timbering for subway work, he suggests the close analogy between subway timbering underdecking, and underground stoping. I would therefore like to analyze conditions met with in the two cases and point out that square-set timbering could not be adapted to subway use.

Square-set timbering is composed wholly of compression members fitted together to resist pressure from all sides and is locked in position by blocking and wedging against the roof and walls of the opening. It is intended primarily to prevent the fall of rock from the roof and walls, but when reinforced by rock filling will resist heavy pressures. It is not, however, a self-contained structure that would stand alone, unless the members were diagonally braced and tied together. Subway timbering has to be a self-contained structure to a considerable degree, especially in rock cuts. There are the side walls to wedge the structure against, from the floor of the cut, up to the cellar-floor level of the street buildings; and there can be additional bracing against the abutments at the two ends of the excavation, in so far as such bracing would not interfere with excavating operations. Overhead, however, there is only the comparatively light street-structure load, including the weight of pipes and ducts, to wedge against; and the vibration of street traffic tends to shake the entire structure apart.

To use square-set timbering for subway work therefore, from the standpoint of security alone, would mean that the structure could not be securely wedged together and the consequent necessity of a prohibitive amount of tying and diagonal bracing. Also it is obvious that the use of continuous transverse members from side to side of the excavation would be more secure than transverse members built up of short-length members tied together, as would be the case in the employment of the transverse members in square-set timbering.

But there are other practical reasons why square-setting would not apply to subway work. The street decking, tracks and subsurface pipes, sewers and ducts, temporary and permanent, require a special transverse spacing arrangement of posts under the longitudinal joists and beams supporting them, and this spacing does not conform approximately to the regular posting of square-sets. These posts, irregularly spaced transversely, are placed in rows 10 ft. apart longitudinally in the excavation and rest on transverse members which distribute the street-structure loads, in order that a more regular system of posting may be used under the transverse members; also that fewer posts may be employed, so as to interfere to the least extent possible with excavating operations in the lower part of the cut. The 10-ft. longitudinal spacing of posts and transverse members in bents is to conform to construction requirements in erecting the permanent steel bents which are spaced on 5-ft. centers. The timber bents are placed in the center of alternate steel bays, except in the deepest excavations, where 5-ft. spacing of the timber bents is used.

In addition the transverse cross-sections of subway cuts vary constantly, owing to the change of depth of the excavation and, generally, to the constantly varying relative grades of the pairs of local and express tracks. The tracks are in some places all on the same level; in other cases one pair or the other is elevated or depressed, and occasionally one pair is superimposed over the other. These variations compel special arrangements of the cross-members and posts.

From the foregoing it may be seen that in subway timbering nothing like the regular arrangement of members, as in square-setting, could be approximated. The only members of constant length would be the horizontal struts between bents, and only a comparatively few of these are required and of much smaller cross-section than the transverse members and posts. The upper tiers of posts in the bents do not line in with the corresponding lower tiers, which makes necessary the use of continuous transverse members to distribute the loads. There is the added advantage in this arrangement, that continuous transverse members make a more secure structure than would be possible in square-sets.

The best practice in subway timbering therefore includes continuous cross or transverse members to distribute loads, to brace the sides of the excavation and to tie the structure together more securely; the requisite rangers and lagging or sheathing to hold the sides of the excavation; sufficient posting in all tiers and secure vertical diagonal bracing, both transversely and longitudinally, of all tiers of posts; sufficient struts or spacers and adequate street structure. JOHN SEWARD.

West Nutley, N. J., Oct. 7, 1915.

Although Mr. Seward in his communication on the subject of "Timbering in New York Subway" agrees with me as to the advantage of employing mining engineers for handling mining-engineering problems in subway work, he seems to have missed the point of the argument, and in his communication loses himself in a detailed discussion of the timbering, which he views solely from the point of the subway engineer; he, himself, having designed one section of subway timbering, according to a letter in the *Tribune*.

I do not want to enter into a discussion of the details of square-set timbering, but would call his attention to the following in the editorial columns of the *Journal* of Oct. 9: "We are not to be understood as recommending that the New York subways during construction ought to be timbered by the square-set method. Without any doubt a study of the problem would result in the development of a special method which might be a modification of the square-set system."

My citation of the square-set system of timbering developed on the Comstock lode more than 40 years ago was intended to show that there was no excuse for not providing an adequate system of timbering in the subway, inasmuch as mining men have known for more than 40 years how to support the most difficult kind of ground. The system of bents used in the section of the subway under discussion, together with the girts between the bents, suggested in a remote way square-set timbering, but emphasized in a distinct way that the subway engineers did not use the judgment which the mining man shows in putting in timber.

The statement that square-set timbering "is not a self-contained structure" applies only if one considers it in the nature of a house, which it is not. Square-set timbering underground is certainly self-contained when it is properly wedged in place and it is not intended to be used any other way. But square-set timbering *per se* is not recommended, as has been already stated.

He also states that "it is obvious that the use of continuous transverse members from side to side would be more secure than transverse members built up of short-length members tied together." Theoretically true, perhaps, but 60-ft. members such as would be required in the subway are a scarce article. Apart from the mere physical difficulties on this point, which will be passed over just now, whether a continuous transverse member from side to side of the excavation would be better than square-setting need not be discussed, since what was used does not come within the definition. As per the sketch in my article quoted (reproduced on page 689 of this issue), the only long transverse member used was one composed of two 24-in. I-beams at the ends connected by two 12-in. channels in the middle and this construction, as well as the entire framing of the bents, using only one short diagonal brace (*A*), not only invited "jack-knifing" of the structure, but got it.

The communication states that square-set timbering requires "a prohibitive amount of tying and diagonal bracing." No definition of "prohibitive" is given, nor is any proof adduced that the amount of tying and diagonal bracing required would fulfill his unknown definition.

The main point of the original criticism and discussion is the lack of mining-engineering talent on this construction work, which involves distinctly mining problems. The complete misconception of the causes of the "rock slides," variously attributed to "soft pockets," "unknown seams," "rotten rock" and other mysterious causes, would not have been had by mining engineers, who would have recognized immediately that the "rust seams" were common, ordinary joint and cleavage planes, and they would have known that the ground would break blocky and would have to be supported or it would slab off in huge blocks and slabs.

"The best practice in subway timbering, therefore, includes cross or transverse members to distribute load, to brace the sides of the excavation and to more securely tie the structure together." Inasmuch as the timbering in question did not "brace the sides of the excavation," which caved in and caused the fatal disaster, I submit that the practice was not proper, even though it is considered "the best practice in subway timbering."

New York City, Oct. 13. PERCY E. BARBOUR.

New Almaden Quicksilver Mine

In the *Journal* of Sept. 18 there appears an article entitled "New Almaden Quicksilver Mine," by Richard G. Place. There are some grave errors in this article.

In the third paragraph Mr. Place states that the ore is introduced into retorts. The New Almaden mines have not used retorts since some time in the '70s, and the present furnaces, which have been in use for several years, are of the latest type of 50-ton Scott tile furnace for the fines and of shaft furnace for the coarse rock. We do not know of any leakage of fumes from our condensers or furnaces that can be prevented in any way or that is of measurable quantity.

In the fourth paragraph he mentions "washing sand and dirt taken from under old parts of the workings that are being remodeled." This is correct if the reader understands that this dirt and sand is taken from the vicinity of abandoned flues and old furnace sites.

In making the foregoing comment, I merely wish to indicate to your readers (and our place is always open to inspection) that our present practice is not out-of-date nor unduly wasteful, although all quicksilver metallurgy is susceptible of great improvement.

W. H. LANDERS,
Chief Engineer, the New Almaden Co.

New Almaden, Calif., Sept. 27, 1915.

Brokers and Wildcats

But why go to the trouble to uproot the fake mining stocks, as Mr. Prill suggests in the *Journal* of Oct. 16? This only gives the "investor" the trouble of looking up something else as bad. Why give him unnecessary work?

New York City, Oct. 18, 1915. A. A. N.

More Mexican Mining Law

At present Mexico seems to be bothered with many different kinds of mining laws. The various so-called authorities no sooner promulgate one of them than something wrong is found with it and another is produced to modify or replace it. Because of the recent action of the United States in recognizing the Carranza faction, the laws devised and enforced by it demand more attention than any of the others. A study of the latest laws framed by Carranza leads to the suspicion that they may, and probably will, do a great deal of damage to the mining industry in Mexico. In that connection it will be of interest to study the law of Mar. 1, 1915, and its modification under date of Aug. 31, 1915, which are herewith presented.

MINING LAW OF MAR. 1, 1915

Modification and additions to the law.

The First Chief of the Constitutionalist army, in charge of the Executive Government, has been pleased to send me the following decree:

I, Venustiano Carranza, First Chief of the Constitutionalist army, in charge of the Executive Government of the Nation and Chief of the Revolution, exercising the extraordinary faculties with which I am invested, have considered it proper to decree as follows:

Art. 1. Articles 2, 5, 9 and 10 of the law of Mar. 25, 1915, regulating the stamp tax and the tax on mining franchises are modified and added to, as follows:

Art. 2. There are subject to the internal stamp tax, without any other exceptions than those expressly fixed in this law, the metals which have been produced in this Republic or which come from a foreign country. Said tax will be in future as follows:

a. On metals which are exported in the shape of ore or mineral or earth, cyanide or sulphide, furnace residue or in any other form and which are combined or mixed with substances which properly speaking are not metal, as follows:

Gold at the rate of $110 per kilogram.
Silver at the rate of $2.60 per kilogram.
Copper at the rate of $0.035 per kilogram.
Lead at the rate of $0.06 per each ten kilograms.
Zinc at the rate of $0.05 per each ten kilograms.

b. For the metals which are worked in the country, so that they do not remain mixed or alloyed except with other metals, and whatever be the assay of the product, there will be a reduction of 20% from the taxes fixed in the foregoing clause.

Art. 5. There is no tax on . . . . etc.

c. The taxes on copper will not be levied when the ore contains the metal mentioned in less amount than 10%, nor on lead when the ore contains a smaller amount than 10%, nor on zinc when the ore contains a smaller proportion than 15%.

Art. 9. The tax of special stamps which, according to the laws now in force, have to be adhered to the titles of ownership of the mines, will be $10 for each unit of mining field (pertenencia) covered by these titles, whatever be the mineral substance which it is intended to produce.

Art. 10. The annual tax on mine ownership will be as follows:

a. The rate will be $12 yearly per unit of mining field (pertenencia) or $4 for every one-third of a year, whatever be the material being mined.

b. If the number of pertenencias of a mining property, or of diverse properties belonging to the same owner and located in the same mining district, exceeds ten pertenencias, the tax will be at the rate of $12 for the first ten pertenencias, and for the excess up to twenty at the rate of $15. For the excess from twenty up to fifty the rate will be $18, and from fifty-one up the rate will be $24.

Transitory.

Art. 1. This decree commences to be in force this present day.

Art. 2. To the mining fields that have payments of taxes pending and have not yet been declared void, a time will be conceded up to June 30, 1915, to pay their debts in gold, in accord with the foregoing rates of this decree.

Therefore I order this to be printed, published, circulated and given due compliance.

Constitution and Reforms. Given in Veracruz, Mar. 1, 1915. Signed V. Carranza. To the Secretary of Finance and Public Credit. Present.

Which I communicate to you for your knowledge. Constitution and Reform. Veracruz, Mar. 1, 1915. The Secretary of Finance and Public Credit, Luis Cabrera.

Art. 2. Article 3 of the law referred to of Mar. 25, 1915, is void.

Art. 3. All amounts which the Public Treasury has to receive in accord with the present decree and with the law above mentioned of Mar. 25, 1915, shall be paid in national gold money.

CHANGES IN THE TAX ON MINING PROPERTY[1]

Decree of Aug. 31, 1915

The First Chief of the Constitutionalist Army, in charge of the Executive Government, has been pleased to send me the following decree:

I, Venustiano Carranza, First Chief of the Constitutionalist Army, in charge of the Executive Government of the Nation and Chief of the Revolution, exercising the extraordinary faculties with which I am invested, and

Considering that the mining business in general, on account of the social disturbance of the country, has been obliged to stop operations, especially points which were subject to the misconduct of forces which are hostile to the Constitutionalist Government and on account of scarcity of material of first necessity, which could not be acquired on account of the European war, have thought it well to decree, as follows:

Art. 1. For the periods of time hereafter mentioned, the accounts described in Art. 10 of the law of Mar. 25, 1915, which modifies Art. 1 of the decree of Mar. 1, 1915, regarding mining taxes, are reformed as follows:

a. The amount will be $6 yearly for each mining pertenencia, whatever be the number of pertenencias, during the four months covered by the months from July to November of the present year.

b. The amount will be $8 yearly for each mining pertenencia whatever be the number of the pertenencias, during the four months from November of this year to February, 1916.

c. From Mar. 1, 1916, the amounts will be those established by the decree of Mar. 1, 1915.

Art. 2. For the mining fields (pertenencias) for which payment of taxes prior to last July is pending, it is conceded that they pay $6 yearly, for each of the first 25 pertenencias and for the excess, $3.

Art. 3. To all the owners of mining property who have paid for the four months which commenced with last July, the excess will be returned, deducting what they have to pay according to this present decree.

Art. 4. A period of time is allowed until Sept. 30, 1915, for payment, without extra charge, of the amounts fixed by the present decree.

Art. 5. The payments referred to in the present decree have to be made in national gold or its equivalent in silver, in accord with the decree of May 8, of the present year.

Be this printed, published and circulated and given due compliance. Given in Veracruz Aug. 31, 1915. (Signed) V. Carranza. To Cit. Rafael Nieto, Secretary to the Treasury. Which I communicate to you for your knowledge and subsequent effects. Constitution and Reforms. Veracruz, Aug. 31, 1915. In the absence of the Secretary, the Asst. Secretary in charge. R. NIETO.

As to Villa, his exploits do not seem to be attracting a great deal of attention at the present time. There are rumors of his death, and other rumors which point out that it was his brother that was killed. His most important move is suggested in a recent announcement that he has requested, or commanded, that the American Smelting and Refining Co. operate at once its Chihuahua smelter and the tributary mines, threatening, if this is not done, to seize and operate them himself. The company, it is said, will endeavor to operate the smeltery to alleviate the destitution of its laborers at Chihuahua, but operation depends almost entirely upon the possibility of getting supplies into the camp and the ability of the company to ship its product.

[1]From El Paso papers of Sept. 30, 1915.

Producing Potash in Utah

A recent press bulletin from the Department of the Interior, announcing the production of potash from alunite in Utah, is another example of the bureaucratic advertising that has become popular with publicity-seeking department heads at Washington. It is full of half-truths covered with a political glaze that might easily give the uninformed public the impression that the Department of Interior or the Geological Survey was producing this potash. A layman reading this bulletin might gather that it was now demonstrated that the Utah alunite was to be regarded as a commercial source of potash in normal times of German competition, and the last paragraph conveys the impression that the potash deposits of Germany are alunite.

Why could not the Interior Department employ a competent Geological Survey expert and give him a free hand to tell the whole truth instead of these "half-truths" promoting "bureau publicity"? For the benefit of those who enjoy their politics and technics mixed, the Interior Department's press bulletin of Oct. 16, 1915, is reproduced herewith:

Secretary Lane today announced the production of the first commercial mineral potash in the United States. This came to him in the form of a report from a special agent of the Geological Survey, in Piute County, Utah, nearly in the central part of the state. The potash is found in a vein of a mineral known as alunite, which is the sulphate of alum-

inum and potassium. The vein found is about 10 ft. wide and has been traced for 3,500 ft. Its depth is not yet known. The alunite when removed is subjected to a very simple process of heating, dissolving in water, filtering and evaporating, and the potassium sulphate resulting is almost pure. About 200 tons of alunite has been put through the mill and two tons of 99% pure potash has been produced, and there is still in solution nearly 100,000 gal. containing large amounts of potash salts which has not yet been evaporated.

The discovery that this mineral yields potash in commercial quantities Secretary Lane regards as one of the most important discoveries made recently with reference to our natural resources, as it assures us of a domestic supply of potash for our national needs in the manufacture of explosives. Alunite is known to exist in the States of Colorado, Utah, Nevada, California and Arizona. It resembles in appearance disintegrated limestone. The technical description given by the Geological Survey of alunite is that it is a "fine-grained, compact rock, breaking with conchoidal fractures and having a porcelain-like appearance, but containing also considerable masses with a distinctly crystalline structure."

Heretofore the United States has been dependent upon the potash supply of Germany, where it is found in strata chiefly at a great depth. Our imports for 1913 of potassium salts were $15,000,000. The world has been dependent upon this German supply as an ingredient in modern fertilizer and in the manufacture of explosives. Potash is known to exist in the United States in some of the salt lakes of the interior, but has not been produced heretofore in any commercial quantity. Some potash has also been produced on the Pacific Coast from the kelp of the seacoast, which takes the potash from the salt water.

The Interior Department is also drilling at various points in the United States in search for potash deposits similar to those of Germany. Should alunite deposits of a similar character be found in large quantities in other states, its significance to the agriculture of this country can hardly be overestimated, as it is an essential soil food and will reestablish from year to year the draft made upon the potash in the soil by the crops produced.

Those who are familiar with the alunite development in Utah will interpret this bulletin as meaning that the private interests that investigated the Piute County deposits and have been constructing a reduction plant near Marysvale, have begun production on a small scale. Moreover, if two tons may be regarded as a commercial production, the feldspar-potash investigators have already taken the edge off the Department's "discovery."

Revision of Mining Laws

The Director of the Bureau of Mines has issued the following letter with respect to the convention that is to be held in Washington on Dec. 16, 1915, under the auspices of the Mining and Metallurgical Society of America, to urge upon Congress action toward a revision of the mining laws.

A convention that will act on recommendations regarding a general revision of the Federal mining laws will meet in Washington, D. C., on Dec. 16. All the known mining societies in the United States have been invited to send delegates, and it is hoped that the mining industry will be so well represented that the action of the convention will be regarded as expressing the wishes of the industry.

As the Bureau of Mines is necessarily interested in any movement intended to benefit mining through changes in Federal laws, I take the liberty of calling the convention to your notice and expressing the hope that, in case you cannot attend the convention, you will authorize someone to act for you.

Some of the resolutions that will come before the convention will recommend the fixing of a reasonable term of years beyond which placer claims shall be immune from attack on the ground of fraud, full privilege of appeal in all cases of contests over locations, recording of notices of mining locations so as to insure public notice, the abolishment of the law of the apex, and the appointment of a Government commission, under an act of Congress, to investigate and to make recommendations as a basis for the revision of the mining law.

In case you wish further details in regard to the convention, I shall be glad to supply you with such information as may be available.

VAN H. MANNING,
Director.

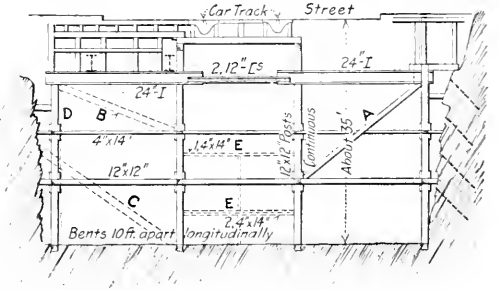
Washington, Sept. 24, 1915.

Ten thousand copies of this letter were distributed, these being sent to all mine operators in the public-land states and to all the more important mine operators in other states. Details respecting the convention will be published in due time in the several mining papers.

Comparative Timbering Costs in Mine and Subway

At the Goldfield Consolidated mine in Nevada during the year 1914, according to the company's annual report, there were mined 300,993 tons of ore. In estimating ore reserves of this mine 13½ cu.ft. of rock in place are estimated at one ton; therefore the tonnage mined in 1914 is equivalent to 150,497 cu.yd. of dirt. The total expense for mining this ore was $1,026,808.

The specifications for the section of the Broadway subway (Section 2, Routes 4 and 36), where the cave-in occurred on Sept. 25, called for a total excavation of 278,900 cu.yd. The contractors' bids ranged all the way from two million and a half to four million odd dollars.



SKETCH OF TIMBERING, BROADWAY SUBWAY, SOUTH OF 38TH ST.

The itemized bid of the successful bidder puts the cost per cu.yd. of excavation at $4.75. The total cost of the 278,900 yd. would therefore be $1,324,775.

This is so stated in order that both jobs can be compared on the basis of yardage removed, and the cost of the subsequent permanent subway construction does not enter in to complicate the illustration and cloud the issue. Here are two problems that are comparable in two important respects—the quantity of material moved and the money cost involved.

A most striking difference is noted in the amount of timber that these two problems used. Before taking this comparison further, it will be necessary to give a short explanation of the diagrammatic figure. For the sake of this comparison, only the timber below the 24-in. steel I-beams is to be considered, because we will assume, for the moment at least, that if a mining engineer had had charge of the timbering in the subway, he would have used just the same amount of timber in the decking, etc., above the 24-in. I-beam as the contractors used. The criticisms in the *Journal* of Oct. 2 were directed more particularly against the timbering below this 24-in. steel I-beam, which we will now consider.

A careful estimate of the amount of timber used in this bent, which any engineer can make from this sketch, shows that there is a maximum, after adding a liberal percentage for wastage in cutting, etc., of 4,500 ft. b.m. per bent. This section of the subway is 3,350 ft. long, and the bents are spaced 10 ft. apart. Estimating the cost of this timber at $50 per M, which is not only the figure used in various subway bids, but is also very close to the cost of timber in Nevada, the total estimated cost of the timber in this section of the subway timbering as per sketch would figure $75,600.

The Goldfield Consolidated report shows that for timber and lagging during the year 1914 there was expended $142,132, or nearly double the amount estimated for the subway excavation.

At the Goldfield Consolidated the greatest number of human lives to be considered in connection with the safety afforded by the timbering did not exceed 1,000. The number of human beings passing over the Broadway section of this subway during the construction period amounts to several hundred thousand per day.

There is, then, this striking comparison. The two problems of this particular mine and this particular section of the subway are comparable in both the yardage of dirt handled and the amount of money involved. In the case of the mine, although not nearly as many lives were to be safeguarded, although less dirt was moved and although the total cost of operation was less, practically double the amount was spent for timbering, which figured per cu.yd. excavated shows that the mining engineers spent in this case almost 3½ times as much for timbering as did the subway engineer.

	Subway Section 2, Routes 4 and 36	Goldfield Con. 1914 Operations
Excavating and mining costs.....	$1,324,775	$1,026,808
Cubic yards of dirt.....	278,900	150,497
Estimated cost of timber used.....	$75,600	
Actual cost of timber used.....	.....	$142,132
Cost of timber per cu.yd. excavated	$0.27	$0.94

Northeast Sonora Undisturbed

SPECIAL CORRESPONDENCE

Conditions in the Arispe-Moctezuma district of northeastern Sonora have been fairly quiet during the first week of October, the rumors of invasion by Villa's forces not having materialized. The Pilares mine of the Moctezuma Copper Co., near Nacozari, is at present producing 2,000 tons daily and the concentrator at Nacozari is running at full capacity. The Nacozari railroad had been nearly out of commission for three months, so that a great quantity of concentrates accumulated at the mill. By Sept. 18 these concentrates had been sent to the Copper Queen smeltery at Douglas and the usual one-train-per-day passenger service was resumed immediately. Although mine and mill are running full force, there had been up until a week ago considerable anxiety over the immediate future. What few American women had remained in the camps of Nacozari and Pilares left after President Wilson's request for all Americans to leave Mexico promptly, and the men remaining—practically the full staff—sent out their baggage, expecting that a hurry call might come at any time to close down and get out.

Villa's army was reported to be coming this way. This part of Sonora is Carranza territory, and after the reports of the battle between Calle's and Maytorena's troops came in, many of the Mexicans packed up and started for Agua Prieta. For several weeks everyone expected to receive notice to close down work in the Arispe-Moctezuma district and hurry to the States. But Villa's army did not seem to be getting nearer. Then reports of the refusal of Villa's troops to go until they were paid in gold came in, followed by others to the effect that his whole army was going to pieces. It hardly seemed credible that Villa would bring a large force into this part of Sonora, which is unproductive and where supplies are kept on hand only for immediate requirements.

The company stores are carrying small stocks, partly because not much has come in since the railroad resumed running and probably because it was deemed inadvisable to carry more than enough for immediate requirements. Certainly, even a small army would fare poorly in requisitioning all the merchandise in this district. There is an inclination now on the part of the men here to think that trouble in Mexico between contending factions must soon cease from exhaustion of supplies.

Some fear that Carranza's generals may not remain loyal and may start a movement to put themselves in power. As has been the case with all Mexican situations lately, the expected never happens, and while the history of the last few years would warrant such an anticipation, there are too many obstacles now, in the present condition of the country, to augur well for any ambitious general starting further trouble.

Reports from the daily press about the Yaquis and bandits do not correspond with the reports here. Of course, should Villa's army disband, it is to be expected that for a time the government—or whatever it is that takes the place of government—would be unable properly to police the great extent of territory, especially the less populated states such as Sonora, and for a time there probably would be depredations here and there by bands of outlaws. As for the Yaquis, the feeling between them and the Mexicans is reported still to be bitter, but there is no reason to suppose or to fear that American nonparticipants would be molested. The coveting of the Yaqui territory by the officials of a past government caused all the Yaqui troubles, and the tales of the cruel savagery of the Indians were doubtless manufactured for a purpose.

[A letter written a few days later supplementing this information appears under "Editorial Correspondence."—Editor.]

Ray Hercules Copper Co.

The Ray Hercules Copper Co. has been organized to acquire a large majority of the capital stock of the Arizona Hercules Copper Co., operating in the Ray district of Arizona. The orebody is said to be a continuation of the Ray Consolidated. The Ray Hercules has elected the following directors: August Heckscher, director of the New Jersey Zinc Co.; Ellis P. Earle, vice-president of the Granby Copper Co.; J. Guthrie Hopkins, director of the Arizona Copper Co.; George A. Huhn, banker, Philadelphia; W. F. Bartholomew, broker, Boston; Frank C. Armstrong, New York, president.

In Guatemala a recent presidential order provides that in the future the Guatemalan Government alone shall have the right to import telegraph and telephone apparatus. The right to import electrical material and supplies for the installation of such apparatus is likewise restricted to the Government, but their importation may be permitted if they are necessary for other installations.

Editorials

New Mining Taxes in Mexico

The revolution in Mexico has brought Carranza on the top of the wave, and his forces now hold most of the mining regions. Mining in Mexico, however, is mostly at a standstill. Only in a few places is it being prosecuted, and then on a much-reduced scale. Most of the American-owned mines have been closed. American citizens have been called out by orders from Washington. Other foreigners, if they have not been called out or ordered out, have generally been obliged to leave. This has entailed a lot of hardship and is costing a lot of money. The question now is, when and what chance will there be for successful resumption of operations when it is safe to return to work? The answer will depend greatly on the protection given to foreign mine operators by the party in power and on the taxes with which the industry will be burdened.

Taxes in general are being increased, and the mining industry will probably be made to carry a burden to its full capacity. The only limit will be what the camel's back can stand. On Mar. 1, 1915, Carranza issued a decree raising the mining taxes, and this decree was only temporarily modified by another, dated Apr. 1, 1915. The translation of the essential parts of these decrees is given elsewhere in this issue. They regulate the property tax (an internal-revenue tax depending on the size of the property) and the production tax (depending on the value of the ores and bullion produced). Large fields will have to pay virtually eight times as much property tax as they formerly paid. Not only does the tax affect the miner, but the work done by the miner affects the tax, and as he will have to be consulted sooner or later, it seems necessary for operators in Mexico to come to some general understanding in regard to these taxes.

The foreigner particularly is interested in the new mining taxes and regulations, since few of the older, larger or more important mines in Mexico are being held by Mexican owners. Mexican owners almost invariably hope to sell to the foreigner.

The purpose of the Carranza decree of Mar. 1, 1915, is evidently to break up large holdings and to stop speculation in undeveloped ground held with the expectation that it may become valuable by the exploration done on near-by property—as it is popularly expressed in words of the revolution, to keep the rich man from taking away the chances of the poor man who cannot afford to hold much ground, or to give the oppressed man a chance. At the present time any new measure that can be advertised as accomplishing this object is of course popular among the Carranza faction.

There is no doubt that abuses were committed under the old law, as there are under any law, but any permanent new decree will have two things to consider. The first of these is whether the new law be a successful revenue producer. Only time can tell this. At first the new law may be successful in an individual way, because many holders of mining ground, even if they want to reduce their holdings, will be obliged to take out new titles, which will require documentary stamps to the value of ten pesos, Mexican gold, for each unit or *hectara*, and also because miners and speculators may wish to take out titles for some of the ground abandoned by previous owners. Many of the middle-class people in Mexico were accustomed to invest their savings in mining property, not because they expected immediate returns, but because they considered the investment a safe one which might some day bring good returns—if not to them, to their children.

The second consideration is as to the effect the new tax on mining property will have on the industry. Will it increase or decrease the receipts from the tax on production—a source of income of much greater importance than the property tax?

There seems to be prevalent an idea that mining in general does not require large tracts of land. This may be true of special cases, but not of gold and silver mining in Mexico. Most of the value of the richer metals mined in Mexico is produced by the large operators. Their extensive operations, needing expensive plants, can be carried on only if there is a certainty that production will be permanent, and for this the first requisite is an ample field.

Formerly, when native labor was cheap and good, operations were carried on in Mexico by individuals. As the price of labor rose, mining operations had to be done on a larger scale with improved plants. Thus a larger investment was required, and to make such investments commercially safe large fields are necessary—not for speculative purposes, but simply to safeguard the investment. There are mining districts where ores are found in large bodies, but in most parts of Mexico silver and gold ores are not found this way. The ores usually occur irregularly in veins, in zones, in chimneys or in spots. To make continuous production possible in this class of mining, a large field is an absolute necessity. Work in small fields is necessarily done on what there is immediately in sight and is speculative. It is not to be trusted as a permanent business and therefore offers no attractions to foreign capital. For a while this kind of work may suit the local *gambucino*, who gouges out the ore in sight but does no development work, but it will not bring foreign capital into the country.

Another thing has to be taken into consideration: Every large mine operator in Mexico necessarily has to hold a quantity of unproductive ground—partly because it is impossible to say beforehand where the ore will be found and partly because profitable results cannot be obtained from large investments unless the adjoining ground is owned and controlled for present and future operations. Cut down the fields and you cut down exploration work.

The large mining establishments of Mexico have been built up on the faith in Mexico's good and clear mining laws. Many a mining district that was prosperous and promising a few years ago will be permanently crippled

if the industry is carelessly overtaxed now. Forcing property not now worked to be abandoned, with the idea that other owners will be found, does not necessarily promote mining or the production of ores.

A mining tax on the value produced sounds innocent, since nothing has to be paid when there is no production; but as there can be no mining industry without production, it is at best a heavier burden than any other industry has to bear and becomes unjust and iniquitous when it is abused. A few years ago a Mexican financier was asked how he excused this production tax on mining, and he replied that all store-keepers, farmers and many other industries had to pay a similar tax. This statement is not true. Stores turn over their capital only once or twice a year, while the miner has to put his working capital back in the ground weekly, or as soon as he realizes on his output. Furthermore, the storekeeper and the manufacturer charge their expenses to the goods and raise their sales prices accordingly. The miner has no say in the market quotation of his product.

To show what the tax on production actually means, let us take an example: Suppose we are practical miners and, like many others, are trying to make a living in Mexico out of a property bought in good faith under the Mexican laws. We bring a small working capital and start work under favorable conditions, investing our money in the weekly payrolls, in dynamite, fuse and other mining materials. To be able to keep on working it is primarily necessary that we net from the sale of the ores taken out the full amount of our weekly investment. The assay value of the gold and silver in the ore must of course be much higher, so as to be able to pay for freight, treatment and realization charges. Unless the ores are exceptionally rich the net cash value of the ore at the mine will be less than two-thirds of the assay value. According to the Carranza decree of Aug. 31, 1915, we have to pay taxes on the ores taken out, according to their assay value, as shown in the table.

TAX RATES UNDER THE NEW MEXICAN MINING LAW

Federal taxes: On gold at the rate of 8.27%, on silver at the rate of 8.09%, or, say	8.18%
State tax: This was formerly 1.50%, and, with an additional Federal charge of 20%, 0.30%	1.80%
	9.98%

Even if the state taxes are not raised, the government assay charges, document stamps, etc., increase this production tax to considerably more than 10% of the assay value of the ore, or to more than 15% of our net return, which again necessarily must be more than our working capital if we are to keep on working. We pay this on every week's product; therefore we pay this 15% fifty-two times a year, which makes more than 780% of our operating working capital.

Seeing that for some time to come the business of silver mining will have its difficulties, this amount of tax on production would certainly make us think twice before investing our little capital in Mexico.

The heavy mining taxes in Mexico have driven Mexican capital out of the business. The Mexican mine owner long ago found out that it was more profitable for him to sell his mine to the foreigner and to invest the money in some manner to exploit the miner instead of the mine. At the present moment the mining industry in Mexico is quiescent. To make it active, investment of money will be required. This money will have to be brought from foreign parts, but the careful foreign operator—the only one who can reëstablish the business—is not likely to invest in new enterprises when there is imminent danger that taxes will make profits impossible and property valueless. Now, before the decrees are ratified, it is up to the interested operators in Mexico to show the government what the results of heavy taxation are likely to be, and in order to get attention and consideration cooperative action will be necessary. How to bring this about, the operators will have to decide as soon as possible.

The Recognition of Carranza

At last the United States has recognized Carranza and Mexico has now, at least nominally, a legal government. As a preliminary to the new move Americans were once more warned to leave Mexico, and judging from the communications that have reached us, the women and children were generally sent out. The men appear, on the other hand, to have remained in order to look out for the property in their charge. This is brave, and American, and just what was to be expected, even if it be not wise.

Villa has breathed defiance and uttered threats, the latter being directed especially against the American Smelting and Refining Co., but so far has not done anything outrageous that has been reported. Carranza's first job will be to snuff out Villa. Then he will have to give attention to Zapata, who still prevails in his private palatinate. All of this may be done if Carranza's chieftains remain loyal. At present the great question is whether they are loyal, patriotic and intelligent, or whether some one of them thinks he holds a hand that he can play for his own account. But while waiting for time to answer this question, let us be glad that there is a possibility that order may be restored in Mexico.

The Clifton-Morenci Strike

Negotiations among certain distinguished "fugitives from justice," alias the Clifton-Morenci mine managers, the governor of Arizona, and representatives of the striking miners, have been going on at El Paso, Tex. The governor and the miners' representatives were almost pitiful in their beseeching of the "fugitives" to come back into Arizona and start their mines again, but the managers were wise and wary, having freshly in mind their recent experiences.

Moyer and his walking delegates apparently do not think much of mines without managers, and their followers have no high opinion of mines that have no payrolls. We wish it might befall Mr. Moyer to find a good mine and become a capitalist, for it would be interesting to see if his point of view would change as did that of the discoverers of the Hercules mine in the Cœur d'Alene.

In the meanwhile the attitude of the governor of Arizona and the state and county officers has been such that the mine managers were wholly justified in refusing to consent to return to that state for any palavering. The disgrace of the situation falls not upon them, but upon the state that could not or would not afford them the protection to which they were entitled. Arizona is run to a large extent by the taxes paid by its copper mining companies, which deserve more consideration than lately they have had.

BY THE WAY

Seventeen German ore steamers which ply in the Baltic Sea are missing, according to a Stockholm dispatch to the Exchange Telegraph Co., and are believed to have been sunk by British submarines.

⁂

Recent reports from Mexico of General Villa's death again appear to be slightly premature. If he has a spark of Mark Twain's genius, he will repeat the latter's famous telegram: "Reports of my death greatly exaggerated."

⁂

Closely guarding 1½ oz. of gold which she is taking to President Wilson for use in the wedding ring for his bride, Miss Dorothy Starr, daughter of the Empire Gold Mine's general manager, was on her way to Washington today, says an Oct. 18 dispatch from Grass Valley, Calif. She will also invite the President to pass part of his honeymoon in California.

⁂

Iron coins are to be used in Germany in place of nickel and copper. According to a recent ordinance of the Bundesrat, the Imperial Chancellor is empowered to authorize the coining of 5-pfennig pieces out of iron to the value of 5,000,000 marks. These coins are to have a milled edge and will contain the words "Deutsches Reich" over the figure "5" and the word "pfennig" under it, followed by the date. The obverse will have the usual stamp of the Imperial coat of arms. The new coins are to replace those now made of nickel and copper, and they are to be withdrawn from circulation not later than two years after the conclusion of the present war.

⁂

The following story is from the American Smelting and Refining Co.'s safety-first bulletin. John Eggen, a structural iron worker at the Garfield plant, was fastening corrugated iron on the roof of the coal-pulverizing plant, when an explosion of powdered coal occurred in the elevator directly under him. He was blown about 10 ft. in the air, lighting on the roof again. He received slight bruises about the face and wrenched his back, and two front teeth were loosened. He was disabled for 5½ days. However, John was thoughtful and to his foresight owes his life. Before he attempted this work on the roof, he fastened a rope around his leg, with the other end of the rope firmly tied to the roof. This safety line prevented his being blown off the roof.

⁂

To a district of "crosscut tunnels driven to intersect the vein at great depth" came a young graduate of a short-cut mail-order mining school, after two months' experience as timekeeper at a New England quarry. Being the nephew of the treasurer of the Cheerful Hopes Mining, Milling and Smelting Co., Consolidated, it was quite fitting that he should be appointed general manager of the company's sole assets, which consisted of 450 ft. of tunnel in barren quartzite. The youth, erroneously dubbed as "one of these here Eastern college dudes," rented a suite of offices in the First National Bank Building of the railroad town and proceeded in a serious way to earn a portion of the liberal salary bestowed upon him by engaging a big Swede foreman and one ordinary miner to furnish copy for the company's press agent by renewed activity at the main tunnel. Supplies were bought and shipped to the property with all due formality, Ole being requested to sign in triplicate a printed voucher form. He did so, and in the space for remarks he laboriously penciled, "Why in Hell you send me only 6 candles?" Upon receipt of this communication the haughty official bit his lip and remarked, "The dirty grafter. Why, I only hired those men to work day-shift."

⁂

The reputation of Henry Ford as an automobile builder and industrial innovator ought to protect him from the wonderful "discoveries" attributed to him by would-be friends in the newspapers. The latest is contained in a dispatch from Detroit to the New York *Times*, which says that "hereafter the iron ore consumed at the Ford plant will go into the blast furnaces in its crude state and be refined by one 'heat' into both pure gray iron and malleable iron. From the time the crude ore enters the furnace until it is turned out in the form of complete parts for motor cars it will not be allowed to cool." As the world has been making iron from ore "in one heat" and running into molds direct from the blast furnace for uncounted years, the new "discovery" will not upset the iron industry to any great extent.

⁂

The great mines of the Eureka district, the Richmond and Eureka Consolidated, long ago vanished from the list of stock quotations, leaving behind them the walls of their smelteries and two immense slag dumps, one at each end of Main St. These unsightly piles add no beauty to the landscape, writes Charles E. Van Loan in describing Nevada's "Ghost Cities" in the *Saturday Evening Post*, but Eureka is convinced that the slag in one of those piles will yield a handsome fortune if ever resmelted. Main Street sentried at both ends by the bare bones of smelteries and refineries, idle these 25 years, is no longer the scene of gun fights, of bowie-knife duels, of Fourth of July parades, with the "Hooks" and "Knicks" proudly kicking up the dust behind the Union Guard Brass Band. Main Street, Eureka, is a very wide street, as Nevada streets go; but a shortsighted hen is perfectly safe on it these days, unless it be her misfortune to pick out the spot where the baseball team is practicing. There was a time—and not so long ago, either—when Main Street was no place for a hen. And speaking of that baseball club, it has to travel 80 miles to get a game. Eureka once had some lively daily newspapers and at least one journalist who achieved national fame; but now she is content with a weekly, which is well edited but somewhat lacking in local news items as compared with the boom period. There are no gamblers in Eureka today, but the inhabitants are past masters at solo, and take money away from the Duckwater farmers, who only think they know that interesting game. The 20-mule teams and towering ore wagons, once the pride of eastern Nevada, have given place to a narrow-gage railroad which meanders leisurely northward through the sagebrush, 80 miles to Palisade, where it taps—ever so gently—one of the main arteries of transcontinental traffic. Ordinarily a railroad is a better and cheaper method of transportation than a mule team, but the "Slim Princess" does not haul any ore these days. The mining companies and the "Slim Princess" have been at a deadlock for years, and until that deadlock is broke, the ore will remain in the mines.

The Bethelehem-Pennsylvania Steel Combination

The arrangements for transferring the control of the Pennsylvania Steel Co. were completed at conferences held in Philadelphia, Oct. 15 and 16. The agreement involved the transfer to Charles M. Schwab and associates—who control the Bethlehem Steel Co.—of the Pennsylvania Steel Co. stock heretofore held by the Pennsylvania Railroad Co. This was a majority of the stock and to it was added that owned by the Reading Iron Co., which is a Philadelphia & Reading subsidiary. Outside stock will also be taken by the purchasers. While the details of the transaction have not been made public, it is understood that the stock passes at $100 per share for the preferred and $35 per share for the common, and the transaction involves the payment of between $49,000,000 and $50,000,000 in cash or securities.

The Pennsylvania Steel Co. is one of the larger independents outside of the Steel Corporation. It has a blast-furnace capacity of nearly 2,500,000 tons yearly, and extensive steel works, the most important being at Steelton, Penn., near Harrisburg. Moreover, it owns the Maryland Steel Co., with blast furnaces and steel works at Sparrow's Point, near Baltimore, with which is combined a large shipbuilding plant. A very valuable asset also is its ownership of great deposits of iron in Cuba, which include large developed mines and working transportation lines for delivery of ore at Baltimore and Philadelphia.

The Bethlehem Steel Co. has been for some time accumulating iron-ore reserves. Some years ago it made a long contract for Swedish ore and recently bought an extensive iron field at Tofo in Chile. Its investments in Texas iron lands have not, it is understood, turned out very well. The Cuba iron ores will be a valuable addition to its resources.

It is stated that there will be no consolidation, the Pennsylvania Steel Co. continuing to operate under its own organization.

It is reported that negotiations are in progress for the control of J. G. Brill & Co., a corporation operating several large car shops in Philadelphia and the West.

There were reports that the Cambria Steel Co. would also be joined in this consolidation, but they have been denied. The control of the Cambria, it seems probable, will pass to a syndicate headed by W. H. Donner, who holds an option on the stock in the company held by the Pennsylvania Railroad Co., and on other stock. A reported sale of the Thomas Iron Co., the oldest and largest merchant pig-iron maker in the East, is also denied.

*

Ore Tonnage and Valuation on Minnesota Iron Ranges

BRAINERD CORRESPONDENCE

The assessed valuation of the unmined ore in St. Louis, Itasca, Lake and Crow Wing counties is placed at $268,084,988 by the state tax commission. This includes the four Minnesota ranges. The tonnage is figured at 1,481,919,571. Iron ore, mined or unmined, is assessed at 50% of its true value as provided by law, while all other state property is assessed at from 25 to 40% of its true value. The new valuation will bring $1,112,552 into the state treasury next year. The rate fixed by the auditor is 4.15 mills. In 1906 the assessed valuation of the mineral lands was but $64,486,409. In 1907 the state commission was organized and the valuation was placed at $191,706,682. Last year it was $259,987,396. The remaining tonnage in the ground in the four counties is figured as follows: St. Louis, 1,232,058,631; Itasca, 160,795,969; Lake, 115,115; Crow Wing, 88,949,856.

*

Tennessee Copper Will Extend Its Acid Plant

At a special meeting of the Tennessee Copper Co., held in New York on Oct. 18, the stockholders approved the proposed issue of $3,000,000 first-mortgage 10-year convertible 6% bonds, of which $2,000,000 are to be issued at present. The bonds are convertible after two years at the rate of $160 in bonds for $100 par value in stock. An increase in the company's capital stock to $6,875,000 was also authorized to provide for the conversion of the bonds. After applying $800,000 of the present funds to the retirement of old bonds, the balance will be used for plant extensions made necessary by the great demand for sulphuric acid.

President Utley Wedge stated that while no figures could be given at present as to the extent of the plant enlargements, the annual capacity would be materially increased. For several years there has been evidence of a greater market for sulphuric acid in this country, entirely aside from present extraordinary demand. The output of the old plant of the Tennessee Copper Co. has been considerably augmented and the additional capacity of about 25,000 tons—contemplated about a year ago, but held in abeyance by financial conditions—is now being completed and will probably be in commission within 30 days. This year the company will produce about 225,000 tons of acid. Copper costs at present are excellent, and it is expected that the company's yearly statement will show a considerable reduction in cost over previous years.

*

Graphite Production in 1914

The United States produced 1,725 tons of amorphous graphite and 2,610 tons of crystalline graphite in 1914, and imported 22,002 tons, of which 8,374 came from Ceylon, 6,327 from Chosen, 4,259 from Mexico, 1,806 from Canada and 1,236 from seven other countries. Seven firms produced graphite in the United States, according to the Geological Survey—three in Alabama, one in Montana, two in New York and one in Pennsylvania.

Prices paid in New York during 1914 were approximately as follows:

Ordinary Lump	C. per Lb.	Dust	C. per Lb.
Best	8½-10½	Best	4 - 5½
Medium	7 - 9	Medium	3 - 4
Poor	6 - 8	Poor	2 - 3
Chip		Flying Dust	
Best	7 - 9	Best	2½- 3½
Medium	6 - 8	Medium	2 - 3
Poor	4 - 7	Poor	1½- 2

Madagascar graphite sold at $100 to $150 per ton, c.i.f., in New York. This is mostly of the flake variety. The crude Chosen amorphous graphite sold at $22.50 to $25, while refined Mexican amorphous graphite of leadpencil grade sold at 4 to 8c. per lb. Huff electrostatic installations are used by two of the Alabama companies for final cleaning.

NEW PATENTS

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

AGGLOMERATES—Process for the Manufacture of Agglomerates. Alphonse Exbrayat, Paris, France. (U. S. No. 1,154,980; Sept. 28, 1915.)

AGITATOR for Ore Treatment. Cyrus Robinson, Mount Vernon, N. Y., assignor to Metallurgical Engineering and Process Corporation. (U. S. No. 1,156,372; Oct. 12, 1915.)

ALKALI METALS—Improvements in and Relating to the Electrolytic Production of Alkali Metals. Badische Anilin and Soda Fabrik, Ludwigshafen-on-Rhine, Germany. (Brit. No. 17,763 of 1914.)

ALUMINUM COMPOUNDS—Volatile Aluminum Compounds and Process of Producing Same. Samuel Peacock, Philadelphia, Penn., assignor, by mesne assignments, to Agricultural Research Corporation, New York, N. Y. (U. S. No. 1,154,801. Sept. 28, 1915.)

BELT IDLER. Walter J. Armstrong, Columbus, Ohio, assignor to Jeffrey Manufacturing Co., Columbus, Ohio. (U. S. No. 1,156,336; Oct. 12, 1915.)

BLASTING CARTRIDGE. Paul Heylandt, Berlin, Germany, assignor to Firm Maschinen- und Apparate-Fabrik A. R. Ahrendt & Co., Berlin, Germany. (U. S. No. 1,154,770; Sept. 28, 1915.)

BRIQUETTING Ore Concentrates. Charles E. Hermann, Searsdale, N. Y., assignor to Moose Mountain, Ltd., Sellwood, Ont., Canada. (U. S. No. 1,155,311; Sept. 28, 1915).

CEMENT—Improved Method of Burning Cement, Ores and the Like Materials. Firm G. Polusius, Dessau, Germany. (Brit. No. 17,145 of 1914.)

CLASSIFIER—Ore Classifier. David J. Nevill, Denver, Colo., assignor to Dorr Cyanide Machinery Co., Denver, Colo. (U. S. Pat. Nos. 1,156,543 and 1,156,544; Oct. 12, 1915.)

COMPRESSORS—Governor for Air Compressors. Charles Otis Palmer, Cleveland, Ohio. (U. S. No. 1,154,798; Sept. 28, 1915.)

CONVEYOR. Freeman R. Willson, Jr., Columbus, Ohio, assignor to Jeffrey Manufacturing Co. (U. S. No. 1,156,385; Oct. 12, 1915.)

CRUSHER MANTLE. George F. De Wein, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,154,100; Sept. 21, 1915.)

CYANIDES—Process of Making Cyanides. Arthur C. Spencer and Karl P. McElroy, Washington, D. C. (U. S. No. 1,156,108; Oct. 12, 1915.)

CYANIDING—Process of Extracting Metals from Ores. Robert S. Towne, New York, and Cyrus Robinson, Mount Vernon, N. Y., assignors to Metallurgical Engineering and Process Corporation. (U. S. 1,156,382; Oct. 12, 1915.)

DRILL. Walter Roy Hockabout, Palo Alto, Calif. (U. S. No. 1,154,636; Sept. 28, 1915.)

DRILL—Percussion Drill. Charles L. Lawton, Hancock, Mich. (U. S. No. 1,154,642; Sept. 28, 1915.)

DRILL HOLDER. Harry C. Lawson, McGregor, Tex. (U. S. No. 1,156,079; Oct. 12, 1915.)

DRILLING—Rock-Reamer for Drill-Heads. John P. Karns, Boulder, Colo., assignor to J. P. Karns Tunneling Machine Co., Boulder, Colo. (U. S. No. 1,156,147; Oct. 12, 1915.)

DRILLS—Adjusting Device for Rock Drills. Aberham L. Bolson, Mason, Nev. (U. S. No. 1,155,034; Sept. 28, 1915.)

DRILLS—Improvements Connected with the Process or Method of Reducing Metals from Their Ores or Other Metal-Bearing Material. E. Millinton, Barrowash, Derbyshire, and Kittel Co., London, Eng. (Brit. No. 20,832 of 1914.)

DRILLS—Improvements in or Connected with Rock Drills. A. Robertson, and J. Jackson, Bolton, Eng. (Brit. No. 19,299 of 1914.)

DRILLS—Shackle for Drills, Etc. Mather W. Sherwood, Franklin, Penn., assignor to Chicago Pneumatic Tool Co., Chicago, Ill. (U. S. No. 1,154,941; Sept. 28, 1915.)

ELECTRIC FURNACE. Edgar F. Collins, Schenectady, N. Y., assignor to General Electric Co. (U. S. No. 1,156,668; Oct. 12, 1915.)

ELECTRIC FURNACES—Apparatus for Improving the Stability of Furnaces with Magnetically Extended Electric Arcs. Einar Trove, Christiania, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. (U. S. No. 1,156,292; Oct. 12, 1915.)

EXCAVATING APPARATUS. Cyrus R. West, Dawson, Yukon Territory. (U. S. No. 1,154,357; Sept. 21, 1915.)

EXCAVATOR—Disintegrator Attachment for Elevator Buckets. Charles C. Jacobs, Amboy, Ill., assignor to Frederick C. Austin, Chicago, Ill. (U. S. No. 1,156,291; Oct. 12, 1915.)

FLOTATION—Apparatus for Ore Concentration. Arthur Howard Higgins, London, England, assignor to Minerals Separation American Syndicate (1913) Ltd., London, England. (U. S. No. 1,155,816; Oct. 5, 1915.)

FLOTATION—Apparatus for Ore Concentration. Arthur Howard Higgins and William Warwick Stenning, London, England, assignors to Minerals Separation, Ltd., London, England. (U. S. No. 1,155,815; Oct. 5, 1915.)

FLOTATION—Apparatus for the Concentration of Ores. Thomas Mackellar Owen, Broken Hill, N. S. W., assignor to Minerals Separation American Syndicate (1913) Ltd., London, Eng. (U. S. No. 1,155,836; Oct. 5, 1915.)

FLOTATION—Ore Concentration. Louis Albert Wood, London, England, assignor to Minerals Separation American Syndicate (1913), Ltd., London, England. (U. S. No. 1,155,861; Oct. 5, 1915.)

FULLERS' EARTH—Process of Treating Fullers' Earth. Richard Claus, deceased, East Orange, N. J., by Ida Claus, executrix Montague township, Sussex County, N. J. (U. S. No. 1,155,466; Oct. 12, 1915.)

FURNACE STACKS—Stack-Head or Boot for Hot-Air Stacks. Albert G. Scherer, Chicago, Ill., assignor to the Excelsior Steel Furnace Co., Chicago, Ill. (U. S. No. 1,155,761; Oct. 5, 1915.)

GALVANIZING FURNACE. Charles Fell, Elyria, Ohio, assignor to National Tube Co., Pittsburgh, Penn. (U. S. No. 1,156,353, Oct. 12, 1915.)

GASES—Apparatus for Cooling and Purifying Furnace Gases. Ernst Hofmann, Duisburg, Meiderich, Germany. (U. S. No. 1,155,237; Sept. 28, 1915.)

HOISTING—Brake for Use on Hoisting Devices. Hermann Graumüller, Berlin, Germany. (U. S. No. 1,154,508; Sept. 21 1915.)

IRON AND STEEL—Method of Changing the Composition of Iron and Steel. Bruce Ford, Philadelphia, Penn. (U. S. No. 1,156,679; Oct. 12, 1915.)

KILN LINING—Basic Lining for Kilns. Spencer B. Newberry, Bayridge, Ohio, assignor to Sandusky Portland Cement Co., Cleveland, Ohio. (U. S. No. 1,156,918; Oct. 5, 1915.)

LAMPS—Apparatus for Electrically Igniting Miners' Safety Lamps. Victor Ernest Joyce, London, England. (U. S. No. 1,154,992; Sept. 28, 1915.)

LEAD—Process of and Apparatus for Comminuting Lead. Clifford D. Holley, Detroit, Mich., assignor to Acme White Lead and Color Works, Detroit, Mich. (U. S. No. 1,156,079; Oct. 12, 1915.)

MAGNESIA—Process of Obtaining Magnesia. Joseph A. Bradburn, Syracuse, N. Y. (U. S. No. 1,156,662; Oct. 12, 1915.)

METAL COATINGS—Method of Applying Protective Coatings to Metallic Articles. Clarence Mark, Evanston, and Clayton Mark, Jr., Lake Forest, Ill., assignors to Clayton Mark, Lake Forest, Ill. (U. S. No. 1,155,317; Sept. 28, 1915.)

METAL TREATMENT—Treatment of Metals to Render Them Inoxidizable. Tycho Van Aller, Schenectady, N. Y., assignor to General Electric Co. (U. S. No. 1,155,974; Oct. 5, 1915.)

MICA-SPLITTING MACHINE. Edward Cooper, Newton, Mass. (U. S. No. 1,155,298; Sept. 28, 1915.)

MINE-CAR BRAKE. Clyde E. Morgan, Holdenville, Okla. (U. S. No. 1,154,041; Sept. 21, 1915.)

MINE-CAR WHEEL. Wilbur D. Hockensmith, Penns Station, Penn., assignor to Hockensmith Wheel and Mine Car Co., Penns Station, Penn. (U. S. No. 1,154,960; Sept. 28, 1915.)

MINE-CAR WHEELS, Bushing for. Christ A. Specht, Punxsutawney, Penn., assignor of one-half to George L. Schicker, Punxsutawney, Penn. (U. S. No. 1,154,345; Sept. 21, 1915.)

MINE DOOR—Manually Operated Mine Door. Newton K. Bowman, North Lawrence, Ohio. (U. S. No. 1,155,703; Oct. 5, 1915.)

MINER'S SHOE. John T. Crowley, Beacon Falls, Conn., assignor to the Beacon Falls Rubber Shoe Co., Beacon Falls, Conn. (U. S. No. 1,155,644; Oct. 5, 1915.)

NITRIC ACID—Process of Concentrating Dilute Nitric Acid. Emil Collett, Christiania, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. (U. S. No. 1,154,289; Sept. 21, 1915).

NITRIDES—Process of Forming Double Nitrides. Samuel Peacock, Chicago, Ill., assignor by mesne assignments, to Agricultural Research Corporation, New York, N. Y. (U. S. No. 1,154,800; Sept. 28, 1915.)

NITROGEN—Process of Fixing Nitrogen. Ottokar Serpek, Paris, France, assignor to Société Générale des Nitrurés, Paris, France. (U. S. No. 1,155,840; Oct. 5, 1915.)

OIL BURNER. Jesse Ditson, Littleton, Colo., assignor to the J. Geo. Leyner Engineering Works Co., Littleton, Colo. (U. S. No. 1,151,101; Sept. 21, 1915.)

ORE REDUCTION—Ore-Disintegrating and Screening Machine. George Woodson Crowe, Santa Cruz, Calif. (U. S. No. 1,156,394; Oct. 12, 1915.)

ORE SEPARATOR. Edward Torrey, Thetford Mines, Que., Canada. (U. S. No. 1,155,292; Sept. 28, 1915.)

PNEUMATIC TOOL. Charles Otis Palmer, Cleveland, Ohio. (U. S. No. 1,154,797; Sept. 28, 1915.)

PNEUMATIC TOOLS—Compressed-Air System for Operating Pneumatic Tools. Charles Otis Palmer, Cleveland, Ohio. (U. S. Nos. 1,154,793, 1,154,794, and 1,154,795; Sept. 28, 1915.)

POTASSIUM CHLORIDE—Process of Obtaining Potassium Chloride. Joseph A. Bradburn, Syracuse, N. Y. (U. S. No. 1,156,388; Oct. 12, 1915.)

PRECIPITATION—Process of Precipitating and Separating Metals from Solution. Robert S. Towne, New York, and Cyrus Robinson, Mount Vernon, N. Y., assignors to Metallurgical Engineering and Process Corporation. (U. S. No. 1,156,383; Oct. 12, 1915.)

PULP—Mechanism for Feeding Pulps. William R. Macklind, Cleveland, Ohio, assignor to George A. Martin, trustee, Cleveland, Ohio. (U. S. No. 1,154,190; Sept. 21, 1915.)

PULVERIZED FUEL—Air-Feed for Pulverized Fuel. Simon Henry Harrison, Easton, Penn. (U. S. No. 1,155,725. Oct. 5, 1915.)

RADIUM—Production of Concentrated Radium Residues and the Separation of Radium Compounds Therefrom. Otto Paul Curt Bredt, New York, N. Y. (U. S. No. 1,154,230; Sept. 21, 1915.)

ROLLING MILL. Johann Puppe, Breslau, Germany. (U. S. No. 1,154,884; Sept. 28, 1915.)

SAMPLING APPARATUS. Alexander G. McGregor, Globe, Ariz. (U. S. No. 1,155,670; Oct. 5, 1915.)

SHOVEL-DIPPER DOORS, Tripping Device for. Frank H. Armstrong, Vulcan, Mich. (U. S. No. 1,154,157; Sept. 21, 1915.)

STADIA TRANSIT. Willie L. E. Keuffel, Hoboken, N. J., assignor to the Keuffel & Esser Co., Hoboken, N. J. (U. S. No. 1,154,253; Sept. 21, 1915.)

PERSONALS

P. C. Schraps, of the South American Development Co., has arrived in New York from Ecuador.

John Tyssowski, mining engineer, was married in Washington, Oct. 9, to Miss Catherine Woodward.

Homer L. Carr has been appointed instructor in mining in the Columbia School of Mines, New York.

Kirby Thomas was in Denver Oct. 12 on his way home to New York from several examinations in the West.

C. S. Herzig, of London, Eng., passed through Denver Oct. 7, after making investigations at Ouray and other points.

Bonthrone & Co., mining engineers, have removed from Bank of Hamilton Building, Vancouver, B. C., to 300 Pender Street West.

W. D. Burcham has left the employ of the Presidio Mining Co. to open up some mines in the Terlingua quicksilver district, Texas.

M. H. Rylatt, of Old Leak, Boston, Eng., has been inspecting his mining interests in the Ouray district and is now on his way home.

Col. Frederic Nicholls, of Toronto, has been appointed acting president of the Dominion Steel Corporation on account of the illness of President J. H. Plummer.

Harley E. Hooper has resigned his position with the Junction North Mine, Broken Hill, N. S. W., to join the staff of Radcliffe & Co., of Kanbauk Mines, Tavoy, Burma.

Frank H. Probert, of San Francisco, is looking over recent developments on the Comstock Lode. From Nevada he expects to go to the Bingham and Park City districts in Utah.

J. Menard, formerly business manager of the West Canadian Collieries, Blairmore, now serving with the Canadian forces in Europe, has been awarded the Distinguished Conduct Medal.

H. S. Lee will spend the next two or three months in the Northern Ontario district on examination work for the U. S. Smelting, Refining and Mining Co. His headquarters will be at Haileybury.

Professor H. O. Hofman, of the Massachusetts Institute of Technology, delivered a lecture before the Franklin Institute, Philadelphia, Oct. 20, on "Recent Progress in the Metallurgy of Copper."

Hon. Louis Coderre, Canadian Secretary of State and head of the Mines Department, has resigned to accept a judgeship and is succeeded by Hon. Pierre Blondin, recently Minister of Inland Revenue.

John Page, superintendent of the Illinois Lead and Zinc Co., Galena, Kan., started for Los Angeles, Calif., and other western points. In his absence Earl Ryan will look after the company's interests.

W. H. Stavert has been chosen president of the Lake Superior Corporation succeeding Thomas Gibson, who remains with the company as general counsel. James Hawson has been chosen a vice-president in place of W. F. Taylor.

Spruille Braden, of New York, a son of William Braden, of the Braden Copper Co., and Miss Maria Solar de Humeris, were married Sept. 15, in Santiago, Chile. Mr. Braden was graduated from Yale in the class of 1914, and the bride comes of an old Spanish family.

Col. D. C. Jackling, accompanied by a party of friends, arrived in Juneau, Alaska, early in October to inspect the Perseverance Mine, Thane Mill, Annex Creek power project, Kensington Mine and other properties. The party arrived on Jackling's yacht "Cyprus."

Barney S. Shearer has been appointed master mechanic at the White Pine Extension in Michigan. For many years Mr. Shearer was master mechanic at the Wolverine mine, later mill superintendent at Gay, in charge of both Mohawk and Wolverine stamp mills.

R. B. Watson, general manager of the Nipissing Mines Co., has returned to Cobalt from a trip of inspection with some of the directors to examine mining properties near Le Pas, Manitoba, and states that no decision as to purchasing will be arrived at until careful sampling has been made.

Several changes in the Carnegie Steel Co. have followed the recent change in the presidency. William Whigham recently assistant to the president of the company, on Oct. 7 was made vice-president and will serve with Col. H. P. Bope and W. W. Blackburn. The appointment was made in recognition of Mr. Whigham's valued services as an engineer. Edward J. Hamilton, who was assistant superintendent of the Duquesne works, is now general superintendent of that plant. His former position is held by Ambrose N. Diehl, who has been succeeded as superintendent of the blast-furnace plant at Duquesne by Harry M. Stewart, former assistant superintendent of the blast-furnace department.

OBITUARY

George H. Abeel died suddenly at Ironwood, Mich., Oct. 13. He was for a number of year connected with the Castile Mine on the Gogebic Range. He was a member of the Lake Superior Mining Institute from its start and in 1913-14 served as vice-president.

The body of T. F. Cheyney, mining engineer of Timmins, Ont., who had been missing since Aug. 30 and was last seen at the Dome Mines office, was found on Oct. 14 in the bush near Timmins Townsite. A revolver was found about 30 ft. from the body. No money was found on his clothes, though he was known to have had money with him. Appearances of a struggle were noted, and the police believe that he was murdered. Cheyney came from Cleveland, Ohio, some years ago and was well known in the mining camps of northern Ontario.

Joseph Sutcliffe, mining and oil operator, San Francisco, jumped or fell from a window on the sixth floor of the Lathrop Building on Oct. 1. He struck the sidewalk and was killed instantly. He had been suffering from paresis and was visiting the office of Dr. J. Henry Barbat. The physician not having the medicine for which Sutcliffe called, promised to visit him at his home that evening. Sutcliffe gave no evidence of his intention and appeared in pleasant humor. His wife, however, said that he has acted queerly before leaving home. He was 37 years old, son of W. W. Sutcliffe, and brother of William Sutcliffe of the German-American Bank of New Orleans. He was well known in the California oil fields and reputed to be wealthy.

Dennis Sullivan, whose death was briefly noted last week, died at Denver, Oct. 10, aged 76 years. He was conspicuous in the mining and banking circles of Colorado. He was a self-made man in the commonly accepted sense. He arrived in Gilpin County, in 1866, with his wife and a few dollars saved up as a conductor on the Harlem R.R. and began as a common miner. Within a few months he acquired an interest in the Roderick Dhu mine, in which a rich strike soon put him in a position to go still more deeply into mining. When Leadville's '79 excitement set in, Mr. Sullivan moved from Central City and quickly secured interests in new mines that produced well. He made money in the Little Chief, Castle View, Big Chief and Penn mines. He owned the Tam O'Shanter mine which he acquired after a costly litigation with the late H. A. W. Tabor. He moved to Denver in 1883, soon becoming president of the city's water-supply company. In 1884 he was one of the organizers of the Denver National Bank, the initial directors including, beside himself, James B. Grant, William H. James and H. H. Eddy, all of whose names are linked with the mining history of this state, especially in connection with the Omaha & Grant Smelting Co. Mr. Sullivan held an interest in El Potosi mine, Chihuahua, Mexico; owned the Brittania copper mine on Vancouver Island, B. C., and was a heavy stockholder in the Yak Tunnel Co. He had always been quietly active in state and local politics, influencing affairs in the Democratic party but never seeking or holding office. He was a delegate to the national convention that nominated Grover Cleveland for the presidency. In his death, the state has lost one of its most respected citizens as well as one of its most earnest captains of finance, mining and general industry.

SOCIETIES

Society of Chemical Industry—The regular meeting of the New York Section was to be held Oct. 22. The subject for the meeting was the Coal Tar and Aniline Industry in the United States; to be discussed from scientific and commercial points of view by E. E. Pratt, J. F. Schoellkopf, Thomas H. Norton, J. M. Matthews and John P. Wood.

American Institute of Mining Engineers—The next meeting of the New York Section will be held Oct. 28, at the Machinery Club, 50 Church St. The meeting will be preceded by a dinner served at 6:30. Following the dinner the subject of "The Subways of New York City" will be discussed.

Editorial Correspondence

SAN FRANCISCO—Oct. 13

At the First-Aid Contests at the Panama-Pacific Exposition a wooden gallery was constructed in the north garden illustrating two divisions of a tunnel or drift connected by a stope, drift and raise. The structure was built low requiring the men to stoop. The parts representing the two divisions of the tunnel were open on the sides. The stope and raise were closed in with glass on one side for part of the length. This inclosure was supplied with formaldehyde and sulphur. The men were provided with breathing apparatus. They made some fine scores in the mine-rescue work. The first-aid events were demonstrated in the open and the demonstrations attracted the applause of the visitors generally and the hearty commendation of mining men.

Hydraulic Mining in Nevada and Placer Counties is being stimulated by efforts on the part of owners in the Lowell Hill, You Bet, Dutch Flat, Gold Run and other districts on Bear and American Rivers to secure Congressional appropriations amounting to $150,000 for building a restraining dam on Bear River. Petitions are being forwarded to Congressman Raker. A large number of hydraulic mines in this region have been idle since the law regulating this class of mining has been in operation. Many experiments have been made by owners in the construction of individual dams but never with great success. As in other regions in California, a number of hydraulic mines in this region could be operated individually by having a common point for disposal of the tailings. These mines are probably capable of an annual production of $2,000,000 of placer gold. Many of the hydraulic miners maintain that the Government put them out of business and now should assist in putting them back.

DENVER—Oct. 14

A Discovery of Tin Is Reported in the vicinity of Carbondale, Colo., where similar finds were reported several years ago. Prospectors are getting busy.

A Large Mineral Acreage in Paradox Valley, Colo., containing deposits of uranium and vanadium, has been acquired by W. A. Clark, former United States Senator from Montana. The senator upon hearing of the uranium and vanadium deposits, sent experts and engineers into the valley and they reported favorably. He then made a personal visit to the country with the result that he secured practically all the lands in Paradox Valley. He has also had experts out in Montana for several years, but they have not yet found anything sufficiently attractive for Senator Clark.

The Frantic Search for Ferberite is not made by men alone; boys are prospecting throughout the Nederland district, some of them doing very well in sorting old dumps. In one instance, while picking over Spratley mine dumps, boys disclosed apex of a vein from which they have begun shipping in small way. Tungsten properties have been soaring in price, due to remarkable rise in the market for metal. Really first-class tungsten mines are scarce. Owners of such are not willing to sell except at inflated prices. Prospects may be purchased at moderate figures but even such properties are held at prices several times figures at which they might have been secured six months ago. Alloy Steel Co, of Latrobe, Penn., through its president, W. H. McKenna, has purchased Rogers Upper Tract, 160 acres, at $1,000 per acre.

BUTTE—Oct. 14

Another Big Pay Day In Butte, on Oct. 8, when between $1,500,000 and $2,000,000 was paid out to the employees of the various mining companies. The wage scale for September was on the basis of $4 per day and although the month was a short one, with Labor Day and Sundays counted out, miners who worked throughout the month drew $100 or close to it. Anaconda company's payroll amounted to $1,090,935, Butte & Superior's close to $175,000, North Butte's was above $100,000, Elm Orlu and Timber Butte's above $50,000, East Butte's close to $90,000. This brings total of these five companies above the million and a half mark. Other smaller companies, such as the Davis-Daly, Butte-Ballaklava, Pilot Butte, Tuolumne and others, as well as industries connected with mining, brought total payroll of Butte mining district close to $2,000,000.

Aftermath of Military Régime in Butte—During the military régime in Butte a year ago, necessitated by serious labor disturbances at that time, numerous arrests were made by the military authorities, and persons found guilty of breaking the laws of the state or defying the orders of the authorities were imprisoned, fined or otherwise punished. Such persons, upon the withdrawal of the military, filed suits in the civil courts for damages against the state of Montana, totaling in all about $70,000. The first eight of these suits will be heard Oct. 15. Judge W. H. Poorman, assistant attorney-general, was in Butte Oct. 8, preparing for the trial. It is generally believed that the state will uphold the action of the officers in charge of the National Guard during the time of martial law in Butte and Silver Bow County and will deny the plaintiffs' claim that they are entitled to damages.

SALT LAKE CITY—Oct. 15

The United States Assay Offices in Salt Lake, Boise, Helena and Carson City will hereafter charge $1 instead of $3 for each metal determined, according to advices recently received from Washington. The list of determinations includes gold, silver, lead, iron, tin, zinc and tungsten. A protest has been made to the director of the mint by the assayer in charge of the Salt Lake office regarding the assaying of tin and tungsten at $1 a determination. The charge of other offices for these assays has been $5 a metal. Two months ago the local assay office was equipped for assaying ores in addition to bullion. The lower charges are expected to encourage mining and especially prospecting.

SEATTLE—Oct. 12

Gold Receipts in the Seattle Assay Office for the last quarter decreased, according to the report of the government official in charge. Receipts for the quarter this year from Alaska show $4,885,865 having been received, while last year for the same period there were $4,906,416 received.

Two New Placer Strikes have been made in the vicinity of Dawson, which have caused a considerable movement of operators. One strike was made on Rude and Dip Creeks, 20 mi. from Coffee Creek. About 150 claims have been staked and ...e discoverers report that they have got better than wages. A landing is made on the Yukon below Selkirk and a good trail is found to the new camp. The extent of the pay has not been determined. Reports from Marshall City on the Yukon tell of a new discovery being made near that deserted camp. The new find was made on Willow Creek, and the paystreak has been developed across four claims. The pay so far developed consists of an average of 7 ft. of gravel running about 12c. per pan, with an overburden of 16 ft. of muck. Practically all the ground has been staked.

"As to the Quartz Possibilities of the Fairbanks District, others may be discouraged," says Dr. Alfred H. Brooks, "but I retain the same opinion expressed some years ago, that this will yet be a good quartz camp." Mr. Brooks has recently returned to Seattle from a trip through Alaska for the United States Geological Survey and continues, "At the present time, the quartz industry is not so active as it was some time ago, but that is because the owners of the properties are waiting for cheaper fuel. As soon, however, as we get some coal there at reasonable prices, I am sure the quartz industry will be more flourishing." Regarding the much discussed antimony mining Mr. Brooks said that neither he nor anyone else in the country had paid a great deal of attention to it heretofore, as the demand for the ore was not great, but now the industry is interesting many operators. At the present time, it is being mined in a number of places where the ore is as free from lead as it is in the Fairbanks district and for that reason it is particularly valuable

LOVELOCK, NEV.—Oct. 13

In the Seven Troughs District, about 20 mi. northwest of Lovelock, new activity is being manifested. The Dalaware property, at Vernon, has been taken on bond by H. H. Hunter, of Lovelock, and Salt Lake City and Butte associates, and is being developed, and at the same time is treating ore from the dumps in the Darby mill, about 4 mi. distant. The Signal Peak property, which has been successfully operating a Tonopah two-stamp mill, is planning development. G. C. Newcomb, the manager, is now east to raise money for the exten-

sions planned. The Fairview is operating on a lease at 600 ft. in depth and is shipping. The Coalition property, at Seven Troughs, is in bonanza on the 1,400-ft. level. The vein is small but very rich. This company is operating a mill at the mine. The Mazuma, adjoining the Coalition, is idle. There is very little prospecting or development in the district, outside the above-noted properties. The veins are in rhyolite and are associated with a double system of dikes of basalt and augite andesite. The chief product is gold, although silver is generally found with the ores.

The Camp of Willard, near Lovelock, is comatose. Recently there was only one man in the camp, a watchman on the Honey Bee mine. The broad street, double lined with ephemeral structures, saloons, dance halls, real-estate offices, cafés, etc., all erected within a year, is as silent as the desert of the poets. This situation is partly due to the long dry spell which has made living and operating in the camp difficult, but chiefly due to a drought of "outside capital." The leasers, after a losing struggle to make their operations pay out of high-grade shipping ore had all left and the heralded operations of the Willard Consolidated, "parented" by a San Francisco stock-selling concern, ceased for lack of funds. However, the camp is not dead yet. Negotiations are under way for the Honey Bee property, the discovery property in the camp and leasers will resume in October on the Operman claims, adjoining the Honey Bee, and on the Sheepherder group, on the northern edge of the camp. As evidence of the cause of the boom the fosterers of Willard show documentary evidence of several carloads of $20 to $44 ore, shipped by leasers, and of several hundred pounds of "jewelry" ore, treated at the Coalition mill, at Seven Troughs. However, the explorations to date, consisting of several tunnels and drifts, and of half a dozen shafts, the deepest about 60 ft., are by no means a conclusive test of the camp. It is possible that the leasers may yet put the camp permanently on the map. It is claimed that enough mill ore has been indicated by the work to justify reviving the project for a custom mill. It is rumored that the Sears Smith Engineering Co., of Oroville, Calif., is reconsidering plans for such a mill to be erected on the flat at the railroad, about five miles from the camp.

MORENCI, ARIZ.—Oct. 10

The Clifton-Morenci-Metcalf Strike at the end of the first month, Oct. 11, is no nearer settlement than the day the miners walked out. The managers of the Detroit, Arizona and Shannon copper companies are still absent from the district and declare they will not treat with the strikers until the non-resident agitators have gone and the complete ascendancy of the Western Federation of Miners is overcome. The power houses at Clifton and Morenci are being operated for lights only, and the Eagle pumping plant, Morenci Water Co., is running one shift instead of three. All other work is stopped. Morenci Southern train makes only one trip a day between Guthrie and Morenci. About 100 troops are on the ground and more are expected daily. Except an occasional parade, the district is comparatively quiet. The effect of the Governor's first order is given in a telegram from one of the mine managers from El Paso as follows:

Governor Hunt Came to Clifton and on the same platform with the organizers of the Western Federation of Miners, made speeches of encouragement to the strikers, the effects of which were to incite them against the managers and embolden them to deeds of violence. During the ensuing days the mob of strikers became more and more demonstrative in showing their hostility against company officials, who were seized by the mob and subjected to annoyance and humiliation. The sheriff was entirely powerless to protect them in their own homes or in the discharge of their duties and was forced to place them in jail for their own protection, and as the governor had announced that he would compel the managers to treat with the Western Federation strikers even if he had to put them in jail to accomplish this, we deemed it expedient to withdraw from the affected district until such time as adequate protection to persons outside of the county jail could be assured, leaving our property in the sheriff's hands for protection.

DOUGLAS, ARIZ.—Oct. 15

The Nacozari Situation is acute and prospects for the mining companies are more than dubious. The Pilares mine of the Moctezuma Copper Co., and the concentrator at Nacozari, Sonora, Mexico, were closed down the evening of Oct. 13; all the American and a large part of the Mexican employees left for Douglas, Ariz., or Agua Prieta, Sonora, the following day. Up to the day of closing down, the mine had been producing and the concentrator treating 2,000 tons of ore per day. For the last three or four weeks operations have been carried on at this full-capacity scale, but under a feeling of tension on the part of the employees. The rumors of a Villista army approaching from Chihuahua was the cause of this, and each day these reports were announcing the closer proximity of Villa's troops to the eastern mining camps of Sonora. The climax was reached Tuesday when General Calles, the Carranza leader of the Agua Prieta forces announced that the railroad would be taken over at once by the military forces under his control; that all food supplies in the company stores would be confiscated and removed to Agua Prieta; and that all rolling stock of the railroad would be moved to that place Thursday, Oct. 14. The announcement was also made that all the Mexicans at Pilares and Nacozari were to leave with their families for Agua Prieta. These announcements were made in Nacozari the evening of Oct. 12, but it was not until noon the next day that more than a few of the mine employees at Pilares knew of them. Work was stopped at the end of the day shift and at midnight every American and all but a few of the Mexicans came down to Nacozari. Everything was hastily prepared for an indefinite shutdown at both mine and concentrator. Thursday morning at eight o'clock the first train carrying nearly all the Americans and several hundred Mexicans and their families left Nacozari, reaching Douglas at 2 p.m. Other trains followed so that by night Nacozari had been left deserted; without provisions and without a railroad car or engine. Considerable apprehension was felt on the trip out as no one knew definitely the whereabouts of the advance column of the Villista troops. It was reported that they had entered El Tigre Wednesday and it was feared that a small squad might force ahead and cut the railroad line in the vicinity of Frontera or Esqueda, before the last trains from Nacozari could pass that part of the line.

The Nacozari Consolidated has also closed down and work has been stopped at all the properties in and about Nacozari, Moctezuma, Cumpas and other points in the region. Notice was sent to all operating in these camps in time for them to make a hasty departure and reach Nacozari in time for the train. Many operators on their way out to their properties turned back and it is probable that no further work will be done for some time, possibly not for the rest of the year.

Agua Prieta Forces have been reinforced by the concentration of the greater part of the population within a radius of 100 miles, all of which has been Carranzista territory. The city is well provisioned, garrisoned and protected by breastworks, trenches and entanglements. Villa's troops are expected to move toward that city, because its taking would give Villa control of nearly the entire state of Sonora. The announcement that the Carranza government would be recognized by the United States has had the effect of making all mine operators extremely doubtful about being able to resume work so long as Villa is in control or near enough to be a menace.

PARRAL, MEXICO—Sept. 21

Owing to the Unsettled Condition of the Country and the absolute lack of mail service, mail for Mexican mining companies is being sent to El Paso, to be forwarded when conditions are more settled. On Sept. 14, a telegram from Secretary Lansing was received, advising all Americans to leave the country. On Sept. 16 a special train, sent down by the American Smelting and Refining Co. took out the entire staffs of the Mina Tecolotes y Anexas, Montezuma Lead Co., and San Francisco del Oro and part of the Alvarado Mining and Milling Co. employees. Most of the American women of the district were sent out to the States several weeks ago, when conditions looked quite threatening. The El Rayo of the Mines Co. of America has also closed down, and its employees are now in Parral, waiting for a train to take them out. Enough Americans of the Alvarado Mining and Milling Co. remained to continue the operations of the Palmilla mill and the Alfareña, Las Cruces, Sierra Plata and Preseña group of mines. This is the only company now operating in the district. There was practically no mail service for the month of September, and little improvement is expected as Villa intends to destroy the railroad from Torreon north to Chihuahua, removing the rails and good ties, and burning the old ties. The shortage of food is becoming serious; there is none in Parral nor Santa Barbara. The Alvarado has enough corn and beans to feed its men for two or three months, providing the soldiers do not confiscate it.

TORONTO—Oct. 13

Interest in the Kowkash Gold Camp shows no signs of abatement. Good showings, many of them displaying free gold, have been found at scores of points along the auriferous belt, and the district is overrun with prospectors. Many buildings are being erected and an 8-mi. winter road is being run through from the King Dodds claims to Kowkash Station, so that machinery can be brought in. To obviate confusion, the Department of Mines is having surveyed a tie line to facilitate accurate locations

The Mining News

ALASKA

ALASKA GOLD (Juneau)—Plans for working of Kensington mine next spring with 500-ton pilot mill said to be confirmed.

ANNEX CREEK TUNNEL (Juneau)—Has advanced 1,000 ft. Pipe line and concreting of tunnel being rushed. Power house practically finished.

STEVE ROWE AND NO. 9 CLAIMS (Golden)—Doctor Chase, of Cordova, owner of ground, has recently shipped in 6-stamp mill, 1,500 ft. of tram, and other machinery with intention of putting the claims on a working basis the first part of next spring, or late this fall.

SLISCOVICH ANTIMONY MINE (Nome)—Has been taken over by syndicate which will immediately start shipping 800 tons of ore now ready and proceed to develop property. Railroad between Kugarock and Nome leased so shipment can be made during winter. Several thousand tons will be ready for shipment to States with opening of navigation.

ALASKA GOLD MINING CO. (Funter Bay)—W. S. Pekovich, who has been working old Funter Bay claims, has formed million-dollar corporation to develop and mine these claims on Admiralty Island. Officers are J. R. Moore, real estate man from Seattle; A. H. Ziegler, Juneau lawyer, and W. S. Pekovich. The new company expects to increase present output and install more equipment. Mill is showing good results.

TALKEETNA MINING CO. (Valdez)—Has been incorporated for $1,000,000 by P. C. Ellsworth, 407 Pioneer Bldg., Seattle, J. L. Fulton, of Portland, and R. L. Hatcher and E. H. Barthoff, of Valdez, who have been connected with Gold Bullion Co. Properties with which new company was organized are formed of a consolidation of Matanuska holdings, Gold Mine Co.'s land and three other grants. Work in 1916 will be confined to development and blocking out ore. In winter of 1916 mill will be taken in, and put in operation following summer. Grade of ore, averages $50 gold per ton. K. I. Fulton, of Berkeley Calif., will be the Supt.

ARIZONA

Gila County

NEW KEYSTONE COPPER (Miami)—By corporate action, capital stock of company recently reduced to $39,797, consisting of 39,797 shares, par value $1 each. Only asset company now owns consists of cash in treasury. Board of Directors of company deems it advisable and to best interests of stockholders to dissolve company, and if such dissolution is authorized and approved by two-thirds in interest of all stockholders as required by law, cash then in the treasury of company will be available for distribution.

CALIFORNIA

Butte County

BUTTERFLY (Oroville)—Lease and purchase option on this property in Morris ravine secured by H. W. Tegrundy, C. F. Belding and others, of Oroville.

MUGFORD (Chico)—Property reported sold by Thomas Mugford to Charles L. Crowder and others, of Chicago. Price said to be $10,000. Mine formerly known as Eureka.

U. S. EXPLORATION CO. (Merrimac)—This San Francisco Co. is reopening Robinson mine in Granite Basin. Contemplate building 150-ton mill and 300-hp. hydro-electric plant in spring of 1916. Designs will be made this winter. Machine shop and sawmill and other complete equipment will also be installed at 1,200; shaft will be sunk to 1,400.

Calaveras County

MARJES MINING CO. (San Andreas)—Permit recently issued by State Commission of Corporations for sale of stock shares has been revoked. Permit was issued on basis of an option for purchase of Ford mine. Company forfeited option, and in order to sell stock for development of other properties it will be necessary to make new application.

Eldorado County

HOLMES LIME CO. has brought suit in Supreme Court against Fred C. Anderson, Walter S. Moore and others to quiet title to extensive lime deposit near Mountain Quarries on middle fork American River.

Nevada County

BEN FRANKLIN AND ALASKA (Grass Valley)—J. L. Claghorn, of New York, has secured bond, and work of unwatering shaft started. Property equipped with hoist machinery.

NORTH STAR (Grass Valley)—Work is progressing below 6,300 incline level. Deepening of shaft will be resumed at an early date. Third quarterly dividend this year disbursed amounting to $50,000.

POLAR STAR (Grass Valley)—Contract for installation of hoist, pump, compressor and other equipment for sinking, secured by Taylor Brothers Foundry and Engineering Co. Mine is one of old producers and has been idle for some time. Property taken over by Utah men. Oscar Coffin is superintendent.

NORTH STAR (Nevada City)—Enlargement of Providence shaft to 1,750 level is about completed. Shaft now has three compartments and has been completely retimbered and new track laid; it will be deepened to 3,000-ft. point. New hoist equipment installed. Providence will be converted into main working shaft of Champion group. Drift from Champion shaft being driven at 2,500-ft. point.

CENTRAL SOUTH YUBA (Grass Valley)—Thirty tons of copper ore shipped to Selby estimated to run 10% copper and 5% zinc. Shaft is down 100 ft. In drift 115 ft. south and 27 ft. north of shaft 4-ft. ledge has been developed. Former shipment of 40 tons returned $12 gold, $6 silver and $14 copper. About 500 tons of ore on dump ready for shipment. Cost of mining and transportation would not permit mining of low-grade ore.

Placer County

HERMAN (Westville)—Thirty-stamp mill in operation since Aug. 17, crushing ore from 300 level, some of which is high-grade. Lost vein on tunnel level was found in south drift in hanging wall and in the foot wall of north drift. This vein is in line with new oreshoot discovered on surface, 600 ft. above. James F. Grimes, of Pittsburgh, and associates, are operators. Company has 1,000,000 ft. of timber now used for fuel as well as mine timbers, but electric power is contemplated. This may be secured from Pacific Gas and Electric Co. or mine operators could install an electric power plant as availability of water is assured.

Trinity County

ASBESTOS deposits, about 12 mi. from Hayfork, reported to have attracted interest of Seattle men. Abundant water and timber available. Bert Kellogg is owner.

GLOBE CONSOLIDATED (Dedrick)—Reported that Crown-Reserve Mines Co., of Cobalt, is negotiating for control of property. Equipment includes 20-stamp mill and cyanide plant. Property has produced approximately $250,000 and has strong ore reserve.

Tulare County

MAGNESITE DEPOSIT north of Porterville reported to be under examination by Chicago men with view of purchase and operation.

COLORADO

Boulder County

U. S GOLD (Boulder)—New milling plant completed. Crushing began Oct. 3. Treatment includes crushing, roasting and cyanide leaching. Ores from Livingston and Sphinx mines of this company will be treated. Underground workings have been put in good shape and are ready for regular production.

BOULDER TUNGSTEN PRODUCTION CO. (Nederland)—New crosscut tunnel started with portal below great dam of Colorado Power Co. If continued on its present northwesterly course through Hurricane Hill, will intercept many tungsten veins at depths up to 1,000 ft. For more than mile tunnel will be within property lines of this company. If continued further, it will develop the ground of Wolf Tongue and Primos companies. This is first tunneling project in this district and is undertaken by an "independent" company not purchasing custom ores. Mill will be erected at mouth of tunnel when such plant is warranted. Superintendent, Fred H. Nye.

Gilpin County

EAST NOTAWAY (Russell Gulch)—This mine, producer of rich ore for many years, closed down year ago by litigation, has been finally secured by opposing litigant Colma Mining Co., and will be reopened under superintendence of R. C. Benight.

Lake County

MATCHLESS (Leadville)—The third fire within 14 months destroyed the shafthouse and equipment, Oct. 10. This is the mine from which late Senator H. A. W. Tabor took fortune and it is still owned by his widow who lived in cabin destroyed in this last fire. Incendiarism is suspected. Leasers Avon and Springhetti had just put mine in readiness for shipping.

DERRY RANCH (Leadville)—The 6-cu.yd. dredge, built by the New York Engineering Co., went into commission Oct. 9; first cleanup Oct. 16, about $7,000; estimated yardage, 17,000 cu.yd. Heating plant now being installed preparatory to cold-weather operation. Dredge owned by Derry Ranch Gold Dredging Co., of which A. C. Ludlum, president of New York Engineering Co., is president and principal owner.

San Miguel County

TOMBOY (Telluride)—Erection and equipment of new cyanide plant are proceeding rapidly.

Summit County

ST JOHNS (Montezuma)—By way of experiment from [illegible] this mine's complex ore, large shipment is being made to Salida for smelting and another large lot will be tested by concentration methods including flotation.

WELLINGTON (Breckenridge)—Flotation equipment is being installed in wet mill to treat tails from present apparatus. Mine produces 150 tons daily. Cable fire-protection service is being installed, equipment consisting of 50,000-gal tank placed about 500 ft. up mountain with ample [illegible]

Teller County

PORTLAND (Victor)—Good ore has been [illegible] 1,900 level. About 40 sets of leasers working.

EL PASO (Elkton)—September production [illegible] carloads, about 2,600 tons. New shoot 3½ ft. [illegible] opened on 500 level in Ajax vein and [illegible] averages about 1.25 oz. per ton.

AJAX (Victor)—September production, entirely by leasers, totaled 1,015 tons, average value of $17.20 per ton. Mill is being remodeled somewhat and sampling machinery installed preparatory to starting up again, on custom basis.

VINDICATOR (Independence)—On 1,800 level, rich strike has been made in what is called No. 1 North vein. Dalzell lease, 800 level, produces two carloads of 1-oz. ore per week. Total September production from this mine was 195 carloads (5,850 tons); record for this company. Of this, leasers are credited with 41%, averaging 1 oz. per ton. Golden Cycle mine, now owned by Vindicator company, shipped 230 carloads, all consigned to Golden Cycle mill at Colorado City. Of this production, leasers mined 52%.

IDAHO

Shoshone County

STANLEY (Burke)—From upper level of this Day-controlled property antimony ore is being stoped and sorted for shipment. Contract has been let to Edward Reese for crosscut tunnel at lower level.

BIG CREEK LEASING (Kellogg)—Contract has been let to John Melise to drive 480-ft. raise from lower tunnel to connect with orebody in upper workings. Ore recently found carries 30% lead and 380 oz. silver per ton.

HYPOTHEEK (Wallace)—A 12-in vein of high-grade galena has been found in crosscut to vein on 1,100 level. No work will be done to prospect this unexpected deposit till main vein has been cut and its possibilities determined.

RAY-JEFFERSON (Wallace)—Capital stock of company has been increased from $1,500,000 to $2,000,000, funds from sale of new issue to be applied to winter development work and building of new 250-ton mill. Reported that entire issue was taken by men who were already heavy stockholders. Work on mill, it is announced, will commence as soon as snow flies.

CŒUR D'ALENE ANTIMONY (Kellogg)—Mine is near mouth of Pine Creek, about mile from railway. Forty-ton car of ore carrying 50% antimony has been shipped. Ore is blocked out and stoping is under way on three levels. At 150-ft. level of main shaft vein is 5 ft. wide and averages 50% antimony. Rock crusher and three jigs will be added to mill equipment. Twenty men are employed.

SILVERADO (Osburn)—Property comprises group of lead-silver claims near Osburn. At Spokane meeting of stockholders W. P. Pinkrell was elected president, Wm. Wood, vice-president, and C. D. Muxen secretary-treasurer. Arrangements have been made with Washington Water Power Co. for current and compressor will be installed soon. Winze is down 110 ft. from inner end of 4,000-ft. working adit.

SUCCESS (Wallace)—Stringer of silver-lead ore recently found on 1,200 level, assaying 60% lead, 10% zinc, and 60 oz. silver, across 16 in., is first lead ore to be discovered in this mine. Stringer lies on footwall below 7-ft. body of zinc ore. An entirely new oreshoot has been tapped by crosscuts on 500 and 800 levels; raise has been driven on this from 800 to the 700; will be extended to 500. As soon as new pump is installed at 1,200, shaft will be sunk to 1,400.

MARSH (Burke)—Operations at this mine delayed by unusual flow of water from crosscut to Got-Em-Now lode. Owing to inadequate pumping capacity water is collecting in lower workings. New pump of 400 gal. per min. capacity has been ordered and will be installed at 900 level, where station 50 ft. long, 25 ft. wide and 20 ft. high has been cut. Mill on Ninemile, near Wallace, has been overhauled and its capacity increased from 150 to 200 tons. Callow flotation process has increased saving by $1.25 a ton. September shipments were 200 tons of crude ore and 600 tons of concentrate.

HIGHLAND-SURPRISE (Kellogg)—After trial run of three cars of ore at new 100-ton mill of this Pine Creek property it was decided to use electric power instead of steam. Ore is now being taken from stope opened last winter in Surprise ground. Ore from Highland-Chief is being stored pending settlement of certain difficulties that arose at time of consolidation of old Surprise and Highland-Chief. Drift from Surprise into Highland-Chief ground has been driven 1,000 ft. and has cut shoot of ore averaging 14% lead, 19% zinc, and 6.6 oz. silver per ton; this drift is 126 ft. below Highland tunnel and raise shows continuous ore between levels.

MICHIGAN

Copper

CALUMET & HECLA (Lake Linden)—Regrinding plant at Lake Linden produced, during month of September, at rate of 4,000,000 lb. of copper per annum. This copper was produced at reported cost of 4c. a pound.

ARCADIAN (Houghton)—Tenth level opening is getting into better looking rock. Nothing is being done at present on conglomerate formation which was opened several months ago. Progress in crosscut from testpit, to gain knowledge of New Baltic vein is good.

CENTENNIAL (Calumet)—Self-appointed committee of Lake Superior shareholders held meeting last week at which it was definitely decided to wait and see what happens to Tamarack deal with Calumet & Hecla before going further with their plans of approaching Osceola Cons. in regard to selling out to Osceola.

HOUGHTON COPPER (Houghton)—Is maintaining average of 28 lb. refined per ton from rock coming from 10th level. Is showing better than anticipated. In addition to daily shipment of two cars of rock to Winona mill, operations at Houghton include sinking from 10th level winze. At point where sinking started, richest rock anywhere in this property was encountered.

WINONA (Winona)—Continues to operate on limited scale and to secure better than 18 lb. refined copper per ton, which is best showing ever made on this property. Experiments with leaching processes continuing with evidence of ultimate success. Winona rock is different from any other in district and requires distinct treatment. Manager Seeber has been persistently experimenting to find best concentrating and leaching combination.

QUINCY (Hancock)—Will make no effort to re-open Pontiac shaft this winter, according to present plans. That is not due to any fear as to merit and value of Pontiac tract, for levels from Mesnard, running north are all in best looking ground to be found anywhere in northerly section of the Quincy's numerous shafts. Three shafts are keeping up daily tonnage that is equal to past performances.

VICTORIA (Victoria)—Is handling average under 450 tons of rock daily and this is now running 12 lb. per ton. About as lean as any rock in Lake Superior district and is profitably handled simply because of water power and economical management. The rock has averaged as low as 11 lb. but it is believed that little closer selection in larger openings can make it come up to 13 lb. There is one 700-ft. lateral that is in the best looking rock that the property has opened. Work of building larger shaft, beside one now utilized, is going forward at six different levels at same time and will take about five months more to complete. That will be followed by installation of rolls in stamp mills with result that company then can hoist and mill product at least 30% larger than at present. The company recently has made some land purchases in vicinity of dam.

Iron

ROLLING MILL (Negaunee)—Orders have been received to ship 100,000 tons from stockpile. This will be first to be moved this year.

CLEVELAND-CLIFFS IRON (Ishpeming)—Diamond drill has been placed in commission just to west of North Lake, Barnes Land Co. owns land.

BALTIC (Iron River)—Mine is being reopened by Pickands, Mather & Co. About 150,000 men will be employed by Nov. 1. Water is now being drained and bailed.

L. S. & I. RY. (Marquette)—Record was established at new dock on Sunday, Oct. 10. Over 42,000 tons were sent out in one day. Eight vessels were loaded. A shortage of cars and boats is causing companies considerable concern. Cleveland-Cliffs Iron Co. is hard after wild carriers and believes that all of ore sold will not be moved this season.

MINNESOTA

Cuyuna Range

IRON MOUNTAIN (Manganese)—First cargo of this mine's product will leave Soo Dock, Superior, Wis., on Oct. 16. Management plans sinking shaft to greater depth with view to increasing output.

Duluth

DULUTH & IRON RANGE RY.—Final plans have been prepared for $1,500,000 steel and concrete ore dock to replace present No. 2 and No. 3 docks. New dock will be similar to No. 1 dock and will have storage capacity of 68,000 tons. During construction, old No. 2 dock will be demolished but No. 3 will continue in operation until new dock is ready.

Mesabi Range

MINORCA (Biwabik)—After shipping 447 cars in September, operation has ceased, all machinery having been moved to other operations in district.

MOHAWK (Aurora)—Workings now being pumped out. Mining to be resumed. Has been idle over a year. Steam shovel started shipping ore in stock this week. Employment will be given to 100 men throughout winter.

EUCLID (Chisholm)—Ground at west end of pit is caving again. Several large holes have appeared in middle of Central Ave. in city. Old drifts that run under town were supposed to be filled, but settling is occurring. Mine has been idle several years.

CROSBY (Nashwauk)—Mill is now about completed. Building is 62x57 ft. Extreme height is 81 ft. Plant is one-half unit in size. All of machinery driven by individual motors. Very little shafting and belting in evidence. All machinery furnished by Allis-Chalmers Co. Mill will probably not go into active operation for several months.

VIRGINIA—H. A. Rogers, of General Electric Co. is here to electrify shovels of one of mining companies. There are few such shovels in operation on Mesabi now. It is claimed that they are being operated successfully at Utah Copper, in Bingham. In the past, trouble has come from heavy strain on motors at time the dipper was getting its load. It is stated that this fault has been overcome.

MISSOURI-KANSAS-OKLAHOMA

Zinc-Lead District

ANCHOR MINING CO. (Lincolnville, Okla.)—Is building new 200-ton mill on lease on Buck land.

WHITE EAGLE (Baxter Springs, Kan.)—Last week made 4 cars of ore, 160 tons; will make about same this week; largest producer in district. Homer Seals is superintendent.

JOHN HUFFMAN, ARTHUR BABE AND RAMSEY BROS. (Galena, Kansas)—Have taken lease on Murdock land northwest of Galena. Will install pumps to drain ground. Land worked formerly at shallow depth. Present company will go to lower level, where good ore is known to exist from result of drilling some years ago.

EMMETT MINING CO. (Joplin, Mo.)—Has succeeded in draining its land east of Joplin to 4ower level. Has been pumping for several months; ground been idle for years on account of water. Has found good run of ore. New 150-ton mill will be built at once. Immense pile of dirt has been broken down and ready to hoist; work will be conducted on the 120-ft. level while mill is being built. At 90-ft. level, face of good ore has been blocked out 300 ft. long and 30 ft. high.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—Tunnel has now reached length of 2,000 ft. and is within 300 ft. of principal veins. Financing of proposed railroad to mines has been delayed due to fact that London financiers who were backing enterprise are obeying orders against outside investments since war broke out in Europe.

Deer Lodge County

WASHOE REDUCTION WORKS (Anaconda)—Fifth section of concentrator is nearly remodeled and will soon be adding to output from flotation plant. New roaster building is half completed and experimental zinc plant is practically ready for first run. New reservoir is being constructed for fire protection, located above buildings to give high pressure in mains. Five pulverized-coal-fired reverberatory furnaces are in operation and work is progressing rapidly on other three. Ninth reverberatory is being installed in converter building to re-treat converter slags.

Fergus County

BARNES KING DEVELOPMENT (Kendall) — Approximately 2,900 tons of ore were mined during September with estimated gold output amounting to between $15,000 and $16,000. This is about same as in August, although tonnage is larger and returns per ton less, amounting to between $5 and $6 against $9 per ton in August. Some accumulated low-grade ore run through mill in September reduced average value. At Piegan-Gloster mill near Marysville, Lewis and Clark County, low-grade ore is being milled. Returns for September between $10,000 and $12,000. Total receipts from gold shipped by company to Helena assay office will be between $25,000 and $30,000.

Silver Bow County

NORTH BUTTE (Butte)—Fourteen men were killed at Granite Mountain mine on Oct. 19 by an explosion of 500 lb. of dynamite. Eight men were seriously injured, one probably fatally. Cause of explosion has not been determined.

DAVIS-DALY (Butte)—Returns on shipments during past two weeks show average of about 7% copper. Shipments are being increased and for October may average 125 tons per day.

BUTTE-ALEX SCOTT (Butte)—Oct. 6 operations were resumed after shutdown of nearly two months during which numerous improvements were made. Shaft was sunk 220 ft. and station started on 2,200-ft. level. Hoisting plant was adjusted to take care of future increase in output and shaft was equipped with skips to replace cage and cars used heretofore.

NEVADA

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 9, amounted to 9,583 tons, valued at $198,454, compared to 9,496 tons week previous. Producers were: Tonopah Belmont, 2,724 tons; Tonopah Mining, 2,850; Tonopah Extension, 1,850; West End, 921; Jim Butler, 1,100; and miscellaneous leasers 138 tons.

Storey County

CROWN POINT-BELCHER (Gold Hill)—Water was lowered and incline repaired below 1,600 level. Jacket mill received 750 tons of dump rock and shipped 2 bars of bullion to smeltery. Saved 42 cars of mill rock from stopes in 1,300 Belcher raise.

MEXICAN (Virginia)—Southwest drift from No. 3 extended 12 ft. to 26-ft. point; face shows 4 ft. of quartz of low assay value. East crosscut No. 3, 2,700 level, is in porphyry and quartz. Mexican mill treated 270 tons of ore, average assay value $9.48 per ton.

CON. VIRGINIA AND OPHIR (Virginia)—On 2,700 level joint west crosscut has been started and advanced 12 ft. through porphyry. On 2,500 level Ophir sunk two-compartment winze 5 ft., making total depth 11 ft. Saved in Central tunnel 307 cars of ore from stopes and development work and milled 250 tons.

UNION CON. (Virginia)—Saved in raise No. 1 stope 32 cars of ore averaging $20 per ton. Top of raise is 54 ft. above sill floor. In stope No. 3, 88 cars of ore worth $13.60 per ton saved from old fill. Mill Union and Sierra Nevada continued repairs in southwest drift on 2,500 level. Sierra Nevada west crosscut advanced 10 ft.; face showing porphyry and quartz of low assay.

UTAH

Beaver County

PALOMA GOLD AND SILVER (Milford)—At meeting of directors, held Oct. 4, it was decided to sink shaft additional 100 ft. Contract for this work has been given.

Juab County

QUARTZ LEDGE, recently disclosed on O. M. Henry ranch, producing good ore, which is being hauled to Central Eureka mill for crushing treatment.

TINTIC STANDARD (Eureka)—Work is being done on 1,350 level, which is reached by inclined winze in vein. Fissure carries quartz, which is at present barren. Seven men are working.

IRON BLOSSOM (Silver City)—Shipments for first nine months of year amount to 754 cars, or about 36,000 tons, making monthly rate of about 84 cars. Week ended Oct. 8 there were shipped 21 cars

Salt Lake County

CARDIFF (Salt Lake)—Daily shipments of from 100 to 125 tons are being made. Telephone line is being built to property from Alta. Parts of new machinery have been delivered, but compressor is not yet installed.

MONTANA-BINGHAM (Bingham)—Conger vein has been cut in Bingham Amalgamated ground by this company's tunnel, and development work will begin at once with considerable force. As soon as this is well under way, tunnel, now in 4,048 ft., will be continued to cut Keystone and Fortuna veins.

UNITED STATES MINING (Bingham)—About 400 tons of ore produced daily from this company's Bingham properties. Most of this is a lead-zinc ore, which is treated at concentrator and Huff electrostatic plant at Midvale. Zinc is shipped to company's recently acquired zinc plant in Kansas. About 50 tons daily of copper ore is produced.

MICHIGAN UTAH CONSOLIDATED (Alta)—This company is advertising for bids for 1,000-ft. extension of its Hot Air drain tunnel. Dimensions are 5x7 in clear. Air, compressorman, blacksmith shop, drills and steel, cars, rails, shoveling sheets, and ventilating pipe are to be furnished. Contractor shall furnish labor, powder, fuse, caps, picks, shovels, and blacksmith coal, and shall drive tunnel under supervision of company.

Summit County

PARK CITY shipments for the week ended Oct. 8 amounted to 1,493 tons.

NEW QUINCY (Park City)—Crosscutting is being done from 90-ft. raise above 900 level of Daly West. Two shifts are being worked.

SNAKE CREEK TUNNEL (Park City)—Face is in 12,700 ft. Progress of 345 ft. was made during September. Tunnel is 3,730 ft. from surface, having reached point of greatest depth to be attained.

SILVER KING CONSOLIDATED (Park City)—During September output averaged 540 tons a day. Earnings for July, August, and September amounted to $188,000, which is nearly equal to three quarterly dividends of $63,000. Ore is bringing about $40 a ton, net smelter returns.

Tooele County

CONSOLIDATED MERCUR (Mercur) — Dividend of $6,000 has just been paid from sale of parts of old mill at this mine. Report covering period from July, 1912, to Jan. 31, 1913, stated that operations were being carried on at loss, and mine closed down. In 1913 and 1914 dividends amounting together to $50,000 were paid from accumulated surplus. Company has been selling off machinery, etc. It still owns mining ground.

WASHINGTON

Spokane County

WASHINGTON STEEL AND IRON CO. (Spokane)—Is completing plans for erection of 100-ton iron-ore furnace in Leavenworth district. Oliver P. Moore is secretary of company.

WISCONSIN

Zinc-Lead District

POLLARD & SAXE (Linden)—Wallace mill at Highland is being removed to Gillman mine at Linden.

STEPHENS & KISTLER (Platteville)—Construction of 100-ton mill has been begun on Cruson property at Platteville.

GREAT WESTERN (Galena)—This company is moving roaster equipment from Brown-Croft mine at Shullsburg to its property at Galena.

OLIVER IRON MINING (Shullsburg) — This company is sinking shaft and assembling material for 400-ton mill on Mulcahy land near Shullsburg.

WISCONSIN ZINC (Platteville)—Rich cuttings of jack were found in first hole drilled on Chas. Aston tract of 280 acres, formerly Ivo, midway between Benton and Shullsburg. This company has also taken over old Ida-Blende site near Benton.

CANADA

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for the month of September, 1915, from Cobalt proper were Beaver, 53 tons; Buffalo, 351; Cobalt Comet, 51; Conigas, 37; Crown Reserve, 79; Kerr Lake,45; La Rose, 130; McKinley-Darragh, 195; Mining Corporation of Canada Ltd., Cobalt Lake Mine, 172; Townsite City, 102; O'Brien, 74; Penn Canadian, 63; Peterson Lake—Seneca Superior Ore, 143; Temiskaming, 42; from New Liskeard, Casey Cobalt, 34; total silver ore shipments, 1,576 tons. From South Porcupine, Dome Lake (gold), 31; from Porquois Junction, Alexo Mine (nickel), 584 tons.

CANADIAN MINING CORPORATION (Cobalt) — For four weeks ended Aug. 12, value of production from different mines was £40,420 of which £19,272 was profit.

DOME (Porcupine) — September production was $139,000 from 28,500 tons of ore; an average recovery of $4.87 per ton. Work of doubling capacity of mill proceeding rapidly.

CROWN-RESERVE (Cobalt)—Has been investigating Globe mine in California with view to purchase. It offers to pay off obligations of the Globe company out of profits of mine and give Globe shareholders a 45% interest in company.

HOLLINGER (Porcupine)—Report for four weeks ended Sept. 9 shows gross profits of $149,935. Mill treated 39,731 tons of ore of which 11,559 tons came from Acme. Average value of Hollinger ore was $9.03. Total operating costs were $3.35 a ton.

Quebec

NORTH AMERICAN MAGNESITE CO., 180 St. James St., Montreal, is working magnesite deposits in Grenville township. The plant for burning and preparing the mineral is at Calumet.

CONSOLIDATED MINING AND SMELTING CO. OF CANADA, LTD. (Montreal)—Has received two-year contract for its output from home government and will put $500,000 into new zinc reduction and copper refining plants.

Yukon Territory

THOMAS P. AITKEN (Mayo Landing, Stewart River)—Will install air compressor and hammer drill at his property, taking material in this fall. Aitken is well known and prosperous miner of Dawson and Fairbanks days.

AFRICA

Transvaal

GEDULD PROPRIETARY MINES, LTD. (Johannesburg)—Board of Directors has decided to immediately increase the capacity of the reduction plant to enable it to crush 40,000 tons per month. The increase will be so made as to permit of a still further addition at a minimum of expenditure, and development will be continued at full speed with this end in view. It is expected that the increased plant will be in operation before the end of the next year. The expenditure involved will not interfere with the payment of dividends, as the necessary funds are in hand.

The Market Report

Metal Markets

NEW YORK—Oct. 20, 1915

All of the principal markets were quiet during the last week without material change in prices.

Copper, Tin, Lead and Zinc

Copper—This market is in a rather chaotic condition. Certain producers who were fortunate in having large stocks of copper abroad have continued to make excellent sales out of warehouse there, and being satisfied with that business have made no effort to do anything here. Other producers in selling for export find it difficult to arrange for freights and are taking chances on freight rates and exchange, their probable net return being a good deal a matter of guesswork. However, they are not disposed to draw fine points about this; for everybody is desirous of selling copper and the present price is lucrative no matter if there be a difference of half a cent a pound in realizations. Operations in the domestic market are conducted with somewhat the same spirit. During the last week a rather large quantity was reported as having been sold by Lake producers on the basis of 17⅞c., cash, New York, which is figured as corresponding with electrolytic at about 17.80c. Lake producers apparently took the bulk of the business, producers of electrolytic finding it rather difficult to make sales in spite of offering at material concessions. Some producers were disposed to take business whenever and however they could get it. In the early part of the week some sales were made at 17.82½c., regular terms, corresponding with about 17.62½c., cash, New York, but on Tuesday and Wednesday copper became available from some quarters at 17¾c., regular terms, equivalent to 17.55c., cash, New York.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19¼@19¾c. per lb. at mill. The chief maker does not quote base price.

Visible Stocks of Copper in Europe on Oct. 15: Great Britain, 18,087; France, 1,905; afloat from Chile, 525; afloat from Australia, 3,200; total, 23,817 long tons, or 53,350,080 lb. This is a decrease of 5,167 tons as compared with the Sept. 30 report.

Imports of Copper in the United States for the week ended Oct. 2 are reported by the Department of Commerce as follows: Metal, 9,858,736 lb.; in ore and matte, 3,600,571; total, 13,459,307 lb. The larger imports were from Chile, Canada, Japan and Spain. Exports for the week were 16,489,622 lb., the larger shipments being 7,628,452 lb. to Russia, 4,686,763 lb. to England, 2,576,804 lb. to Italy and 1,402,623 lb. to France.

Tin—This market was quiet, but there was a steady demand and a fair volume of business was reported done. Stocks apparently are being absorbed. Talk about the prospective British duty has died out.

Banka tin production for the five months, Mar. 1—July 31, was 3,550 long tons, a decrease of 170 tons as compared with the corresponding period last year.

Lead—A rather large business was done, but the market exhibited a considerably mixed situation. In New York heavy transactions were made at 4.50c., and in St. Louis at about 4.42½c. On sales for export a premium could be readily obtained, but there was difficulty in arranging such sales owing to the scarcity of freight room. Premiums over the schedule prices of the A. S. and R. Co. were also realized in other markets, Philadelphia, for example. On the other hand, in selling for delivery in Pittsburgh, there was sharp competition.

Spelter—A moderately large business—several thousands of tons—was done during the week at an average of about 12⅜c., basis St. Louis. A far larger proportion of this business was done for delivery during the fourth quarter of 1915 than was the case in the previous week. Many of the producers made offers to sell for delivery in the first quarter of 1916, but the interest of buyers in such deliveries was less marked than it had been. On the other hand, several producers preferred to confine their sales to the immediate quarter. Of the business done during the week, by far the larger proportion, say, 80 or 90%, was for export, especially to France.

Zinc dust is quoted at 25@30c. per lb. One sale was reported at 28 cents.

The ore sales of the Amalgamated Zinc Co. to American smelters have been as follows: New Jersey Zinc Co., 1,000 tons; American Zinc, Lead and Smelting Co., 2,000 tons; Robert Lanyon Zinc and Acid Co., 2,000 tons; Granby Mining and Smelting Co., 1,000 tons, and Edgar Zinc Co., 50,000 tons. Other sales are pending. The first cargo of ore for the Edgar Zinc Co. (destined for Donora) has been delivered at Mobile.

Zinc Sheets—Business has been active, sales good but with no material change in quotations. The base price for carload lots is $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Oct	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Spot, Cts. per Lb.	Lead New York, Cts. per Lb.	Lead St. Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
			17 62½			4 40	11 25
14	4 6775	49⅞	@17 67½	32¼	4 50	@4 45	@13 25
			17 62½			4 40	11 50
15	4 6813	49⅞	@17 67½	32¼	4 50	@4 45	@13 25
			17 62½			4 40	11 50
16	4 6859	49⅞	@17 67½	32¼	4 50	@4 45	@13 25
			17 62½			4 40	11 50
18	4 6950	49⅞	@17 67½	33	4 50	@4 45	@13 25
			17 55			4 40	11 50
19	4 6875	49⅝	@17 65	33¼	4 50	@4 45	@13 25
			17 50			4 40	11 50
20	4 6838	49¼	@17 60	3½	4 50	@4 45	@13 25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c., St. Louis-Chicago, 6.3c., St. Louis-Pittsburgh, 13.1c.

LONDON

Oct.	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos.	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts. per Lb.
14	24	72½	73	88	18.35	150	151¼	23 1/16	5 00	63½	13 25
15	24	72½	73	88	18.36	150	151¼	24⅛	5 06	63	13.15
16	23⅞	.	.	.	.	.	.	.	.	.	.
18	23 1/16	72¼	72½	88	18.44	150¾	152¼	24 3/16	5.15	63	13.20
19	23 1/16	72⅜	73⅛	88	18 39	152¼	153¾	24 7/16	5 12	63	13.18
20	23⅞	73	73	88	18 37	152¼	154	24½	5.14	63	13.16

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Oct. 20

Aluminum—Conditions remain about the same as for several weeks past. Metal for early delivery is scarce, stocks being very low. The American producer has none for sale for some months. Quotations are high, 57@60c. per lb. being quoted for No. 1 ingots, New York.

Antimony—Business has been more active than for some time. Demand is good and the market is firm, with a tendency to advance. The ordinary brands are held at 29@29½c. per lb., New York, while 45@46c. is asked for Cookson's. The shipments of Chinese which were held up in the Panama Canal have been ordered to San Francisco.

Nickel—Quotations for ordinary forms are nominally 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—Demand is fair and stocks are rather low, so that prices remain firm and are inclined to advance. The New York quotation is $92@94 per flask of 75 lb. for large orders, $93@95 for smaller quantities. San Francisco reports by telegraph an advance from $87.50 early in the week to $90@92 per flask today. London price remains £15 10s. per flask, with the same quotation from jobbers.

Gold, Silver and Platinum

NEW YORK—Oct. 20

Gold—A shipment of $25,000,000 gold from London has arrived at New York, by way of Halifax. The gold being in British coin was sent to the Assay Office as it arrived.

Transvaal gold production in September is reported at 776,750 oz., being 2,013 oz. less than in August, but 74,580 oz. more than in September, 1914. For the nine months ended Sept. 30 the total production was 6,733,916 oz., or $139,190,044, being 500,497 oz. more than last year.

Platinum—The situation has not been relieved by any new arrivals, and stocks remain low. Sales to jewelers are at a stand for the present. Quotations are a little unsettled, but very firm, with no present prospect of a break. Refined platinum is $51@55 per oz., New York, while $55@59 is asked for hard metal.

Silver—The market has ruled steady and quiet without special feature the past week, the demand being sufficient to take care of offerings. It closes steady at 23⅞d. in London.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Oct. 16

The base price paid this week for zinc ore was $80@75 per ton for 60% grades. The base price paid for 80% lead ore was $54 per ton.

SHIPMENTS, WEEK ENDED OCT. 16

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,393,170	280,790	593,080
Year	158,242,580	5,276,910	21,707,850

Shipped during week to separating plants, 5,929,300 lb. zinc ore.

JOPLIN, MO.—Oct. 16

Blende, high price, $88; base per ton of 60% zinc, premium ore, $85; medium grades, $84@80; lower grades, $79@75; calamine base per ton of 40% zinc, car lots, $60@55; average selling price, all grades of zinc, $81.18 per ton. Lead, high price, $54.90; base per ton 80% metal content, $55@50; average, all grades of lead, $51.07 per ton.

SHIPMENTS, WEEK ENDED OCT. 16

	Blende	Calamine	Lead	Values
Totals this week..	12,596,020	518,400	1,976,360	$575,930
Totals this year..	457,285,840	34,226,180	71,482,310	$20,135,930

Blende value, the week, $511,320; 42 weeks, $17,479,530.

Calamine value, the week, $14,150; 42 weeks, $783,070.

Lead value, the week, $50,460; 42 weeks, $1,875,380.

The shipment this week of purchases of the previous week is a large one, but the buying this week indicates a small shipment for the ensuing week.

Iron Trade Review

NEW YORK—Oct. 20

Domestic orders are coming in more and more to fill up the mills, already pretty well supplied with contracts for export business.

The railroads are evidently persuaded that they have held back too long; orders for rails and cars have been coming in freely. Structural-steel orders are looking up. Plates and shapes are in demand for car, bridge and ship work, and more are expected to come soon.

Mills are rather holding back on next year business, largely owing to the general expectation of higher price. The Steel Corporation's tonnage statement seems to indicate that it has taken more orders running into 1916 than most of the independents, but nothing definite can be determined.

The pig-iron market is generally strong. Steel-making iron is in demand. Foundry iron is holding back a little, but demand there is increasing also.

Imports at Baltimore for the week included 922 tons ferromanganese from Liverpool; 6,200 tons manganese ore from Brazil.

PITTSBURGH—Oct. 19

Pressure to place specifications for finished-steel products has increased further, while there is a fair volume of orders going for specific tonnages. At the present rate the mills are bound to fall farther and farther behind in deliveries, and the condition makes them indisposed to book open contracts for first quarter or first half. Under similar conditions in previous price movements the mills would have sold freely for deliveries farther and farther ahead, but at this juncture they prefer to keep their forward tonnage and take advantage of further price advances. Finished-steel prices have now advanced substantially as much on this movement to date as they did from the bottom to the top of the 1912 movement, and the advancing tendency has become more marked instead of dwindling.

Oct. 15 the Carnegie Steel Co. advanced its minimum price on bars, plates and shapes from 1.40c to 1.45c. Some other mills had already made such an advance and on the Carnegie announcement the remaining mills followed, making 1.45c. the market, against 1.05c. last December. Mills are reserved about contracting and the market may be 1.50c. within a few weeks. The leading sheet interest yesterday announced an advance in bessemer black sheets from 2c to 2.10c., and all other mills are expected to follow promptly. Openhearth are quoted as high as 2.20c. An advance in wire products is expected in the very near future.

Railroad buying has increased, there being a particularly insistent demand for prompt steel to be used in car and locomotive repairs. The Philadelphia & Reading has just ordered 2,000 freight cars and predictions are made that car buying will be very heavy in the next two months.

August exports of tonnage products of the iron and steel industry amounted to 401,000 gross tons, showing a continued increase, and October exports will probably amount to fully 450,000 tons. Including iron and steel taken by manufacturers of goods for export, machinery, automobiles, cars and locomotives, shells, etc., iron and steel is now going into export channels at the rate of about 8,000,000 tons a year, and of this about 7,000,000 tons is rolled steel, representing about 25% of the current rolled-steel output.

All the indications are that steel will grow scarcer and prices will continue to advance. Considering the character of much of the demand it is not expected, in most quarters, that advancing prices will curtail consumption to a material extent. Fundamental conditions are held to be different from those obtaining in other times.

Pig Iron—There is a slightly better demand for foundry iron, but there is no general buying movement. Consumers seem to be well covered for this year and to have no particular fears about supplies for the future. The West Penn Steel Co. has bought 10,000 tons of basic, for first-quarter delivery, from Rebecca furnace at Kittanning, which is to blow in before January. The Marshall Foundry Co. is understood to have practically closed for 10,000 tons of bessemer for first-half delivery at $16, Valley, and some sellers profess surprise that iron for such delivery could be obtained at the prevailing market for early shipment. We quote: Bessemer, $16; basic, $15; foundry and malleable, $14.50@15; gray forge, $14.25@14.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Prospects of delivery of English ferromanganese upon contracts now being offered by sellers appear to be somewhat less uncertain than a few weeks ago and the market is less nervous. We quote contract at $100 for imported and $115 for domestic, with prompt lots going at intermediate figures.

Steel—There are no offerings of soft openhearth billets, as the mills can make so much more money on special steels for war purposes, fancy prices being readily obtained for billets to be rolled under specifications that are not particularly difficult to meet. A sale of 9,000 tons of billets for rolling shell rounds has just been made at $50, Youngstown, and there are rumors of bids of $55. Bessemer billets are quotable at about $25, Youngstown. A broader market for bessemer billets and sheet bars is expected, when consumers of ordinary soft steel cannot secure openhearth. Rods are quotable $1 higher at $32, Pittsburgh.

FERRO-ALLOYS

Ferromanganese is quoted at $110@115 per ton for domestic 80% material.—**Spiegeleisen** has been sold at $27 per ton for 20%, at furnace.—**Ferrosilicon,** 50%, is quoted at $75 per ton at Pittsburgh. Bessemer ferrosilicon is from $20 per ton for 10% up to $24 for 14%, all at furnace.

IMPORTS AND EXPORTS

Imports and Exports of those articles of iron and steel which are reported by weight, and exports of machinery for August and the eight months ended Aug. 31, are reported as follows; iron and steel in long tons; machinery by values:

	August		Eight Months	
	1914	1915	1914	1915
Imports, iron and steel	28,572	27,560	195,826	152,183
Exports, iron and steel	86,598	401,298	1,046,347	2,077,783
Machinery, value	$4,759,663	$11,439,291	$67,322,446	$79,396,113

For the eight months tonnage imports decreased 43,643 tons, or 22.3%; while tonnage exports increased 1,033,436 tons, or 98.8%. Mining machinery was valued at $4,358,245 this year.

Exports and Imports of Secondary Metallic Products in the United States, seven months ended July 31, in pounds:

	Exports		Imports	
	1914	1915	1914	1915
Copper sulphate	6,848,978	9,869,280	.....	
White lead	11,054,662	13,764,343	.....	
Zinc oxide	17,834,431	25,473,850	.....	
Zinc dust	37,122	249,868	2,645,638	818,081
Zinc dross	648,631	6,654,425	.....	

Exports of zinc dust were all reëxports of foreign material.

Imports and Exports of Metals in Great Britain other than iron and steel, are reported as follows for the eight months ended Aug. 31, in long tons:

	Imports		Exports	
Metals:	1914	1915	1914	1915
Copper	111,776	146,990	39,035	20,905
Tin	29,601	30,703	27,416	28,816
Lead	147,145	178,907	35,824	43,992
Zinc	83,867	63,284	7,019	1,770
Quicksilver	1,220	946	306	303
Minor metals	5,997	3,435	17,221	13,252
Ores, etc.				
Tin concentrates	25,808	31,604	.....	.....
Pyrites	569,001	594,066	.....	.....

Copper imports include estimated contents of ore and matte. Exports include reëxports of foreign material.

Spanish Exports of Metals and Minerals, seven months ended July 31, as reported by "Revista Minera" in metric tons:

	Metals		Ores, etc.	
	1914	1915	1914	1915
Iron	11,502	84 071	4,467,837	2,599,185
Copper	14,851	11,100	74,975	26,304
Copper precipitate	6,481	7,216		
Lead	103 913	87 448	470	1,544
Zinc	990	2,172	60 866	17,059
Quicksilver	1,273	703		
Manganese			7,029	5,120
Pyrites			1,926,418	1,081,196
Salt			384 921	396,336

Imports of coal for the seven months were 971,706 tons, a decrease of 562,911 tons from 1914; imports of coke 117,789 tons, a decrease of 121,770 tons.

FOREIGN IRON

Foreign Iron Trade of Great Britain eight months ended Aug. 31 is valued by the Board of Trade returns as below:

	Exports	Imports	Excess
Iron and steel	£25,557,454	£6,501,686 Exp.	£19,055,768
Machinery, hardware, etc.	13,502,645	9,977 491 Exp.	9,525,154
Totals	£45,060,099	£16,479,177 Exp.	£28,580,922
Totals, 1914	68,287,516	19,871,738 Exp	48,415,778

Quantities of iron and steel exported were 2,954,263 long tons in 1914, and 2,087,676 in 1915; decrease, 866,587 tons. Quantities imported, 1,428,114 tons in 1914, and 766,319 in 1915; decrease, 661,795 tons.

Steel Production in Germany in July was 1,138,478 metric tons, being 57,692 tons more than in June. For the seven months ended July 31, the production was, in metric tons:

	Basic	Acid	Total
Converter	3,684,885	89,271	3,774,156
Open hearth	2,939,670	129,306	3,068,976
Direct castings	241,823	78,765	320,588
Crucible		58,265	58,265
Electric		61,964	61,964
Total	6,866,378	417,571	7,283,949

For the corresponding period in 1914 the total make was 11,015,676 tons, showing a decrease of 3,731,727 tons, or 33.9%, this year. In July there were 223 steel furnaces in operation.

Pig Iron Production in Germany in August was 1,050,610 metric tons, being 3,103 tons more than in July. For the eight months ended Aug. 31 the total was: Foundry iron, 1,587,913; forge iron, 200,739; steel pig, including all ferro-alloys, 1,073,673; bessemer pig, 117,463; Thomas or basic pig, 4,652,662; total, 7,632,450 metric tons, against 11,436,891 tons in 1914; showing a decrease of 3,804,351 tons, or 34.1%, this year.

IRON ORE

Shipments of Lake Superior iron ore continue heavy, and October is expected to show a heavy tonnage. Talk about prices for next season continues, but nothing definite has been done.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 417,724 short tons; shipments, 418,082 tons. This is the largest production for over two years. Shipments of Greensburg and Upper Connellsville districts, 40,055 tons.

Connellsville—Last Thursday's market for spot furnace coke was quotable at not over $1.90. Friday morning bids were made of $2.25 without bringing out enough coke and Saturday $2.40 was paid, this price being rather freely bid yesterday and today. The demand for prompt seems to be chiefly because the Republic Iron and Steel Co. has closed its Connellsville beehive ovens, in order to ship the coal to the battery of 75 additional byproduct ovens at Youngstown, to be put in operation early next month and giving, with the present 66 ovens, enough byproduct coke for all the company's blast furnaces. Meanwhile the company is a large buyer of prompt coke. Pickands, Mather & Co. have bought furnace coke for the first four months of next year for one of their Toledo stacks, and a six months' supply for Perry at Erie and Ella at West Middlesex, while there is still to be bought a three-months' supply for the other Toledo stack, coke being required for Toledo only until the byproduct plant being built at that point is completed. The total tonnage bought and still to be bought is about 45,000 tons a month. Contracts placed on this movement now amount to between 175,000 and 200,000 tons a month, chiefly at about $2.25 if for the year and at $2.35 if for the six months. These prices have been shaded in some instances but with the advance in spot coke operators are now expecting higher prices. Foundry coke has stiffened and is quotable at $2.60@2.75 for prompt and $2.60@2.85 for contract.

Chemicals

NEW YORK—Oct. 20

The general markets show little or no change from recent weeks.

Arsenic—There is no special change in the market and demand is only moderate. Quotations are $3.50 per 100 lb. for large lots and up to $4 per 100 lb. for smaller orders.

Copper Sulphate—About the usual business is forward and prices are steady. The quotation is lower at $6.50 per 100 lb. for carload lots, and $6.75 per 100 lb. for smaller orders.

Nitrate of Soda—There is little change. Demand is fair for the season and quotations are steady. They are held about 3.45c per lb. for both spot and futures.

Pyrites—Imports at Baltimore for the week included 2,862 tons pyrites from Pomaron, Spain.

Potash Salts—It is stated that experiments on the treatment of Utah alunite at one of the plants of the United States Smelting Co. have resulted in the production commercially of 18 to 20 tons daily of potash sulphate. The residue is an almost pure alumina. The Armour Fertilizer Co., it is said, has contracted to take all the potash salt that can be supplied.

Imports of refined potash salts into the United States for the eight months ended Aug. 31 are reported by the Department of Commerce as follows, in pounds:

	1914	1915	Changes
Carbonate	13,035,605	8,940,608	D. 4,094,997
Hydrate	5,081,483	2,028,142	D. 3,053,341
Nitrate	2,229,856	14,855	D. 2,215,001
Cyanide	318,087	862,127	I. 544,040
Other potash salts	4,067,764	2,075,741	D. 1,992,023

Imports of crude salts used mainly as fertilizers were as follows for the eight months, in long tons:

	1914	1915	Changes
Kainit	317,205	6,646	D. 310,559
Manure salts	150,973	13,647	D. 137,326
Sulphate of potash	30,696	10,627	D. 20,069
Muriate of potash	151,395	56,800	D. 94,595

The decreases, of course, are due to the stoppage of exports from Germany by the War.

Mining Companies—United States

Name of Company	and Situation	Shares Issued	Par	Dividends Total	Latest	Amt
Acacia, g	Colo.	1,438,989	$ 1	$ 122,004	Jan '11	$0.01
Adams, s.l.c.	Colo	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	50,000	25	3,050,000	July '15	10.00
Alaska Mexican, g.	Alas.	180,000	5	3,489,381	May '15	0.20
Alaska Treadwell, g.	Alas.	200,000	25	15,435,000	Aug. '15	0.75
Alaska United, g.	Alas.	180,200	5	1,937,150	Aug. '15	0.40
Am. Zinc, Lead & Sm.	U. S.	171,200	25	983,320	Jan. '14	0.50
Anaconda, c.	Mont.	2,496,250	50	97,741,875	July '15	0.50
Argonaut, g.	Calif.	200,000	5	1,680,000	Sept '15	0.06
Arizona Copper, pf.	Ariz.	1,426,120	1.20	2,121,274	May '15	
Arizona Copper, com.	Ariz.	1,519,896	1.20	18,461,338	July '15	0.24
Bagdad-Chase, g., pf.	Calif.	184,819	5	202,394	Jan. '09	0.10
Baltic, c.	Mich.	100,000	25	7,950,000	Dec. '13	2.00
Bingham N. H., c.	Utah.	228,690	5	408,564	Mar. '15	0.10
Bonanza Dev., g	Colo	300,000	1	1,425,000	Oct. '11	0.20
Brunswick, g	Calif.	395,287	1	203,314	Sept. '15	0.06
Bunker Hill Con., g.	Calif.	200,000	1	860,000	Oct. '15	0.02½
Bunker Hill & Sul., l.s.	Ida.	327,000	10	16,416,000	Sept. '15	0.25
Butte-Alex Scott, c.	Mont.	74,000	10	148,000	Oct. '13	0.50
Butte-Ballaklava, c	Mont	250,000	10	125,000	Aug. '10	0.50
Butte & Superior, z.	Mont.	272,019	10	3,264,985	Sept. '15	5.75
Caledonia, l.s.c.	Ida.	2,605,000	1	650,300	Aug. '15	0.03
Calumet & Arizona, c.	Ariz.	617,385	10	22,176,828	Sept. '15	1.00
Calumet & Hecla, c.	Mich.	100,000	25	127,750,000	Sept. '15	15.00
Camp Bird, g.s.	Colo.	1,100,051	5	10,428,674	July '15	0.08½
Centen'l-Eur., l.s.g.c.	Utah.	100,000	5	4,050,000	Apr. '14	1.50
Center Creek, l.z.	Mo	100,000	10	535,000	July '15	0.15
Champion, c.	Mich.	100,000	25	10,500,000	Sept. '15	2.00
Chief Consolidated, s.g.l.	Utah.	871,384	1	306,821	Aug. '15	0.05
Chino, c.	New Mex.	869,940	5	5,828,015	Sept. '15	0.75
Cliff, g.	Utah.	300,000	1	90,000	Jan. '13	0.10
Cliff, g.	Alas.	100,000	1	210,000	Oct. '13	0.01
Colo. Gold Dredging	Colo.	100,000	10	650,000	Sept. '14	1.00
Colorado, l.s.g.	Utah.	1,000,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s.	Utah.	285,540	5	226,832	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercur, g.	Utah.	1,000,000	1	3,445,313	July '13	0.03
Continental, z.l.	Mo.	22,000	25	341,000	July '15	0.50
Copper Range Con., c.	Mich.	393,692	100	13,986,746	Oct. '13	0.75
Daly Judge, s.l.	Utah.	300,000	1	1,020,000	July '15	0.25
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	45,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,783	100	3,550,969	Dec. '13	0.76
Eagle & Blue Bell, g.s.l.	Utah.	893,146	1	401,916	Aug. '15	0.10
Elkton Con., g.	Colo.	2,500,000	1	3,579,460	May '15	0.02
El Paso, g.	Colo.	490,000	5	1,707,545	Feb. '14	0.10
Ernestine, g.s.	N.M.	300,000	5	150,000	July '15	0.10
Fed. M. & S., com.	Idaho.	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho.	120,000	100	9,976,361	Sept. '15	1.00
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	258,000	Oct. '14	0.02
Frontier, z.	Wis.	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,305,000	Dec. '14	10.00
Gold Chain, g.	Utah.	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor	Colo.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con.	Colo	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g	Colo	1,500,000	1	4,080,000	Sept. '15	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,559,148	10	28,288,001	July '15	0.10
Grand Central, g.	Utah.	500,000	1	1,620,750	Sept. '14	0.05
Granite, g.	Colo	1,650,000	1	270,000	Nov. '12	0.01
Hazel, g.	Cal	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s.	Idaho.	1,000,000	0.25	3,510,000	Oct. '15	0.07
Hercules, l.s.	Idaho.	1,000,000	1	5,725,000	June '15	
Homestake, g.	S. D.	251,160	100	38,150,986	Sept. '15	0.65
Horn Silver, l.s.z.	Utah.	400,000	25	5,642,000	Sept. '07	0.05
Iowa, g.s.l.	Colo	1,666,667	1	233,499	Aug. '14	0.00½
Iowa-Tiger, g.s.	Colo.	3,000	1	9,250	Dec. '14	1.00
Iron Blossom, s.l.g.	Utah.	1,000,000	0.10	2,420,000	July '15	0.05
Iron Silver, s.l.g.	Colo	500,000	20	4,950,000	Dec. '14	0.10
Jamison, g.	Cal	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo	2,500,000	0.10	187,500	Nov. '14	0.01
Kendall, g.	Mont	500,000	5	1,505,000	July '14	0.06
Kennedy, g.	Cal	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug '09	0.12
Klar Piquette, z.l.	Wis.	20,000	1	259,000	Apr. '13	0.50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct. '13	0.00½
Liberty Bell, g.	Colo	133,552	5	1,559,179	Sept. '13	
Little Bell, l.s.	Utah.	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah.	400,000	2.50	2,300,000	July '13	0.05
Mary McKinney, g.	Colo	1,309,252	1	1,169,308	July '14	0.02
May Day, g.s.l.	Utah.	800,000	0.25	220,000	Aug. '15	0.03
Mexican, g.s.	Nev.	201,600	2.50	161,910	June '14	0.75
Miami, c.	Ariz.	747,112	5	5,645,698	Aug. '15	0.75
Modoc, g.s.	Colo	500,000	1	275,000	Dec. '11	0.01
Mohawk, c	Mich.	100,000	25	3,575,000	Feb. '15	2.00
Monarch-Mad'a, g.s.l.	Colo	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	488,588	Dec. '12	0.10
Mountain, c.	Cal	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,457	5	18,976,141	Sept. '15	0.37½
New Century, z.l.	Mo	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal	100,000	5	1,680,000	Apr. '14	0.10
North Butte, c.	Mont.	430,000	15	12,062,000	July '15	0.40
North Star, g.	Cal	250,000	10	4,687,040	Sept '15	0.20
Old Domin'n, M. & Sm.	Ariz.	162,000	25	7,553,000	Sept. '15	1.50
Ophir, s.g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah.	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging	Cal	700,000	5	1,771,838	Sept. '15	0.12
Osceola, c.	Mich.	96,150	25	12,660,425	July '15	3.00
Parrot, c.	Mont.	229,850	10	7,871,839	July '15	1.63
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	7,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g	Nev.	2,790,000	1	771,200	July '14	0.02
Portland, g.	Colo	3,000,000	1	9,993,080	July '15	0.02
Quilp.	Wash.	1,500,000	1	67,500	Feb. '12	0.01

Mining Companies—United States—(*Continued*)

Name of Company	and Situation	Shares Issued	Par	Dividends Total	Latest	Amt
Quincy, c	Mich.	110,000	$ 25	$21,447,500	Sept '15	$2.00
Ray, c	Ariz	1,485,333	10	4,362,030	Sept '15	0.37½
Republic, g	Wash.	1,000,000	1	170,000	Nov '12	0.01½
Rochester, l.z	Mo	4,900	100	190,846	July '12	0.50
Round Mountain, g	Nev.	1,188,019	1	369,365	Aug '13	0.04
Seven Troughs Coal., g	Nev.	1,500,000	1	144,306	Sept '15	0.02½
St. Joseph, l.	Mo	1,472,252	10	9,925,530	Sept '15	0.25
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck Arizona, c	Ariz.	350,000	10	2,625,000	Aug. '15	0.50
Silver King Coal, l.s	Utah.	1,250,000	[illegible]	2,909,885	July '15	0.15
Silver King Con., l.s.	Utah.	627,582	1	685,338	July '15	0.10
Sioux Con., s.l.g.	Utah.	745,389	1	872,0[illegible]	July '11	0.04
Skidoo, g	Cal	1,000,000	5	365,000	Oct. '14	0.01
Snowstorm, c g.	Ida	1,500,000	1	1,192,103	Oct. '13	0.02
South Eureka, g	Calif.	299,981	1	411,680	July '15	0.03
Standard Con., g s	Cal	178,394	10	5,274,407	Nov. '13	0.25
Stewart, s.l.	Ida.	1,238,362	1	1,950,243	Sept. '15	0.10
Stratton's Ind., g.	Colo.	1,000,000	[illegible]	456,625	Dec '14	0.03
Success, z.	Ida	1,500,000	1	870,000	Sept. '15	0.06
Superior & Pitts., c	Ariz.	1,499,792	10	9,748,658	Sept '15	0.38
Tamarack, c	Mich.	60,000	25	9,[illegible]20,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	4,756,250	July '15	0.75
Tomboy, g s.	Colo	310,000	4.85	3,709,395	June '15	0.24
Tom Reed, g	Ariz.	909,555	1	2,443,[illegible]57	Apr. '15	0.06
Tonopah Belm't, s g	Nev.	1,500,000	1	7,455,510	July '15	0.12½
Tonopah Ext., g s.	Nev.	943,433	1	896,259	July '15	0.10
Tonopah of Nev., s g	Nev.	1,000,000	1	12,850,000	July '15	0.25
Tri-Mountain, c.	Mich.	100,000	25	1,450,000	Dec. '13	2.00
Tuolumne, c	Mont.	800,000	1	520,000	May '13	0.10
Uncle Sam, g s l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov. '12	0.01
United (Crip. Ck.) g.	Colo	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	100	2,472,500	June '15	6.00
United Verde, c.	Ariz.	300,000	100	35,497,000	Aug '15	0.75
Utah, s l.	Utah.	100,000	10	281,869	Dec. '10	0.02
Utah, c.	Utah.	1,624,490	10	30,275,161	Sept. '15	1.00
Utah Con., c.	Utah.	300,000	5	9,000,000	Sept '15	0.50
Valley View, g.	Colo	1,000,000	1	210,000	Dec. '10	0.04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo	1,500,000	1	3,217,000	July '15	0.03
Wasp No. 2, g	S. D.	500,000	1	489,466	Sept. '15	0.01
Wellington Mines, g.	Colo	10,000,000	1	450,000	Aug '15	0.00½
Wolverine, c	Mich.	60,000	25	8,220,000	Mar. '15	4.00
Yak, s l	Colo	1,000,000	1	1,907,685	June '14	0.03
Yankee Con., g s	Utah.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal	100,000	10	1,163,789	May '15	0.02
Yellow Pine, l z.s.	Nev.	1,000,000	1	683,008	Sept. '15	0.10
Yukon Gold, g	Alas	3,500,000	5	7,350,000	Sept. '15	0.07½

Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,879	100	103,495,183	Aug '15	$3.77
Am. Sm. & Ref., com	U. S.	500,000	100	28,833,333	Sept. '15	1.00
Am. Sm. & Ref., pf	U. S.	500,000	100	53,083,333	Sept. '15	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	10,274,800	July '15	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	15,125,000	July '15	1.25
Greene Cananea	U. S.	450,642	100	4,371,646	June '14	1.00
Guggenheim Expl.	U. S.	831,732	25	22,489,595	July '15	1.00
Inter'l Nickel, com.	U. S.	380,315	100	19,605,684	Sept '15	5.00
Inter'l Nickel, pfd	U. S.	89,126	100	8,525,869	Aug. '15	1.50
National Lead, com.	N. Y.	206,554	100	8,890,632	Sept '15	0.75
National Lead, pf.	N. Y.	243,676	100	30,545,959	Sept '15	1.75
Old Dominion, c.	Ariz.	293,245	25	6,747,098	Sept '15	1.50
Phelps, Dodge & Co.	U. S.	450,000	100	44,184,304	Sept '15	5.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	222,360,438	Dec. '14	0.50
U. S. Steel Corp., pf.	U. S.	3,602,811	100	383,208,093	Aug. '15	1.75
U. S. S., R. & M., com.	U. S.-Mex	351,114	50	6,362,188	July '14	0.75
U. S. S., R. & M., pf.	U. S.-Mex	486,348	50	15,944,131	July '15	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s	Mex.	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,580,884	Feb. '15	0.03
B. C. Copper	B. C.	591,709	5	615,198	Jan. '13	0.15
Beaver Con., s.	Ont.	1,936,490	1	529,857	Apr. '15	0.03
Buffalo, s.	Ont.	1,000,000	1	2,757,000	July '14	0.03
Canadian Goldfields, g	B. C.	600,000	0.10	290,000	July '14	0.001½
Chontalpan, g s l.z	Mex.	7,000	25	59,500	May '14	0.75
Cobalt Townsite, s.	Ont.	45,000	1	1,042,259	May '14	0.10
Coniagas, s.	Ont.	800,000	5	7,720,000	Aug. '15	0.30
Con. M. & S. Co. of Can	B. C.	58,052	100	2,058,907	July '15	2.00
Crown Reserve, s.	Ont.	1,768,814	1	6,067,030	July '15	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dos Estrellas, g.s.	Mex.	300,000	0.50	10,335,000	Dec. '13	1.50
El Oro, g.s.	Mex.	1,147,500	4.85	8,668,418	July '13	0.24
Esperanza, s g.	Mex.	455,000	4.85	13,327,999	July '15	0.24
Granby, s.l.c.	B.C.	149,985	100	5,756,178	Aug. '15	1.50
Greene Con., c	Mex.	1,000,000	10	9,544,400	May '14	0.50
Guanajuato D., pf., s	Mex.	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold.	B. C.	120,000	10	1,704,000	Sept '15	0.50
Hollinger, g.	Ont.	600,000	5	3,693,000	Sept '15	0.20
Kerr Lake s.	Ont.	600,000	5	5,970,000	Sept. '15	0.25
La Rose Con., s	Ont.	1,498,627	5	5,387,122	July '15	0.25
Le Roi No. 2, g.	B. C.	120,000	24.30	1,501,740	May '15	0.24
Lucky Tiger Com., g.	Mex.	715,337	10	3,263,100	Sept '15	0.09
McK.-Dar. Sav. s.	Ont.	2,247,692	1	4,540,333	July '15	0.03
Mines Co. of Am. (new)	Mex.	1,700,000	10	1,215,000	July '13	0.12½
N. Y. & Hond. Ros., g	C. A.	2[illegible]0,000	10	3,730,000	July '15	0.30
Nipissing, s.	Ont.	1,200,000	5	13,290,000	July '15	0.25
Peñoles, s l.g.	Mex.	80,000	25	6,361,688	June '13	1.25
Pinguico, pf., s.	Mex.	20,000	100	840,000	Oct '13	3.00
Right of Way Mos, s.	Ont.	1,685,500	1	219,115	Nov. '14	0.02
Rio Plata, s.	Mex.	374,518	5	345,745	Feb. '13	0.05
San Rafael, g s.	Mex.	2,400	25	1,442,380	Jan. '14	0.50
San Toy, g s.	Mex.	5,750,000	1	530,000	July '13	0.01
Sorpresa, g s	Mex.	19,200	20	3,979,240	Jan. '11	34.00
Stand'd Silver-Lead	B. C.	2,000,000	1	1,550,000	Sept '14	0.02½
Temiskaming, s.	Ont.	2,500,000	1	1,384,155	Apr '13	0.06
Tem. & Hud. Bay, s	Ont.	7,761	1	1,940,250	Nov '14	3.00
Trethewey, s.	Ont.	1,000,000	1	1,061,998	July '14	0.05
Wettlaufer-Lorrain, s	Ont	1,416,590	1	637,465	Oct. '13	0.05

Assessments

Company	Delinqe	Sale	Amt.
Aetna, Ida	Oct. 16	Nov. 15	0.001
Argenta, Ida	Oct. 11	Nov. 13	0.001
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0.01
Cash Boy, Nev	Sept. 29	Oct. 30	0.01
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah	Oct. 10	Oct. 30	0.025
Comstock, Ida	Sept. 30	Oct. 30	0.001
Con. Virginia, Nev	Sept. 28	Oct. 19	0.05
Copper Mt. M. & D., Ida	Oct. 28	Dec. 1	0.002
Diamfield Black Butte, Nev.	Oct. 4	Nov. 4	0.01
Eagle Mt., Ida	Oct. 15	Nov. 15	0.0005
Enterprise, Ida	Oct. 15	Nov. 15	0.002
Exchequer, Nev	Oct. 4	Oct. 25	0.02
Four Timbers, Wash	Oct. 4	Nov. 4	0.001
Friend, Wash	Oct. 18	Nov. 10	0.002
Giant M. & D., Ida	Oct. 7	Nov. 8	0.003
Goldstrike M. & L., Utah	Oct. 1	Oct. 20	0.01
Hancock Cons., Mich	Jan. 3		1.00
Idaho-Nevada Exp., Ida	Nov. 1	Dec. 1	0.002
Idora, Ida	Oct. 11	Nov. 11	0.005
LeRoy, Ida	Sept. 25	Oct. 25	0.002
Lewis & Clark, Ida	Oct. 15	Nov. 15	0.001
Military M. & M., Ida.	Oct. 28	Nov. 29	0.0065
Nahob, Ida	Oct. 25	Nov. 15	0.005
Naildriver, Utah	Oct. 9	Nov. 8	0.02
Nevada-Douglas, Nev.	Sept. 27	Oct. 20	0.10
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0.50
Northern Light, Ida	Nov. 2	Dec. 2	0.004
Old Veteran, Ida	Nov. 1	Nov. 27	0.002
Ophir, Nev	Oct. 12	Nov. 2	0.05
Oriental, Nev	Nov. 6	Dec. 7	0.003
Pacific M. & M., Ida	Nov. 10	Nov. 30	0.0005
Phedora, Ida	Sept. 21	Oct. 21	0.0005
Phoenix, Mich	Jan. 1		1.00
Phoche Metals, Nev	Oct. 20	Nov. 20	0.004
Rainbow, Ida	Oct. 15	Nov. 20	0.002
Revelator, Utah	Oct. 4	Oct. 25	0.004
Rockford, Ida	Oct. 4	Oct. 30	0.005
Silver Moon, Ida	Oct. 15	Nov. 18	0.005
Silver Pick Cons., Nev.	Oct. 16	Nov. 23	0.01
Snowstorm Ext	Sept. 16	Oct. 18	0.003
Sunset M. & D., Nev.	Oct. 18	Nov. 22	0.02
Sunshine, Ida	Oct. 15	Nov. 15	0.0005
Temple, Ida	Sept. 20	Oct. 20	0.002
Ton. Gipsy Queen, Nev.	Oct. 29	Dec. 6	0.01
Umatilla Ton., Nev.	Nov. 8	Dec. 13	0.005
Union Cons., Nev	Oct. 25	Nov. 15	0.05
Virginia, Ida. (post.)		Oct. 30	0.02
Wisconsin, Ida	Oct. 19	Nov. 19	0.003

Stock Quotations

A memento of bygone days appeared on the Boston Exchange last week. Seventy-five shares of Ashbed sold at 40c.

COLO. SPRINGS	Oct. 19		SALT LAKE	Oct. 19	
Name of Comp.	Bid.		Name of Comp.	Bid.	
Acacia	02		Beck Tunnel	05	
Cripple Cr'k Con.	‡ 008		Black Jack	05½	
C. K. & N.	‡ 02		Colorado Mining	09½	
Doctor Jack Pot.	09¾		Crown Point	01½	
Elkton Con.	24		Daly-Judge	6	55
El Paso	75		Emma Cop.	22½	
Findlay	03½		Gold Chain	16	
Gold Dollar	‡ 01		Grand Central	54	
Gold Sovereign	05		Iron Blossom	66	
Golden Cycle	1 78½		Lower Mammoth	04½	
Isabella	16¾		May Day	19½	
Jack Pot	06½		Opohonga	00½	
Jerry Johnson	04¾		Prince Con	63	
Lexington	‡ 005		Seven Troughs	01½	
Mary McKinney	06½		Silver King Coal'n	03	
Pharmacist	09½		Silver King Con.	2	02½
Portland	1 62		Sioux Con.	02	
Raven B. H	03½		Uncle Sam	08	
Vindicator	1 50		Yankee	25	
	TORONTO	Oct. 19			
Bailey	04		Dome Exten.	25	
Chambers Ferland	14		Dome Mines	21	87½
Conlagas	04½		Foley O'Brien	35	
Peterson Lake	21		Hollinger	24	50
Right of Way	04		Imperial	05	
Seneca Superior	‡ 78		Jupiter	10	
Silver Queen	01		McIntyre	50	
T. & Hudson Bay	20	00	Pearl Lake	‡ 00½	
Timiskaming	36		Porcu Crown	73	
Trethewey	‡ 16		Preston E. D.	06	
Wettlaufer-Lor	05		Rea	‡ 09	
	SAN FRANCISCO	Oct. 19			
Comstock Stocks			Misc. Nev. & Cal		
Alta	04		Belmont	3	60
Andes	12		Dan Butler	75	
Best & Belcher	08		Lone Star	04	
Caledonia	1 03½		Mac Namara	02	
Challenge Con	‡ 04		Midway	12	
Chollar	04		Mont.-Tonopah	27	
Confidence	23		North Star	9	00
Con. Virginia	23		Rescue Eula	07	
Gould & Curry	04		West End Con.	57	
Hale & Norcross	05		Atlanta	26	
Jacket-Cr. Pt.	15		Booth	38	
Julia	02		C.O.D. Con	04	
Mexican	39		Comb. Frac	08	
Occidental	78		D'field Daisy	03	
Ophir	40		Jumbo Extension	1 27½	
Overman	11		Pitts.-Silver Peak	‡ 05	
Potosi	04		Round Mountain	10	
Savage	06		Sandstorm Kendall	10½	
Sierra Nevada	53		Silver Pick	08	
Union Con	67		Central Eureka	08	

N. Y. EXCH.	Oct. 19	BOSTON EXCH	Oct. 19
Name of Comp.	Clg.	Name of Comp.	Clg.
Am.Sm.&Ref.,com.	94¾	Adventure	2
Am. Sm. & Ref., pf.	109	Ahmeek	397½
Am. Sm. Sec., pf. A	86	Alaska Gold M	33½
Am. Sm. Sec., pf. B	82	Algomah	1¼
Anaconda	76	Allouez	55
Batopilas Min	1¾	Am. Zinc	62½
Bethlehem Steel	491½	Arlz. Com., ctfs.	8
Bethlehem Steel, pf.	166	Bonanza	40
Chino	50	Butte-Tallahlava	3½
Colo. Fuel & Iron	57½	Butte & Superior	40½
Cruelble Steel	63½	Calumet & Ariz	64½
Federal M. & S., pf.	50½	Calumet & Hecla	540
Great Nor., ore, ctf.	49½	Centennial	17½
Greene Cananea	40½	Copper Range	56
Guggen. Exp.	67¼	Daly West	2 11
Homestake	20	East Butte	12½
Inspiration Con.	43¼	Franklin	9¼
International Nickel	201	Granby	84
Miami Copper	34½	Hancock	16½
Nat'l Lead, com	69	Hedley	26½
National Lead, pf.	110½	Helvetia	‡ 50
Nev. Consol.	15	Indiana	5
Ontario Min	3	Island Cr'k, com.	44½
Quicksilver	2½	Island Cr'k, pfd.	86
Ray Con.	25½	Isle Royale	28
Republic I.&S., com.	55½	Keweenaw	2½
Republic I.&S., pf.	104	Lake	13
Sloss-Sheff'd, com.	63	La Salle	5½
Tennessee Copper	66½	Mason Valley	2
Utah Copper	70½	Mass	11
U. S. Steel, com	85½	Mayflower	4
U. S. Steel, pf.	115½	Michigan	2¾
		Mohawk	78
N. Y. CURB	Oct. 19	New Arcadian	10
Alaska Juneau	12	North Butte	30½
Alta Con	20	North Lake	1½
Beaver Con	28	Ojibway	1½
Big Four	05	Old Colony	3½
Blue Bell	‡ 02	Old Dominion	54
Braden Copper	9¾	Osceola	85½
Buffalo Mines	50	Quincy	82½
Can. Cop. Corpn.	1	Santa Fe	3¾
Cashboy	05	Shannon	7¼
Chile Cop.	22¾	Shattuck-Arlz.	26
Con. Ariz. Sm.	1¼	Superior	27
Con. Coppermines	1¼	Superior & Bost.	2¾
Con. Nev.-Utah	5/16	Tamarack	54½
Dia. Black B	05	Trinity	9½
Florence	45	Tuolumne	43
Goldfield Con.	1 17	U. S. Smelting	43½
Goldfield Merger	18	U. S. Smelt'g, pf.	47¾
Kennecott Cop.	52½	Utah Apex	2¾
Kerr Lake	3¾	Utah Con	12½
La Rose	50	Victoria	2½
Magma	14	Winona	3
McKinley-Dar'Sa	30	Wolverine	59
Mines of Am	2½	Wyandot	1½
Mother Lode	35		
Nevada Hills	20	BOSTON CURB	Oct. 19
New Utah Bingham	3¾	Bingham Mines	7
Nipissing Mines	6¼	Boston Ely	21
Oro	06	Butte & Lon'n Dev	30
St. Joseph Lead	12½	Calaveras	1¾
South Utah	03	Calumet-Corbin	01
Grand'd Oil of N.J.	200	Chief Con	90
Standard S. L.	1½	Cortez	55
Stewart	1 11	Crown Reserve	35
Success	82	Davis-Daly	1¾
Tonopah	5½	Eagle & Blue Bell	1½
Tonopah Ex.	2½	First Nat Cop	5½
Tonopah Merger	37	Houghton Copper	2¾
Tribullion	¾	Iron Cap Cop., pf	5
Tularosa	‡¼	Majestic	70
Yukon Gold	2½	Mexican Metals	23
		Nevada-Douglas	70
LONDON	Oct. 4	New Baltic	3
Alaska Tre'dwell	£6 5s 0d	New Cornelia	8¾
Burma Corp.	1 11 3	Ohio Copper	14
Can. & Motor	0 14 0	Oneco	85
Camp Bird	0 4 6	Ray Con. Copper	10
El Oro	0 7 0	Rex Cons.	48
Esperanza	0 7 3	Smokey Dev	15
Mexico Mines	3 11 3	So. Lake	5
Nechi, pfd.	0 12 9	Tonopah Victor	25
Oroville	0 14 6	United Verde Ext	5¼
Santa Gert'dis	0 7 6	Utah Metal	7¼
Tomboy	1 0 3		
Tough Oakes	0 6 9	‡Last Quotations.	

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57 572	48.855	28 983	26 553	22 731
February	61 642	57 506	48.477	28 357	26 573	22 753
March	57 870	58 067	50.211	26 669	26 788	23.708
April	59 493	58.519	50.250	27 416	26 958	23 709
May	60 361	58.175	49.915	27 825	26 794	23.570
June	58 990	56.471	49.034	27 199	25 948	23 267
July	58 721	54.678	47.519	27 074	25.219	22 597
August	59 293	54.344	47.163	27 335	25 979	22 780
September	60 640	53.290	48.680	27 986	24 260	23 591
October	60 793	50.654		28 083	23.199	
November	58 995	49 082		27 263	22 703	
December	57 760	49.375		26.720	22 900	
Year	59 791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13 603	19.477	61 336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64 955	91.409
August	*	16 941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*		‡		‡	
November	11.739		53.227		*	
December	12 801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 779	34 260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48 426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33 360	38 790	150.702	162.675
June	30 577	40.288	138.321	167.636
July	31 707	37 423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284		‡	
November	33.304		149.391	
December	33.601		147.102	
Year	34 301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4 111	3.729	4 011	3.548	19.605	18.606
February	4 048	3.827	3 937	3.718	19.600	19.122
March	3 970	4.053	3.850	3.997	19.051	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.847
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3 891	5.659	3.738	5.531	19.051	24.611
August	3 875	4.656	3 715	4.520	‡	21.946
September	3.828	4.610	3 658	4.490	‡	23.151
October	3.528		3 384		‡	
November	3.683		3.585		18.500	
December	3 800		3.662		19.097	
Year	3 862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5 113	10.014	4.963	9.837	21.500	49.884
May	5 074	14.781	4 924	14.610	21.393	68.100
June	5 000	21.208	4 850	21.038	21.345	100.614
July	4 920	19.026	4.770	18 856	21.568	97.250
August	5 568	12.781	5 418	12.611	‡	67.786
September	5 380	13.440	5.230	13.270	‡	67.841
October	4 909		4 750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5 213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15.06	14 55	14 12	13.45	14.08	13.90
March	15 07	14.55	13.91	13.45	14 10	13.95
April	14.90	14.55	13 90	13.45	14 13	13.95
May	14 90	14.61	13 90	13.60	14.27	13.83
June	14 90	14.70	13.90	13.67	13.96	13.77
July	14 90	14.94	13 90	13.91	13.90	13.68
August	14.90	16.01	13 90	15.31	14 08	14.75
September	14 90	16.86	13 90	15.95	14 03	15.70
October	14.83		13 75		13.97	
November	14.59		13 43		13.83	
December	14 70		13.45		13 83	
Year	$14 88		$13 78		$14 01	

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Winter Mining at Fairbanks

By Hubert I. Ellis*

SYNOPSIS—Surface operations form the principal field for differences between summer and winter operations, but underground there are a few differences. Steam pipes have to be carefully wrapped to guard against excessive condensation, and pumps have to be carefully handled. Dumps are thawed by means of long sweaters, forced into the material. Sluicing methods are described in detail.

Although winter mining at Fairbanks, Alaska, differs from summer operation chiefly in the methods employed at surface, there are also important differences in the procedure underground. As a rule, winter mining is on a less elaborate scale and less time and expense are taken in opening up, or developing, the body of pay. The area to be stoped is smaller, most winter dumps mined in recent years consisting of gravel from pillars and other isolated blocks not large enough to justify the heavy development expense necessary for summer work. Since all the gold in the gravel is locked up in the dump until water runs in the spring and most operators have a limited bank account, it is not the usual practice to employ more men than is absolutely necessary, many mines being worked by four or five men on a cooperative basis, with perhaps as many more wage-workers during part of the winter. Another thing militating against extensive winter mining—by which is meant the storage of pay gravel at surface as distinct from prospecting and development—is the fact that it takes nearly all winter to find the pay and open it up on a large scale for summer work.

FIG. 1. SLUICING GRAVEL AT THE ALASKA FIELDS, HAND METHOD OF MOVING THE MATERIAL

Plan of Operations for Winter Work

The shaft is sunk in the usual manner, but is rarely timbered except that a light square-set may be inserted at the station. To avoid the cold as far as possible, it is a good idea to place the sump and pump a short distance from the shaft, but this frequently is not done. Drifts are usually short, rarely extending more than 100 ft. from the shaft, and less pains are taken to keep the working faces regular and of as great extent as possible. The cold air from the surface is sufficient to overcome the heat of the steam line and points for a considerable distance from the shaft, and it is often possible to work without timbering the drifts. On account of decreased sloughing and the smaller area of roof exposed for slabs to form, it is likewise easier to start stoping at the shaft, leaving a suitable pillar to be robbed later, and to work

*Kellogg, Idaho.

outward in all directions. Transport underground, owing to the small scale of operations, is usually by wheelbarrow.

Steam pipes must be wrapped or otherwise insulated to guard against excessive loss from condensation, and great care is essential to keep water from freezing in the pipes and bursting them. The pump, too, should be handled with care; it is sure to be refractory on a cold morning—and all mornings are cold in winter—and to require thorough warming with steam before it can be induced to start.

In the fall, before snow has fallen in any quantity, the site for the dump must be prepared at surface. If an old tailing pile happens to be in just the right place, it makes an excellent foundation; otherwise the brush and moss must be removed over an area as large as the dump is expected to occupy. The gin-pole is placed a little back from the center of this circle to make the bucket dump in the center. To avoid unnecessary rehandling of the gravel in sluicing, it is dumped over the sluice boxes, which are placed as near the ground as possible. If there is sufficient grade they are sometimes set in shallow trenches, which are easily dug in the brittle surface muck. Sometimes, however, the boxes must be raised several feet from the ground, in which case they are

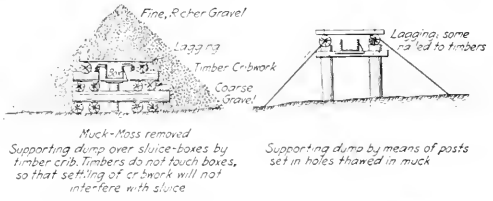


FIG. 2. THE GRAVEL PILE

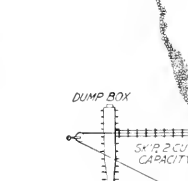


FIG. 4. THE DUMP SUPPORT

protected by a cribwork of logs with removable top lagging, as shown in Fig. 2. Two or three sets, or strings, of these boxes are used in order that the gravel may be sluiced with the smallest possible amount of work. It is not customary to place riffles in those boxes immediately under the dump, but to use the so-called "false-bottom" boxes, which are merely sluice boxes with 1-in. boards to protect the bottoms, and which may be set with a grade of 6 or 7 in. or less to the box length where 9- or 10-in. grade is required for riffled boxes. Since there is almost always an abundance of water while the winter accumulation of snow is thawing, the sluice boxes themselves will run with less grade than usual; they are not ordinarily placed in position, however, until spring. Short ditches anywhere along the hillsides will usually collect all the water required, and these are best excavated in the fall before snow begins to fall; in fact, that is regarded as the best time for all ditch construction. The ditches to collect water for sluicing a winter dump need not be large, since they usually have such grade that they are able to cut their own channels through the muck.

Classification Resulting in Building a Dump

As hoisting proceeds the dump piles up as a large cone. The biggest rocks roll farthest when the bucket dumps and collect at the bottom in a constantly expanding ring. Consequently there is a rude sort of classification, the bottom of the dump being composed of coarser, lower-grade material than the rest and the richest part being at the apex and directly below it. For this reason and for the additional reason that the bottom is generally below the boxes and requires elevating before it can be sluiced, the lower 2 or 3 ft. of the dump is often left if it does not show good values by panning, only the richer portion being sent through the boxes.

One disadvantage of the winter dump is that it must be thawed again in the spring. The sun would of course thaw it in time, but this would take so long that, aside from the matter of the loss of time, there would be no water for sluicing. Thawing is usually done by means of long "sweaters" of ¼- or ⅜-in. pipe, which are easily driven into the loose, poorly compacted material with light wooden mallets. Sometimes a sweater strikes a rock and has to be withdrawn, but it does not take long to insert it again. Each successive addition having frozen before it had a chance to settle and considerable snow

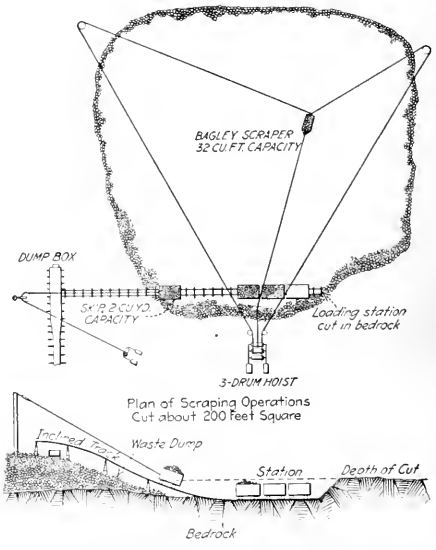


FIG. 3. DIAGRAM OF TYPICAL SCRAPING AND LOADING OPERATIONS

having fallen and been included in the dump, there is naturally a large proportion of voids; hence, when the dump thaws, it slumps heavily and loses its regular conical outline.

In sluicing, the lagging over the boxes is removed, one piece at a time, by means of a sharp pick and the gravel is allowed to fall into the boxes just rapidly enough to keep from clogging them. This work always starts at the lower end of the dump, since the boxes might otherwise clog underneath, where it is difficult to open them. All the gravel that will fall in having been sluiced, as much more as convenient is raked in by picks or pushed in by shovels.

When it becomes impossible to take further direct advantage of the force of gravity, there are several alternatives, among which the operator may choose. One of these is to drive into the boxes by hydraulicking with a small pump and suitable nozzle as much as possible of what gravel is left; this is probably cheapest for large dumps.

Another is to shovel the material into the boxes, using wheelbarrows for the final stages if they are of any advantage. If the boxes are set nearly flush with the ground, it may be feasible to use a horse or power scraper for the lower portion of the dump.

Disposal of the Washed Tailings

Since the boxes are always set as near as possible to the ground, there is rarely room for the free discharge of tailings. A place may be prepared for them in the fall by ground-sluicing away some of the muck, but this is not often done and is rarely adequate. In most cases the tailings require handling by some method or other. If the ground slopes fairly steeply and the dump is not large, room may be obtained by keeping a man constantly at work in the tailings, since he can spread the gravel rethawed and rehandled, involving great expense aside from loss of time; and the tailings must also be rehandled, making the third time for much of the gravel.

Winter mining is especially adapted to coöperative work on small isolated blocks or pillars, to narrow and irregular paystreaks, and to those creeks where it is difficult or impossible to obtain an adequate and dependable supply of water in summer.

It may be noted, in reference to winter mining, that some operators have been able to continue sluicing till December or later by returning the sluice water to be used again and again. The exhaust of the pumping engine, if turned into the discharge of the pump, helps materially to keep the water from freezing. A small amount of fresh water must be obtainable from a creek or ditch, however, to replace the inevitable loss. This

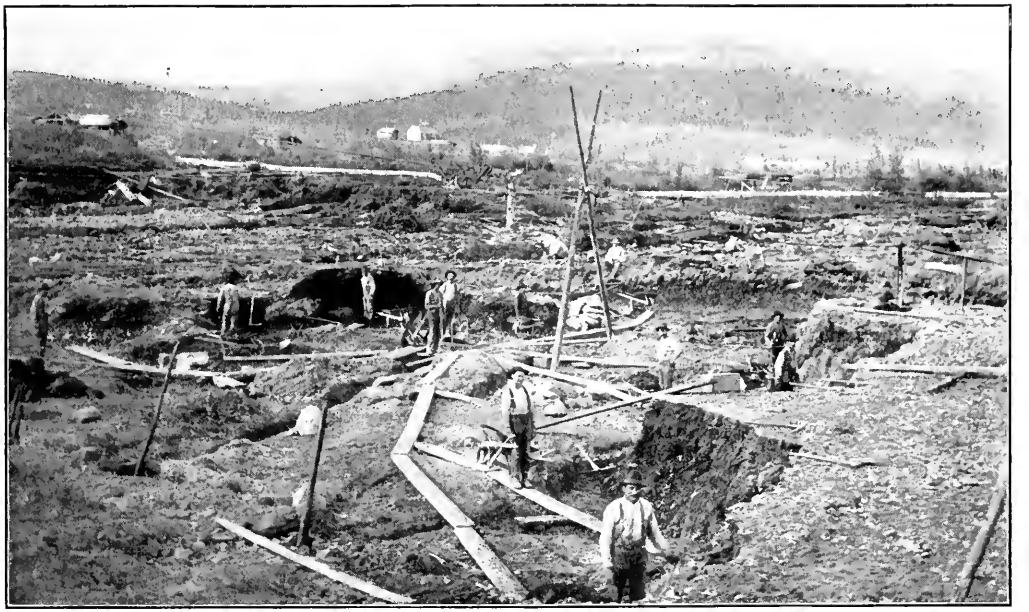


FIG. 5. OLD METHOD OF WORKING OPENCUTS, USING WHEELBARROWS TO DUMP INTO CARRIER BUCKET

out over a large area by simply pushing it around with a shovel while the sluice-head of water is running and by adding new boxes from time to time. Where the tailings problem is more serious, horse scrapers or small power scrapers are sometimes used with excellent results.

The chief advantages of winter mining are the following: Less cost for shaft, since it does not need to be timbered and may therefore be smaller; smaller cost of driving tunnels, for the same reasons; greater ease of obtaining fuel, machinery and other supplies while snow is on the ground; and the possibility of obtaining gravity water for sluicing at small expense on some claims where it is impossible to obtain it at all during the dry season. The disadvantages, compared with summer operation, are: The gold is not immediately available and it is difficult to form accurate estimate of the tenor of gravel; much time is taken to sluice the dump in the spring, which is in addition to the time required for mining and sluicing the same gravel in summer; the dump must be method is not suitable for general adoption, and it is probable that the muddy water greatly increases the loss of fine gold.

Opencut Mining and Its Variations

Owing to the depth to bedrock on most creeks, opencut mining did not attain any great importance in the Fairbanks district until the power scraper was introduced. Except for Fairbanks Creek, and upper Goldstream and its tributaries, the only ground suitable for surface work is at the extreme heads of the creeks, where paystreaks are narrow, irregular and generally low-grade. Some of this ground was mined in the early days, and a little is still mined by shoveling directly into the boxes. The gradient of the creeks is so low that it is necessary to place the boxes as high as possible, naturally increasing the difficulty and expense of shoveling, to avoid undue trouble with tailings; and in some cases the pay has been hoisted by windlass or the tailings removed by horse

scrapers. These narrow, shallow paystreaks are usually in the creek bottoms, and excess water during wet weather is likely to cause considerable trouble unless a large drain is dug on bedrock to keep the cut dry. It is necessary, near the heads of the creeks, to store the water in dams during dry weather, and even then it may not be possible to operate at capacity.

If the depth to bedrock is more than 6 or 8 ft. it is obviously necessary to elevate the gravel by some means; and if the paystreak is more than 20 ft. wide the gravel must be conveyed to the boxes or the boxes must be moved from side to side. The wide, shallow deposits of Goldstream and its tributaries were the first to be worked on an extensive scale by opencut methods, and the operators here hit on the scheme of combining drift mining and opencut mining by using buckets and automatic carriers in conjunction with wheelbarrows. The buckets dropped into sumps cut in bedrock and were filled from wheelbarrows; they were then hoisted up the inclined trolley-cables and dumped into the mud-boxes. Except for the smaller amount of development work required, less expense for thawing and the greater convenience of working in the open air, this process had little advantage over drift mining. Cost of digging bedrock drains or pumping out rain and seepage water, cost of removing overburden, delay when waiting for ground to thaw in spring or cost of thawing in order to expedite operations, and less efficient work of laborers hampered by rain, sun and mosquitoes—all these tended to place total costs more nearly on a par with those in drift mining.

The next step in advance in opencut work involved the use of small slip scrapers drawn by horses. On account of the high cost of equine power in a region where all feed must be transported thousands of miles at great expense, this method was important chiefly in that it paved the way for the power scraper. Double-drum engines succeeded the horse as the source of power; the main drum served to drag the loaded bucket forward while the other took the empty back. The drums operated by friction and reverse gearing, so that when the main drum was pulling the other was free to revolve in its bearings, and *vice versa*. By shifting the tail-block the scraper could be made to dig at different points in the cut. Holding the handles of a light scraper attached to the drum of a powerful engine was something worse than attempting to master a bucking horse, or so the workmen complained, and a substitute scraper, less dangerous to life and limb and at the same time capable of taking a larger load, was sought.

The Scraper and Methods of Using

In recent years the slip scraper has dropped from use and its place has been taken by the Bagley scraper of the bottomless or of the wheel type. These scrapers are operated by double-cylinder three-drum hoists, of which 15 were working in the Fairbanks district in 1911. Thirteen were on Goldstream and its tributary, Pedro Creek, one was on Fairbanks and one on Cleary. The smallest had 7x10-in. cylinders, the largest 10x12. Twelve were "Americans," made by the American Hoist and Derrick Co., of St. Louis, and three were made by the Washington Iron Works, of Seattle.

The usual practice is to have the dump box and sluice boxes at one end or side of the cut, on a timber trestle at sufficient elevation to discharge the tailings freely. The Bagley scraper, having obtained its load, is dragged up an inclined approach to the dump box, where it discharges automatically, the teeth engaging a timber and causing the scraper to turn bottom up. By means of two tail lines and suitable leads, as shown in Fig. 3, the scraper can be dragged back to any desired position in the cut. The overburden of muck is usually removed by "ground-sluicing" and the barren gravel is scraped into a pile at one side if there is room. The pay-gravel and as much of bedrock as carries gold, unless it is too difficult to move, are then scraped into the boxes. Details of operating vary, of course, at different mines, but a brief description of the more important features of a typical mine will illustrate the practice.

The ground was about 16 ft. deep, with 13 to 14 ft. of overburden and 3 or 4 ft. of pay. The upper 6 ft. of the deposit, being muck, was removed by ground-sluicing. The rest of the waste was scraped out, and owing to lack of a site for storage much of it was sluiced at considerable expense. The creek was diverted and carried past the cut on the left limit, the pay being chiefly on the right limit. This was not a difficult operation; the new channel was merely started in the muck and the creek was forced to do most of its own cutting. The area covered by the cut was about 40,000 sq.ft., about half of a normal season's work. The engine was of the ordinary three-drum type with 8x10-in. cylinders, and the scraper had a capacity of 32 cu.ft. The scraper dumped into a car set in a station cut in bedrock; the car held 2 cu.yd. and was of the skip pattern. It was raised on an inclined track to the dump box by means of a separate engine. This was the first time a car was used in scraper mining at Fairbanks for elevating the gravel to the sluice boxes, but the saving in fuel was so great that the method will be widely copied.

After the waste had all been removed about 1,000 sq.ft. of bedrock was stripped a day when everything worked smoothly. The average crew consisted of 12 men for two 10-hr. shifts, except in cleaning bedrock, which was done by hand and required several extra men. Three cords of wood were burned per shift of 10 hr. at a cost, when delivered during the winter, of $10 per cord, ranging up to $14 when delivered in summer. The total operating cost per shift was about $89, divided as follows: Engineer, $9.50; fireman, $7.50; dump-box man, $7.50; three extra men at $6.50 each, $19.50; wear and tear on machinery and depreciation, $15; wood, $30. The recovery, stripping, 1,000 sq.ft. running 50c. per sq.ft., was about $500 a day. The cost of erecting plant, removing overburden, etc., is a large but variable item in scraper mining. At this particular mine it was nearly 35c. per sq.ft. last season, as against about 10c. for mining the pay itself. This was the first season's work, however, and many unforeseen difficulties arose, not the least of which were a very backward season and continued bad weather; it is hoped to get costs down to 25c. per sq.ft. in the near future, equivalent to 42c. per cu.yd., waste and all, or about 60c. per yard of gravel handled.

Cost of Instituting Operations in Gravel

Starting on a new claim and buying new machinery the total expense on such ground as that described, before sluicing of pay begins, is not far from $12,000. In order to win a profit the operator must have at least three or four years of work on material yielding 50c.

per sq.ft. of bedrock. Aside from labor, the largest single item entering into the cost is fuel, which may be $60 a day when two shifts are working, of a total operating cost of $188 a day. Cheaper power is of even greater importance here than in drift mining, and the continued prosperity of the industry depends on the construction of a central power plant or the importing of a cheaper fuel. Unlike drift mining, opencut mining by scrapers offers a growing market for electric power, for there are outside the Fairbanks district proper many shallow, low-grade deposits that can undoubtedly be worked at a good profit by this method. On many of these creeks the gravel is 6 to 10 ft. deep and there is very little muck overburden. Under present condition this can be mined for about 60c. per cu.yd. With cheaper power, cheaper labor and cheaper freight, all consequent on the construction of the government railway, this cost should easily be reduced to 40c. and can probably be cut to 30c.—about 10 or 12c. per sq.ft. of bedrock.

The matter of cost is always one of great interest. Unfortunately the operators at Fairbanks do not keep records that make it possible to determine detailed costs or even, in many cases, the total. It is therefore impossible to do more than make a rough guess, and this would place the average of the entire district at about 75c. per sq.ft. of bedrock, with a minimum of 50c. and a maximum of $1.25. The following figures, which are estimates of the cost of working a certain block of ground on Engineer Creek a year ago, may be of value as showing in a general way the weight of the principal items:

COST OF MINING OPERATIONS

Development	
Bunkhouses, messhouse, cost of setting up plant	$1,500
Shaft and station (90 ft. to bedrock)	2,500
Main drifts, 400 ft. at $4	1,600
Crosscuts, 200 ft. at $2.50	500
Incidentals	600
Total	$6,700
Cost per sq.ft. developed, at 40,000 sq ft	17c.
Mining	
16 shovelers, 2 carmen, 1 fireman, 2 extra men, at $5	$105
Engineer, blacksmith, pointman, at $7	21
Dump-box man	6
Board, at $2.25 per man per day	58
Fuel, 3 cords at $8	24
Wear and tear and depreciation on plant	10
Total operating cost per day	$224
16 shovelers, each stripping 35 sq ft per day, sq ft	556
Cost per sq.ft.	40c
Total cost, including development, per sq ft	57c

It may be noted that this ground is more easily worked than the average in the district, that fuel costs less, and that the points require less attention and less steam. Water for sluicing must be pumped, however, and must be returned during most of the summer. Owing to a desire to be on the safe side, in the absence of reliable figures for other mines, these costs should be slightly reduced in operation. Unfortunately, the ground passed into other hands and there was no opportunity to check the above estimates.

Duty Concerning Belt Repairs

By A. L. H. Street*

An experienced employee in a Missouri ore mill was injured while assisting in shortening a belt that operated a mineral pump, owing to his arm being drawn into the pulley, which was not stopped. A suit against his employer resulted in a judgment for $1,000 damages, but the St. Louis Court of Appeals recently reversed the award on the ground that negligence had not been established. (Chandler vs. St. Joseph Lead Co., 178 Southwestern Reporter, 217.) The view of the higher court is expressed in the following language:

> The master is not an insurer of the safety of the servant and, within the limits of ordinary prudence, may conduct his business in his own way. There is here no negligent order or command to the servant. No one directed plaintiff to repair this belt, but he did so of this own initiative, in a manner of his own choosing and without requesting anyone in authority to stop the machinery. . . . . An employee performing the duties assigned to plaintiff was expected by the defendant to make such repairs. But the evidence is that the task in which plaintiff was engaged when injured was one which could be safely performed if reasonable care was employed. And plaintiff, by reason of his long experience, possessed the requisite knowledge and skill for the proper performance thereof. The master may intrust to the servant the performance of the ordinary and simple duties incident to the servant's employment and resting upon the latter's knowledge and skill. And the master has the right to assume that the servant will exercise ordinary care in the performance of such duties.

*Attorney, Security Building, Minneapolis, Minn.

Stellite, a Cobalt-Chromium Alloy of Great Hardness

In a paper read before the annual meeting of the American Institute of Metals, Sept. 30, 1915, Elwood Haynes described some of the characteristics of stellite, a binary alloy consisting of cobalt and chromium, which was discovered by him and produced as early as 1899. Its principal property is a considerable hardness, since alloys containing 10% or more of chromium could not successfully be filed, but the file could slowly wear away the surface of the metal. It also has considerable toughness. Alloys containing as high as 25% chromium show an elongation of 10% or more. Its tensile strength and elastic limit are comparatively high, a bar of metal showing elastic limits of 85,000 lb. and a tensile strength of 110,000 lb. The color of the alloy lies between that of steel and silver. It is resistant to oxidation or other changes when exposed to either dry or moist atmosphere at all temperatures under a dull-red heat.

The combination has been used particularly as a cutting tool for steel and iron. Its virtue for such a purpose lies in its ability to maintain its cutting edge at a high rate of speed at temperatures which would immediately cause the failure of any known tools containing any notable quantity of iron. Owing to the fact that it retains its hardness even at a full-red heat, it cannot be forged.

Stellite can only be reduced to a desired form by casting it in dies in the form of bars which are afterward ground to a cutting edge. It was recently ascertained that a ⅜x2½-in. piece of stellite ground to the form of a grooving tool cut 14,000 grooves in cast-iron pistons ranging from 3½ to 4⅜ in. in diameter before it became too much worn for further use. This work was done in regular practice and not as a test. A stellite tool of the same dimensions, but which was ground to round-nose form and used for turning pistons, turned off more than 8,500 lb. of cast iron before becoming too short for use. Considering only the portion of the tool that was actually ground away, the tool turned off 1,000 times its weight of cast iron before becoming too short for service.

There are combinations made for turning steel and others for turning cast iron. Those for turning steel are now being used extensively for making shrapnel shells at high speed.

Potassium Salts: An Economic Geological Study--II

By E. Mackay Heriot*

SYNOPSIS—In continuation, the characteristics of the Stassfurt and Hannover deposits are discussed, also the Alsatian deposits. The probability of the discovery of new deposits is examined and explained.

I am going to divide the German potassium deposits into two types: The Stassfurt and the Hannover, for there is a considerable difference between them.

In the Stassfurt type the upper Permian contains from 20 to 30 m. of massive red clay with anhydrite balls and some rock salt, then from 0.3 to 3 m. anhydrite. The following Permian contains 50 m. rock salt; 1.5 m. anhydrite with rock-salt crystals; 5.15 m. red massive clay with anhydrite balls and rock salt; 100 to 150 m. younger rock salt; 40 to 50 to 90 m. main anhydrite; 4 to 10 gray salt clay; 30 to 40 m. carnallite region; 20 to 40 m. kieserite region; 40 to 60 m. polyhalite region and 300 to 500 m. older rock salt (anhydrite region). The middle Permian contains 70 to 100 m. older anhydrite with inclosed layers of bituminous dolomite slate, so-called "stinkslate," and with one or two salt beds of from 10 to 15 m. The lower Permian contains 4 to 10 m. Permian limestone; 0.5 to 4 m. copper shales; and Permian conglomerate. The copper shales referred to are those of the celebrated Mansfeld copper mines.

In the Hannover type of deposit the upper Permian contains up to 250 m. rock salt, with at about 50 m. a small potassium layer; 30 m. younger main potash bed; 20 to 40 m. rock salt, sometimes with a small potassium layer; up to 1 m. intermediate anhydrite; 5 m. red massive clay; 30 to 50 m. younger rock salt; 40 m. main anhydrite; 4 to 5 m. gray salt clay; 3 to 30 m. older potash bed; up to 60 m. of kieserite region and some older rock salt.

The middle Permian has older anhydrite with layers of bituminous stinkstone.

The Stassfurt type is well-known and has been carefully studied, but the Hannover type has not. It has a confused build, which makes a clear study all the more difficult.

First and foremost, the absence, in many localities, of the gray salt clay and main anhydrite layer is unfavorable. Only here and there mixed pieces show its presence. It will be remembered that when I described how these formations originated, I said that after the potassium salts had been precipitated, the salt clay was formed. This salt clay has been the preserver of the easily soluble potash salts, and its absence in the Hannover mines gives rise to unfavorable ideas.

The thickness of the older rock salt is not yet known in the Hannover type. A kieserite and polyhalite region, as found in Stassfurt, is not met with here. Then again there are no potassium salts in the younger rock salt. At Stassfurt we find the older rock salt marked with year-rings, and in the Hannover the younger rock salt is well marked with year-rings of anhydrite. In the Hannover mines one finds also rock salt, sylvine and carnallite in fissure veins.

*Mining engineer, Rio Tinto, Huelva, Spain.

As examples of the Stassfurt type I give sections of the Stassfurt-Leopoldshall mines,[1] Solwayhall, near Bernburg and Vienenburg im Harz. In the former, one sees the Trias formation covering the Permian is made up, from top to bottom, of gypsum, salt-clay carnallite region, kieserite region, polyhalite region, and last the older rock salt or so-called anhydrite region. In Solwayhall it is nearly the same, except that the younger rock salt fails at certain points, and hartsalt is found above the carnallite. The anhydrite has not changed to gypsum as is the case at Stassfurt. At Vienenburg the succession is normal, only the carnallite has been partly altered to sylvine.

Of the Hannover type I give Wilhelmshall am Huy.[2] We see a large mass of older rock salt, limited on one side by sylvine, carnallite, salt clay and anhydrite and on the other side by carnallite, salt clay and anhydrite. At the top the kainite forms a cap on the carnallite. The younger rock salt is considered as a secondary mineral, having been deposited by solutions which received their salt from other salt formations. Carnallite, the best-known of the potassium minerals, is the originator of most of the other secondary minerals such as sylvine, kainite, sylvinite, etc. It must be accepted that only a small part of the potassium minerals are of primary origin. On the other hand, most of the primary salts occur as secondary minerals. At certain localities the secondary minerals form the chief mass and the primary minerals are only present in small quantities. The accompanying table by Lowe shows the occurrence of primary and secondary minerals:

OCCURRENCE OF MINERALS

Without Exception	Chiefly	Seldom
Anhydrite	Primary	Primary
Gypsum	Rock salt	Sylvine
Salt clay	Polyhalite	Kainite
Douglasite	Kieserite	Schonit
Boracite	Carnallite	Langbeinite
Hydroboracite		
Sulphoborite		

I must leave the Permian era for a time, and will now show salt layers in other geological formations. The most important, next to the Permian occurrences, is the new find in Alsace, near the French border. Borings at Niederbruck in Upper Alsace tapped the upper layer of potash salts 154 m. thick at a depth of 358 m. The lower salt-bearing stratum had a total thickness of 327 m. and was cut at 620 m. Many borings have cut the salt formation, and a large area has been proved.

In 1913 shipments began from Alsace and reached over 500,000 tons. The salts were really discovered when boring for oil. In 1909 the first shaft was finished. Over a dozen mines are now at work. They represent 4% of the total German output. Up to the present the salts seem to underlie about 7 sq.mi.

The Alsatian Potash Deposits

From a geological point of view the Alsace occurrence is similar to that of Kalusz (Austria), which I shall describe later on, and very different from that of Stassfurt. The Alsace deposit occurs in the Oligocene. A boring at

[1] See "Eng. and Min. Journ.," Oct. 23, 1915, p. 670, for the geological section.

[2] Ibid., page 671.

Wittelsbach was put down to 1,119 m., and from 0 to 358 m. the ground traversed was gravel and marl; from 358 to 512 m., salt marl; after 358 m., 3 beds of rock salt and anhydrite, and at 473 m. a 5-m. bed of potash salts. Then came various beds of rock salt, anhydrite and dolomite, then a hundred meters of greenish-gray marl schist. There seems to be a marked absence of carnallite and chloride of magnesia. The question is, Does the Alsace basin cross over into France?

Potash salts have been found near Salzgitter in Germany. I give a sketch of this occurrence which pertains to the Triassic era.[3] The salt is 280 m. thick and contains carnallite and kieserite. Fossils of the Rot have been met with and prove a sea deposition.

The salt deposits of Bochnia and Wieliczka lie along the slopes of the Carpathian range of mountains. No potash salts have as yet been found here, but otherwise the geology is exceedingly interesting and I give a section of the Wieliczka mine.[4] The local strata are divided into two epochs, a younger and an older. The former is composed of sand and clay with gypsum, and pertains to the upper Miocene with *ostrea digitalina* and *cerithium lignitarum*.

The older formation is the rock-salt series. In Wieliczka the salt lies directly under the gypsum clay. It is quite clear that the salt is of lower Miocene age. The deposit is 3½ km. by 0.8 km. and about 150 m. in depth.

Beginning at the top is the salt clay, then salt sandstone, clay, anhydrite and rock salt. The rock salt is classified as Spiza salt, of fine crystalline structure; Szybiker salt, which is coarse-grained; and green salt, which is also coarse-grained and of a greenish color.

Fossils and Salt Deposits

Within the stratified salt region fossils are found, more especially in the Spiza salt, where one may say they never fail and often occur in great masses. The fauna, with the exception of a *planorbis art*, are sea dwellers and are classified into 68 species. This is interesting because in all the great German potash deposits not a single fossil has been found, and yet there is no doubt as to the origin of these salt beds. It is, however, by no means easy to explain the lack of fossils.

Will potash salts ever be found in the neighborhood of Bochnia and Wieliczka? I have found it necessary to introduce a small map of the Carpathians in order to show the positions of Bochnia, Wieliczka and Kalusz.[5] All three lie on the north slope of the Carpathians. At Kalusz, potash-salt deposits have been encountered and are being worked. The age is also lower Miocene. Kalusz lies 26 km. NE of the mountain range. The salt-bearing formation dips SW 30, 40 or 50°. There is a lower salt clay without potash salts and an upper salt clay carrying potash salts. The lower salt clay consists of thin layers of clay and salt and carries about 50% of rock salt. It has a thickness of 90 m. and has not been pierced. The upper salt clay is about 40 m. thick. In this is found a bed of kainite. Anhydrite, gypsum, carnallite and picromerite are also met with in small quantities. Above the salt clay follow gypsum and clay. The kainite is from 8 to 12 m. thick and is generally covered with anhydrite. The production of potash salts, which is about 1,000 tons annually, is not exported, but consumed at home.

[3] "Eng. and Min. Journ.," Oct. 23, 1915, p. 670.
[4] Ibid., page 671.
[5] Ibid., page 669.

The latest find of potash salts is in Spain. Carnallite has been cut while boring for rock salt at the Cardona mine, near the borders of the Barcelona-Lerida provinces. The salt is in the Miocene formation. Nothing definite is known to the public as yet in regard to the commercial value of the Spanish potash, but the government has sent geologists to make a report. In the meantime the German potash syndicate has acquired large interests.

The salt beds of the Saltrange, in the Punjab, India, are of Cambrian age, and those of Cheshire, England, of Triassic. Thus we see that potash and rock-salt formations are not peculiar to any one geological period.

Probability of New Deposits

What are the prospects of finding new deposits of potash salts? They are certainly favorable. Let us look back to a few facts already recorded. Potash beds have been encountered in Prussia in the Permian formation; near Salzgitter, Germany, in the Triassic; at Kalusz in Austria and Alsace in Germany, in the Tertiary formation. The Prussian Permian and the Tertiary occurrences at Alsace and Kalusz were doubtless formed by deposition from sea water. Thus we find that the Permian era holds no monopoly of potash salts, as was formerly believed to be the case. The Alsace find is the most striking contradiction.

It only needs certain natural conditions to form a potash deposit. First there must be a salt-water basin in which more water is evaporated than enters; and second, the potash salts which are deposited must have a waterproof covering, such as anhydrite or, better still, salt clay. Whether the basin is in intermittent connection with the ocean—the bar theory—has nothing to do with the question in general. Today one can observe the process of salt deposition in the Caspian Sea. This body of water is an inland salt sea, and its bottom is already covered with rock salt. The potash salts being more soluble, are still held in solution.

It is not likely that the German Permian sea is the only large one of its kind among the many periods of the earth's formation. There are most likely many more. Why then have such depositions not been found more often? This question is easy to answer—they have not been looked for. The Spanish potash salts were met with by accident when testing the thickness of the rock-salt bed. The Alsace potassium was found casually while boring for oil. Another such mere chance found the Kalusz salts. The Anhalt mines, the first German salt mines, were worked for their rock salt. Later, Precht discovered the value of potash salts as a manure. This gave rise to the opening up of the salts of the North German plain, the potash salts of the Permian Sea.

That the German potash syndicate, which controls the output of the German salts, is well aware that potash may eventually be found outside Germany is seen by its hurried interest in the Spanish field. Up to the present, potash salts of marine deposition, other than the German Permian, have been discovered by accident. Wherever such a find has taken place, many competitors have rushed to the scene of action and often availed themselves of a good opportunity. It would seem to me that any company laying out a considerable amount of money to discover these salts should be given a certain monopoly, or say a large area to work upon, if it were so lucky as to find them. Such a company would have to examine thor-

oughly the territory under which salt formations are supposed to exist; at the start superficially, after which drilling operations would commence.

I hardly think that a study of the relation of land to water in the different geological ages will help much. I have given, however, a sketch[6] of the German Permian Sea, connected, as it seems to be in Russia, with the ocean. On the same map will be seen the Mediterranean Sea, which is about the same size. If we look at the map of Germany, we see that the salt area extends to Hamburg on the north, to Inowratzlow on the east, to Münster on the west, and to Alsace on the south; and no one as yet knows the real boundaries of these huge salt areas.

To the west, borings were being carried out in France, near Belfort, on the chance of the continuation of the Alsace field. The map shows that potash always occurs with the rock salt, but that the former covers only a small portion of the latter. This, of course, is natural, although where rock salt is found it is by no means certain that potash salts will be present, and boring is the only way to find out where they do exist. Potash is not likely to appear in salt springs, because if it did, it would indicate that water had entry to the potash beds and they would soon cease to exist.

How Prospecting Should Be Done

The rock salt must be pierced, and then, as a result of careful observation and expenditure of sufficient capital, potash salts may also be cut. The German potash was found at considerable depths, varying from 300 to 600 m. A borehole of this depth is an expensive undertaking. It would cost about $10,000. The prospecting of a small area of country would necessitate say 10 holes and cost more than 10 times this amount. A suitable spot for the first hole would have to be found, and this might entail much pioneer work. When the likely spot was located, a contract could be made for a hole with a guarantee of, say, 600 m. depth. The class of ground and local conditions would settle the price per meter and the size of the hole at the surface. The boring should be rotary, as every meter of core must be examined. Even if the result were negative as regards salt, it would add more knowledge with reference to hole No. 2.

A mining engineer with considerable experience in potash-salt prospecting should be placed in charge and the advice of local geologists taken advantage of; but the engineer should be allowed to determine the position of the holes. Those who have spent several years at this work will understand what this means. In Germany during the potash boom geologists sprang up in many corners; even chemists who had no knowledge of geology drove up to the boreholes and gave their opinions of the cores. In many cases the engineer who was most competent was not asked to give an opinion. In those days boring syndicates were formed overnight, perhaps by needy gentlemen after a good dinner.

A representative drove out to see the landowners, who in Hannover have the mineral rights. The landowners were generously treated to beer and schnapps, and when they had had considerably more than was good for them, a contract was agreed to. Today this matter is not so easy. Chance sometimes brought luck and the value of shares would rise from a few dollars up to $700 in one night; but there were plenty of failures.

In Prussia he who bored the rock salt first had a right to the potash salts also. Therefore in Prussia boring was carried out in competition. The writer has taken part in many interesting borings both in Prussia and Hannover. A sketch of the ground pierced by one of these borings I superintend in the Eichsfeld basin is given.[7] No one thought that the potash salts discovered in the plains would continue under the Muschelkalk Mountains. It will be seen, however, that these are mountains made by erosion and that the stratification lies concordant with the underlying strata. Thus it needed only some geology applied to mining, and I give this example for that reason. Again, look at the section of Wilhelmshall am Huy. If the hole was sunk on the left-hand side, an immense amount of kainite and carnallite would have been indicated, and as it is a question whether the dip could have been observed, it might have been taken for the width of the layer.

The engineer anyway would have to report the length of the potash cores. Subsequent mining would prove that the stratification was "on end." This is often the case in the Hannover type. If the drill had passed only a little more to the left, no potash salts would have been found.

As a detail of boring, care must be taken to use magnesium chloride instead of water when in the salt region. Water leaches out the rock salt, but it would in a short time completely dissolve the potash cores before they reached surface.

Boreholes Must Be Carefully Refilled

It takes nearly as long to fill up a hole as it does to bore it, that is to say if it is done properly. In Germany this is a most important item and government engineers establish special regulations for the procedure and see that their orders are carried out. In the salt region the hole is filled with baked clay balls. A certain number are thrown in per minute and stamped at given intervals. This is done in order to safeguard the potash beds against the intrusion of water. All shafts sunk for this industry are circular in form and watertight. In Germany two shafts are obligatory for the safety of the men. I have described the methods of sinking these shafts in previous pages of the *Journal*, and there is nothing new to relate. The cost of a shaft under average conditions is about $150,000, but if much water or quicksand is encountered the cost may be much higher. One may say that this class of shaft sinking has reached a very high standard in Germany, thanks to the modern potash-salt industry.

In this article I have endeavored to show the importance of the potassium-salt industry, its main geological features and the chance of its extension in the future. I will now give some of the principal conclusions at which I have arrived:

1. As far as can be seen the only considerable source of potash is marine depositions in the form of beds of Tertiary or earlier age.

2. That the chance of finding such deposits is good provided prospecting and boring are carried out to great enough depths at suitable places. It is to be remembered that up to the present, potash salts, outside of known areas, have been found by chance.

3. That the present consumption of potash salts is only a small part of what the world really needs.

4. That on account of these facts governments should offer special facilities for prospecting.

[6] "Eng. and Min. Journ.," Oct. 23, 1915, p. 672.

[7] Ibid., page 671.

Minerals of Asiatic Turkey

SYNOPSIS—Northern Asiatic Turkey contains a wide variety of minerals of economic value. Among the important resources of the region are copper, mercury, antimony, iron, manganese, chromium, coal, petroleum, borax, emery and meerschaum. These deposits have long been worked in primitive fashion, but political conditions have delayed modern exploitation. Some of these supplies, especially copper, are now badly needed by Germany, and feverish activity in certain mines would doubtless follow the cutting through of "the road to Turkey."

Should the Germans succeed in hewing a road through to Turkey, a mineral empire of the first magnitude will be opened up to the Teutons, one which contains some rich though little developed deposits of copper—a metal of prime importance to the Central Monarchies.

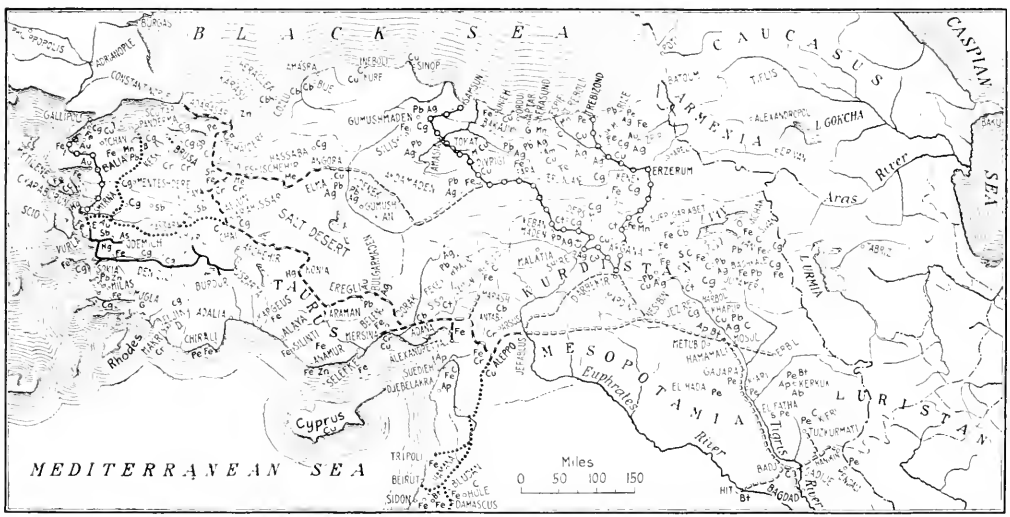
The mineral resources of northern Asiatic Turkey are important and varied, but these deposits have lain practically dormant for centuries, largely owing to the inability of anyone to exploit the deposits without being themselves exploited. The heavy government fees and the lack of transport facilities have also retarded the mineral development.

The copper resources, while not great in the sense of some modern mines, are of special importance to the Central Empires, which happen to be deficient in deposits of this indispensable war metal. The high grade of the Turkish copper deposits might permit of their being useful in case the present conflict becomes protracted, and in any event would be a valuable asset to the Teuton empires in future wars. The varied mineral deposits of the Turkish peninsula form one of the links in the chain of strategic resources that will be connected up by a Teutonic victory in the Balkans. It therefore seems likely that the Allies, even though they give up the Dardanelles project, will do their utmost in blocking "the road to Turkey."

The accompanying map, based on one by Leon Dominian, reveals to what a large extent mineralizing agencies have been at work in the peninsula of northern Asiatic Turkey. The process of ore deposition[1] appears to have been heaviest in the three zones of major folding which encircle the elevated barren plateaus of the interior. Metalliferous zones and mineral belts are fairly well outlined by the cartographic distribution.

The complex metalliferous regions of Anatolia[2], of the east Pontic range—extending from the coast inland between Unieh and Trebizond—and of the upper basin of the Tigris constitute fields that bear promise of interesting developments when results of detailed investigations become available.

Asia Minor as a human habitation is very old. The economic value of various minerals was duly recognized



Ab Alabaster	B Borax	Cu Copper	Mn Manganese		Ag Silver
Am Alum	Cr Chrome Ore	E Emery	M Marble		S Sulphur
Sb Antimony	C Coal	G Gems	Me Meerschaum		Sn Tin
As Arsenic	Cg Lig Coal	Au Gold	Hg Mercury		Zn Zinc
Ap Asphalt	Cb Bit "	Fe Iron	Pe Petroleum		
Bt Bitumen	Ct Anthr."	Pb Lead	P Phosphate		

RAILROADS	
In Operation	Under Construction or Projected
French	
German	
British	

MAP OF NORTHERN ASIATIC TURKEY, SHOWING DISTRIBUTION OF MINERALS—AFTER DOMINIAN, 1913

[1] Excerpts from "Cartographic Documents of Economic Geography," No. 2, 1913. Geographischer Kartenverlag Bern, Berne, Switzerland.

[2] The term "Anatolia" is employed here in the sense generally accorded to it by European writers, whereby it refers to the western section of Asia Minor. The Turkish name "Anadolu" is used, however, by the Turks and Turkish-speaking races to designate the entire peninsula.

within the peninsula throughout ancient times. In the heyday of the vanished kingdoms of Sumer and Akad, throughout the supremacy of the Babylonian Empire, as well as at the height of the Hittite and Mycenean powers, mining had assumed sufficient importance to have become the means of sustenance of the inhabitants of numerous settlements scattered between the Ægean coastland and the Persian Gulf. During Byzantine and Ottoman sway the art of working ores was also carried on profitably. From the Seventeenth Century to our day, however, the industry gradually declined. Some attempts have been made in the past decade to revive it; in a few instances, as at Balia in the western end of the peninsula, success has attended these endeavors. In general it should be noted that mining in recent years has been mainly confined to the districts lying close to the coast.

Coal Widely Distributed in Asia Minor

Coal is of widespread occurrence in Asia Minor. The northwestern projection of the peninsula forms part of a district wherein lignite deposits have been worked in a number of localities. The lignitic beds occur mostly in Tertiary lacustrine deposits and appear to belong to a zone of transition between the Miocene and the Pliocene. The southwestern coast of Asia Minor, with its hinterland, does not appear to be devoid of coal. In the Province of Smyrna, the Sokia and Nazili beds have been developed for local use. Coal was mined about half a century ago in the northern section of Mesopotamia, near Jesireh. Some work was also undertaken in the Hamrin mountains. The deposits near Mosul have not been worked. In the hills lying east of Kifri, the natives indulge in occasional desultory exploitation of this fuel. In Syria and the Lebanon a number of native exploitations are encountered. Some of these were undertaken to supply the small silk factories with fuel.

The best-developed Turkish coal field is found at Heraclea. The coal is bituminous and occurs in a belt about 60 km. in length. The coal beds outcrop near the coast. They overlie Carboniferous limestones and are in turn unconformably overlain by Cretaceous beds of great thickness. The output for 1912 from this field exceeded 700,000 metric tons. Occurrences of bituminous coals are also reported from the eastern section of the peninsula. The district between Lake Van and the Persian frontier appears to be favored in this respect. Anthracite has never been mined in Asia Minor, but its occurrence is reported from a number of localities.

Gold Mined by the Ancients

Little gold is produced at present, but the precious metal is known to occur at Serjiller, south of the Dardanelles. The abundance of gold jewelry found in the excavations on the site of the several cities of Troy indicates a large production from near-by localities. An ancient locality which was famed for its gold mines was Astyra, the site of which is now marked by mines that existed at the time of the explorations of the Greek geographer, Strabo.

The valleys of the Hermos and the Pactolus, in Anatolia, have been the site of ancient placer mines. How prolific in their yield of the precious metal the gravels of these rivers must have been may be inferred from the frequent allusions in ancient literature to the gold-bearing sands of the district, now known as the valley of the Gedis River. In recent times peasants living in the vicinity of Boz Dagh (Boz Mountain) make a scanty livelihood by washing the gravels brought down by the rivers.

The environs of Izpir in the east Pontic area contained gold fields that are known to have been worked from the Third Century B. C., to the end of the Seventeenth Century A. D. Throughout the Nineteenth Century small quantities of gold were mined intermittently around Bulgar Dagh. This region bids fair to become the site of future producers of gold, silver and lead.

The best-developed silver-lead mines are found near Balia, at a distance of about 100 km. from the sea. The ore occurs in a contact zone between Tertiary augite-andesite and Carboniferous limestone. The contact zone varies between 2 and 5 m. in width. The limestone at the contact is silicified but barren. In the andesite, on the other hand, are found accumulations of pure galena which seem to be connected with fissures parallel to the contact zone. The ores carry galena, blende and pyrite, and as formerly mined, contained on an average from 16 to 20% Pb and 8% Zn. The last operating company was the Société Anonyme Ottomane des Mines de Balia Karaidin. The 1913 production was valued at £171,000.

Copper Mines Along Black Sea Coast and in Upper Valley of the Tigris

The two most important copper belts in Asiatic Turkey occur in the eastern portion of the Black Sea coast, as far inland as the Pontic ranges, and around Argana (Arghanah) in the upper valley of the Tigris. Copper prospects have been noted as far west as the vicinity of the seaport of Sinop. The region around Espie, near Kerasund, is the center of a district noted for its mineral yield in antiquity. Here ancient workings abound and have been the site of small operations carried on intermittently in the last 20 years.

The celebrated Argana mines, from all accounts, contain high-grade ore. These deposits are known to have been exploited since 1096 A. D. within an area of about 12 km. square. In recent years mining has been carried on by the Turkish government, both on a leasing system and by direct management. The ore is broken to nut size and undergoes successive roasting until a product containing about 30% Cu is obtained. In this form the product is transported on camels to Black Sea or Mediterranean harbors. The cost of mining and treatment at Argana is estimated at less than 3c. per lb. The disturbances of the last three or four years have caused cessation of work throughout Turkey, although it is possible that exploitation has been resumed recently under German management. The production cannot be of great importance immediately, however, as the organization of operations will require time in order to be productive in a large sense.

Mercury, Manganese, Antimony and Chrome Ores Occur in Important Quantities

Two deposits of cinnabar were working in 1913. The Karaburmu mines, situated about 30 km. from the town of Smyrna, produce about 3,000 flasks of quicksilver annually. The deposit lies in the vicinity of basaltic flows and consists of metamorphic siliceous schists impregnated with cinnabar. Mining is done entirely in opencuts on ores containing as little as 0.25% Hg. The

cinnabar appears to be concentrated in the fines, and the ore is accordingly screened. The screenings assay from 0.75 to 2% Hg. The plant at the mine comprised two double Spirek tower furnaces for broken ore and a Cermak-Spirek furnace for fines. This installation had a capacity of 30 tons per day. The other mercury deposit occurs in the vicinity of Konia. Here the ore is found in veinlets, nodules and small particles in a crystalline limestone close to schist, at no great distance from old eruptives. The mineral appears to be present whenever the limestone becomes silicified. Some stibnite is associated with the cinnabar.

Pyrolusite is mined from the Phlinika district, much of the ore produced assaying 52% Mn. At the Zengan mines, high-grade manganese ore is obtained. Manganese ore is also known to occur near the Russian frontier in the eastern Pontic area.

The two important centers of antimony production are Odemich and Jinlikaya. Ore carrying as much as 65% antimony is found in both. At Jinlikaya the veins cut through crystalline schists. Shipments were formerly made chiefly to England by way of Smyrna.

Asia Minor has contributed largely to the world's supply of chrome ore. The Turkish ores are soft, rich in chromic oxide, have a low silica content, and are free from objectionable impurities. Although the production has fallen off in recent years, the mineral is of widespread occurrence in Anatolia. The most important deposits are those at Dagardi.

Important Minor Minerals Include Borax, Emery and Meerschaum

Extensive beds of pandermite, a massive and not entirely pure variety of colemanite, are mined at Sultanchair, in the Province of Hudavendighiar. The principal operations are those of Borax Consolidated, Ltd. The mines lie on the mail route leading from Panderma harbor to Balikesser. The pandermite occurs in Tertiary sedimentaries lying in a basin surrounded by steep hills of gabbro, granite and crystalline schist. The productive beds consist of a brownish and bluish gray gypsum, containing nodules of variable sizes dispersed within the gypsum, and forming from 10 to 20% of the aggregate mass.

The production of emery from Asia Minor and the islands of the Ægean Sea practically constitute the bulk of the world's supply. The output of the former exceeds that of the latter. The mines lie in a belt extending south and southeast of Smyrna. The ore is found in lumps up to 15 cm. in diameter embedded in a red-brown clay and associated with calcite.

The plains near Eskischehir constitute one of the most important meerschaum localities in the world. The meerschaum district extends from the town of Eskischehir almost due eastward to the City of Angora. The mines lie at a distance of about 22 km. from the railroad station, to which the ore is packed by camel trains. The two chief producing mines are those of Sarasu and Sepki. The deposit occurs in a valley filled with drift material from the surrounding mountains. The sepiolite is scattered through the drift in rounded nodular masses, with fragments of magnesian and hornblendic rocks. As a rule the nodules do not exceed 10 cm. in diameter, but a few attain larger dimensions. In the raw condition the mineral is soft, light and nontransparent. The color is white, with occasional blending of yellow, red or gray. The thickness of the meerschaum-bearing strata varies between 3 and 10 m.

Other minerals have been mined or are known to exist in various districts of Asia Minor. Arsenical pyrite has been found near Odemich. Lithographic stone occurs in extensive massive beds north of Mihailich, also east of Kimasti and south of Abulonia Lake. Iron is found in many places in Asiatic Turkey. The region east of Adalia Bay was to have been the site of an exploitation, prior to the war. In the vicinity of Anamur, iron ore has been mined on a small scale during the last few years. This district lies at the foot of the southernmost projection of the base of the Tauric region, where various ores are reported to occur and within which mining has been carried on in a desultory fashion for over 20 centuries. Zinc also exists in this region. Zinc deposits at Karassi were worked prior to the war by the Société Anonyme Ottomane des Mines de Karassi.

Petroleum is found in the provinces of Erzerum, Mosul and Bagdad. The Mesopotamian deposit, probably an extension of the Persian field, promises to be of importance, and the Bagdad railway will give this field much needed transport facilities. Just before the war, the Turkish Petroleum Co. was formed[3] to exploit this area: half of the capital was British and the Deutsche bank and Royal Dutch Shell Trust each held a quarter interest. Further development with this combination of interests is now unlikely. Asphalt is known to exist at Anti Lebanon, Kerkuk, Hit and other places. Besides the mineral resources already mentioned, salt and sulphur are produced in a small way and precious stones are mined in a number of places.

American Mining Congress

In a letter to the members of the American Mining Congress, J. S. Callbreath, secretary, announces that for the better carrying out of the comprehensive plan outlined at the San Francisco convention to secure the cooperation of the mining men in this country in the betterment of mining conditions, one of the first steps is to secure more interest in the work of the congress. President Carl Scholz, in his plea for extension of membership in the congress, said that there are 90,000 men in the United States directly or indirectly interested in the operative side of mining. Probably there are not 20 men in the 90,000 who disapproved the objects sought by the American Mining Congress. But the organization has only 1,500 members, and this condition presents certain elements of unfairness. It allows the 1,500 members to work for, pay for and secure benefits for the profession in general, while the rest of the 90,000 enjoy them without any effort on their part. President Scholz believes it is the duty of all mining men to work for improvements in the profession and, to secure this end, pleads for an enlarged membership in the congress.

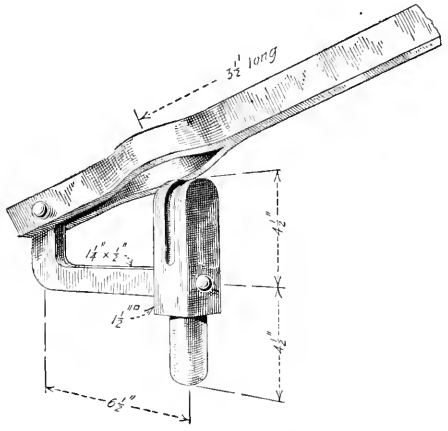
Illium Is the Name for a new acid-resisting alloy worked out at the University of Illinois and described by S. W. Parr at the recent American Institute of Metals convention. Its composition is given as: Cu, 6.42%; Mn, 0.88; Si, 1.04; W, 2.13; Ni, 60.65; Al, 1.09; Fe, 0.76; Cr, 21.07; Mo, 4.67; total, 98.81%; carbon and boron not determined. It is said to be entirely resistant to 25% HNO_3. Its properties are ascribed to a proper proportioning of electropositive and negative metals. Details of preparation are not given.

[3] "Engineering," Oct. 8, 1915.

Details of Practical Mining

Home-Made Chuck-Bolt Bender

The accompanying sketch shows a home-made chuck-bolt bender that will be of great service to any blacksmith in making chuck bolts for piston drills. Without any



CHUCK-BOLT BENDER

device of this kind, it is necessary first to bend the bolt to shape and then to twist the ends apart so that the thread can be cut on each and then reheat the bolt and twist it back again. With this device it is possible to cut it and bend accurately with one downward motion of the lever.

Two Cornishmen and a Jackhamer

By Paul F. Chamberlain*

Thomas Pollard and Robert Bone, two Cornish miners, had a hand-drill contract in one of the drifts of No. 3 Alpena mine, Virginia, Minn. Their "dirt" had been very hard to break all during the month and they were making practically no headway. The two men concluded, along about the 20th of the month, that their contract price was not large enough for them to make a living wage. Accordingly they decided to call on the local superintendent, Charles Grabowsky, and ask him either to give them a better price or grant them company-account wages for the month.

Said Thomas to Robert, "Hi say, pardner, us ain't goin' to make our bloody sault this month. Let me and thee goas on up an' see Cap'n Charlie and see if 'ee won't give us company 'count for the month or else raise the price o' the contract."

It was so agreed; Thomas was to do the talking while his partner stayed outside. Thomas entered the office and doffing his hat said:

"Mornin' Cap'n; me and pardner 'ave a drif' contract down in the bal (mine) and we bean't makin' wages, and we thought as how us shouldest come up and talk to 'ee and see if thee couldent fix us up a bit. Say, give we company 'count for the month or raise the price a bit."

"Well now, my man," said the superintendent, "I can not do either at this time of the month, but I am going to send a jackhamer in your place tomorrow which I am sure will help you a whole lot."

"Thank 'ee, Cap'n, that's fair enough sure; we does need a bit of 'elp," said Thomas as he retired. To Robert he reported, "Pardner, we be all fixed up; Cap'n's goin' to send Jack 'ammer into our place to 'elp us out."

"That's fair enough," agreed Robert, "but 'oo the bloody 'ell is Jack 'ammer, never 'eard tell of 'ee. I naw Jack Thomas and Jack Williams, but I never did 'ear of Jack 'ammer; 'oo is 'ee?"

"I dinnaw 'oo 'ee is myself," answered Thomas, "but I speck 'ee's one of they there bloody Finlanders that's been 'angin' about the shaft all week!"

*Virginia, Minn.

Foundation Bolts for Steel Chimneys*

As the rules suggested by engineers for the sizes of foundation bolts for chimneys vary widely, the following table has been compiled to compare this practice. The

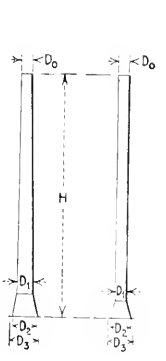


Fig. 1

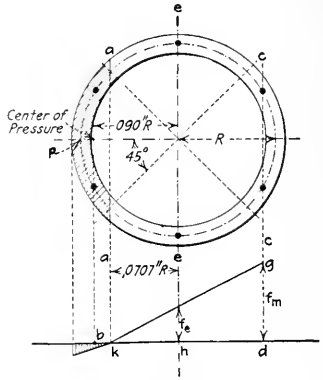


Fig. 2

OUTLINE OF CHIMNEY AND STRESS DIAGRAM FOR FOUNDATION BOLTS

first six chimneys are described in a published pamphlet and are said to have been built. The remainder have been built and are standing. Of the numerous formulas the two extreme ones may be put in the form,

$$f_m = \frac{M}{k \times N \times a \times R}$$

in which

*H. D. Hess, professor of machine design, Cornell University, in "Power," Oct. 5, 1915.

M = Moment tending to overturn the chimney, in foot-pounds;

N = Number of foundation bolts;

a = Minimum area of a bolt, usually at the root of the thread;

R = Radius of the bolt circle in feet;

f_m = Maximum fiber-stress in any bolt in pounds per square inch.

The value k varies with the different conditions and is given later.

If we assume the nuts brought to a bearing, with practically no initial stress and no wind acting, the center of pressure between the chimney and the foundation will coincide with the center of the bolt circle. If the wind now acts from the right the center of pressure will move toward the left, and at the extreme position it will approach the point p on the bolt circle. The formula giving the lowest stresses assumes this concentration at the point p and further assumes the fiber-stresses in the bolts proportional to their distances from a tangent through the point p. The value k is then 0.75 in the equation just given, and M is the wind moment less the righting moment. The latter is taken as the weight of the chimney in pounds times R.

In the formula giving the highest stresses the chimney is assumed as fixed at the base, the neutral axis being taken as e-e. If the bolts on both sides of e-e are effective they must resist compression, a condition here impossible of realization. When the formula is solved in this way k is approximately 0.50 and M is the full wind moment.

DESIGN DATA FOR STEEL CHIMNEYS

Design-ation	Chimney Diameters: Top D_0 Ft. In	Base D_1 Ft. In	Bell Base D_2 Ft. In	Bolt Circle D_3 Ft. In	Ht. of Chimney, H Ft.	Wt of Steel, Tons	Net Overturning Moment, Ft.-Lb.	Foundation Bolts: No.	Diam. In.	Maximum Fiber-Stress in Lb. per Sq. In.
1	3 4	4 6	7 0	7 6	70	7 1	228,400	6	1½	11,700
10	4 4	5 6	8 9	9 3	90	12 3	492,100	6	1¾	15,200
20	5 10	7 8	12 0	12 6	125	24 7	1,281,270	8	2¼	12,700
30	7 4	9 6	15 9	16 3	175	45 0	3,183,165	10	2½	17,500
38	9 10	12 0	18 6	19 0	190	62 3	4,706,540	12	2½	16,000
45	11 10	14 8	25 0	25 6	300	140 7	14,218,000	16	2½	28,000
B	4 9			6 5	100	8 3	664,900	4	2¼	20,080
D	6 0		9 6	9 10½	125	16 0	1,263,700	4	2	41,400
E	6 6		9 0	9 4	120	15 3	1,276,400	4	2¼	27,500
F	8 0		11 3	11 7½	120		1,538,200	4	3	18,400
G	10 0		14 0	14 6	146	30 8	2,795,460	6	2¾	25,900
K	16 0			27 0	225	77 0	10,278,900	12	3	17,600
L	11 6			18 0	200	55 0	4,359,000	8	3¼	15,550
M	30 9½			51 0	400	438 0	41,518,300	36	4	6,780
R	8 0	12 4		21 1	217	65 0	4,683,800	12	2¼	11,950

A comparison of the data given in the accompanying table indicates that few of the 15 chimneys had been designed on either basis. It seems to me that a basis nearer the truth might be had by assuming in the extreme position one-quarter of the chimney base in contact with the foundation, as shown in Fig. 2 by the shaded portion. The neutral axis is a-a. The bolts to the right of a-a are stressed proportionally to their distances from a-a. The figure also shows the stresses in the concrete. The moment due to any bolt will be the product of its area, fiber-stress and the arm from the bolt center to a line through the center of pressure and parallel to a-a. In this case the value of k is 0.67. The overturning moment is here the wind moment about the base less $W \times 0.9R$. In all cases the wind moment equals the wind force on the chimney times the distance from the base of the chimney to the center of pressure of the wind force. For a cylindrical chimney this equals $\frac{D_1 \times H^2 \times w}{2}$ foot-pounds, where w, the wind pressure per square foot of projected area of the chimney, is usually assumed at 25 to 30 pounds. D_1 and H are measured in feet. The working fiber-stress may be taken from 12,000 to 16,000 lb. per sq.in. The maximum calculated fiber-stresses based on a wind pressure of 30 lb. are given in the right-hand column of the table.

How To Choose Rock Drills

By J. R. McFarland*

Of what type of drill, Mr. Mine Manager, was that last order? Were the drills selected after a careful test which demonstrated them to be of the type best adapted for drilling in your own mine, or were they chosen at random?

With the keen competition nowadays between drill manufacturers and the resultant radical improvement in rock drills as a whole, inasmuch as the drilling cost is a large factor in producing the ore it behooves the active mine manager to make frequent tests to determine on which type of drill to standardize.

Different Classes of Drill Buyers

A considerable number of the older managers and superintendents have used one or two sizes of a standard type of machine for years—usually a one-man and a two-man drill. A large sum of money may be tied up in repair parts. Their machine shops may be making a considerable number of the parts for these drills, thus reducing the cost for repairs. This makes it very hard for a manager to get away from the old type of drill, even though he may be convinced that a newer type is better.

There is also a class that tries everything that comes along and as a result accumulates a motley variety of machines, which causes an extraordinary amount of confusion in and about the mine. A full supply of repair parts has to be kept for each machine, thus involving a much greater amount of money invested in repairs than would be, if only one or two types of machines were used; also, the master mechanic has a much harder time keeping the drills in good repair. Probably the greatest trouble is underground, where the miner may find that the steel does not fit his machine or the hose and connections are not of the right size or have a different thread; or the column, arm or bar and wrenches may be of wrong size. Such trouble causes an extra trip to the surface and maybe the loss of the round for that shift. In losing the round the cost for practically the same advance is doubled. So it is no wonder that some of the older heads feel just as well satisfied to "pass up" the pastime of drill testing.

However, a majority of managers try to keep up with the drill problem, standardizing on one or two of the later types. They figure that the increase in speed and the greater economy in air consumption and repairs more than pay them for the loss in throwing away the old repair parts and designs. In the larger mines and many of the smaller ones the matter of drill testing is gone into with the foregoing facts in mind and with the idea of standardizing on one type of drill for each kind of work.

At a surprising number of mines no systematic attempt is made at testing. The drill is given to the

*5710 Kimbark Ave., Chicago, Ill.

runner; the mine foreman or shift boss may stop for a few moments to watch the drill run; the superintendent may hardly notice it as he passes by on his daily rounds; and the manager often never sees the drill at all. In most cases it is left to the runner, and if he likes the machine it is kept. Or if it is a little heavier, even though much faster, than his old one, or if it is one of the newer types which he has not yet learned to run, he will say that the drill is no good and it will be returned.

It is therefore necessary that the trial should be given the best attention and a record kept, or the test may as well not be made at all.

How the Test Should Be Conducted

To go into the problem properly, the following investigation, or one with the same object in view, should be made.

The machine is first taken to the machine shop and placed on the bench. The drill should be taken apart by the master mechanic and a report made on the following items:

1. What points of design?

2. What does the drill promise as to probable repair cost?

3. What air consumption?

The chief points of design are as follows:

a. Are the arrangement and design of the various parts such as to give the least wear or strain?

b. Does the type of chuck enable a rapid change of steel, and does the chuck hold the steel in alignment or not?

c. Are the front head and bushing or gland of proper design and strength to withstand the constant blows of the piston?

d. If a piston drill, is the piston stem of sufficient size and strength to withstand the heavy side strain and does the piston head have sufficient length of bearing to hold the piston in alignment and prevent serious cylinder wear?

e. If a hammer drill with a striking block, or anvil, is the striking block heavy enough?

f. What is the diameter of the cylinder?

g. If a self-rotating hammer drill, how is the rotation transmitted from the piston to the steel? Is rotation positive or not?

h. Is the rifle bar strong enough?

i. Are the ratchet ring and pins or pawls and springs of good design and easily assembled?

j. Is the back head well designed?

k. If a water or hollow-tube machine are the tube and packing so designed as to give little trouble and be easily accessible?

l. The valve chest is very important. Does it freeze or not? Does it use air wastefully? Is it in the way when extracting steels from the holes?

m. If a stoper, is the feed piston of proper size for your air pressure? Is it of sufficient strength to withstand hard blows?

n. Is there any special benefit from the arrangement of the side rods, springs, throttle valve, oiling device, hose connections, shell, etc., of the machine in question?

o. What is the weight of the machine?

p. Finally, are the parts that are subject to the greatest wear and strain made of properly treated and worked steel or are they made of cast iron?

The master mechanic is able to tell to a great extent, from the foregoing investigation, whether many parts will be broken and whether such parts as are ordinarily expected to break in time will cost much to replace. If the company maintains an elaborate machine shop, the master mechanic may figure on the number of parts he may be able to make himself. An accurate record of repair costs should be kept to determine whether the superior speed of one drill is not more than counterbalanced by the low repair cost of another.

As a rule, only a few mines have any apparatus to test the air consumption. Machines for testing may be purchased from various drill and machinery companies.

The displacement-tank method, while rather cumbersome and expensive, is always reliable. In this, water under pressure is used to displace the air from two receivers alternately. The drill is run from the air thus expelled. The quantity of air consumed by the drill is figured from the amount of water that displaces it. The amount of water is indicated by the height in the water gages on the two receivers. Air meters are constructed on the principle of the fan or bellows or a combination of both. They are not usually so reliable as the displacement-tank method, but are less cumbersome. However, if two drills are tested at the same pressure, a reliable comparison can be obtained.

An inexpensive way to obtain a comparative test of two machines is to fill a receiver with air to a certain pressure and run each machine in turn from the receiver, noting the time necessary to reduce to various pressures. It is obvious that the drill that reduces the pressure to the lowest point in a given length of time uses the most air. However, owing to the different valve designs, some drills use proportionately more air at some pressures than at others, and this fact has to be kept in mind in such a test.

A very few mines have an elaborate system of testing the strength, nature and rapidity of the blow of a machine. This test is not essential, although it is well to know, if possible, just how the drill in question compares with others in this respect. This test is valuable in testing drills after they have been in use for some time. An exhaustive consumption of air generally shows that the piston or cylinder or both are badly worn. If the air consumption is no more than proper but the blow is weak, it is likely that the trouble is in the valve or valve ports. If the valve "flutters," it is generally a sign of excessive cylinder wear, as the air is allowed to pass by the piston and into the reverse ports, thus reversing the stroke prematurely.

As a general thing, a light, rapid, tapping blow is best adapted for soft ground, while a heavy, slugging blow is best for harder rock. However, it is difficult to tell from this kind of a test just what drill is going to do best in your ground and the only sure way to find it out is by the actual drilling.

Making the Underground Test

Having made the tests above ground, the next thing is to prepare for the underground test.

A suitable face to drill in must be selected. This is a point where mistakes are sometimes made. There is a tendency on the part of the superintendent to pick the hardest rock in the mine. This should not be done unless the sole object is to test the strength of the drill.

The rock chosen should be a fair average of what is encountered in the mine. A drill specially designed for hard rock would make the better showing if tested in the hardest rock in the mine; while another drill, adapted to the average mine rock, would not do so well in the hard rock, but would do much better than the other in the average rock that has to be drilled.

Drill Type Must Fit Conditions

In this connection it may be said that it does not usually matter so much what make of drill you buy, as that the drill should be selected for the special conditions in your mine.

In a great many mines, most of the attention is given to the studying of the ore formation and little toward cutting down the production costs. It is in such mines that contractors thrive, as they are able to give their whole attention to progress.

In such mines, where no special effort is expended toward drilling efficiency, or in portions of mines that are working in ore, or where water is hard to obtain, it may be best to use the one- or two-man solid-piston machines, depending on the hardness of the ground. This is particularly so in stopes and sublevels, where the machines have to be taken up and down chutes or ladderways and where it would be too much bother to take water and the extra fittings for the water drills. If possible it is best to use self-rotating hammer drills for drifting in such places. This method of drilling often doubles the speed on account of the fact that no mounting need be used. It is desirable to use the hammer drill with water through the steel. If air is used through the steel, a spray or atomizer should be attached to lay the dust as it is blown from the hole.

If much attention is given to speed, a water drill should be used if possible. Such a drill is best adapted to the driving of long drifts in development work. If the ground is soft or if the rock is "ravelly," with much fine rock falling in behind the bit, it is often best to use a water-piston machine. The action of the alternating water and air jet, together with the reciprocating motion of the steel, always leaves the steel free to be pulled from the bottom of the hole. If the water-hammer drill be used in such ground more time is often required to extract the steel than to drill the hole. If in hard, solid rock, the water-hammer drill will probably give as great or greater speed than the water-piston machine.

For sinking work either the heavy two-man solid-piston drill or hollow-piston two-man machine can be used. The latest and most popular method of shaft sinking is with the self-rotating hammer drill. With this machine the round can be drilled in less time as no mounting is used. The holes also can be spaced better and drilled at more advantageous angles, thus "pulling" the ground better.

After a suitable place is selected, proper steel should be prepared. The bits should be well formed and tempered for the rock selected and the shanks made the right size. Proper mounting, wrenches, hose and connections must be provided. A pressure gage should be placed at the end of the air-pipe line if one drill is tested at a time.

In testing, one man should be detailed to keep an accurate record of all operations, taking readings of the air pressure every 10 minutes or so, if much variance is had, or every half-hour if the pressure is fairly constant. If a comparison is to be made with another drill, care should be taken to have all conditions as nearly alike as possible. The test should be conducted by the same person and the same drill runners, using the same gage of steel and as close as possible to the same average air pressure. The following report should be made, the example including actual test figures.

1. Type of machine: Sullivan FF-12 Water Drill, size 2⅝ in., weight 162 lb.
2. Place of work: American Flag Mine, Park City, Utah., north heading, 900-ft. level.
3. Date: July 30, 1913.
4. Kind of ground: easy-drilling quartzite.
5. Character of work: drifting; size of drift, 5x7 ft.
6. Type of mounting, column and arm.
7. Average depth of hole, 6 ft.
8. Gage of steels: Starter, 2½-in.; dropped ¼ in. gage on each change of steel.
9. Air pressure at drill, 80 lb.
10. Time of starting work, 7:30 a.m.
11. Time of stopping work, 1 p.m.
12. Total elapsed working time, 7 hr. 30 min.
13. Exceptional delays, none.
14. Total elapsed drilling time, 5 hr., 30 min.
15. Total net elapsed drilling time, 2 hr. 30 min.
16. Actual net reciprocating time, 1 hr. 30 min.
17. Number of holes, 9.
18. Total footage, 54 ft.
19. Drill speed, average inches per minute: (a) Total elapsed drilling time, speed 2 in. per min.; (b) net elapsed drilling time, 4.3 in. per min.; (c) actual drilling time, 7.2 in. per min.
20. Number sticks of dynamite, 27; strength, 40%.
21. Results: (a) Advance, 5½ ft.; (b) cars of muck removed, 20.
22. Name of runner, John Doe.
23. Name of official in charge of test, John Smith.

Remarks on the Form for Reporting Test

1. The type and size of machine should be stated as a matter of record. The weight must be suited to the work and hardness of the rock.

2 and 3. The location and date are a matter of record.

4. In giving the report it is essential to show the class of rock and hardness in order to make any just comparison. A drill that drills 7 in. per min., actual drilling time, in medium-soft rock, may not drill 1 in. per min. in very hard rock.

5. The character of the work is a matter of record and must be stated before the operations can be completely understood. The size of the tunnel, shaft or stope should be given for the same reason.

6. It is well worth while to show the type of mounting used, as considerable time may be gained or lost from this cause. If a piston drill is used in a stope with a column mounting, it is quite possible that a hammer drill may be substituted and save an hour or two of time by the omission of setting up, tearing down of the column and the time lost in changing positions on the column.

If only one shift drills and the next shift mucks out, it is best to use a vertical column, as a "clean" set-up is afforded when the drill shift goes on. The column permits vertical as well as horizontal shifting of the drill and gives the runner a better chance on a "running" hole. However, if drilling is to be done on the same

shift as the mucking, it is often advisable to use a horizontal bar. While drilling is harder and a better runner is required to "bottom" his holes, yet the bar can be set up at once; but if the vertical column is used, an hour may be spent in "mucking back" to clear a place to set the column.

Sometimes, when the ground is favorable, all the holes can be drilled from one set-up. Even though the bar has to be lowered for the bottom holes, only a few minutes is required, as compared with a possible hour lost in "mucking back."

As the "mucking back" is only a waste of high-priced driller's time and the work is a total waste, the muck having yet to be shoveled into the car, the use of a bar wherever possible cannot be too strongly emphasized.

Slick Sheets Should Be Used in Shoveling

It is also surprising how few mines use boards or "slick sheets" for the muck to be shoveled from. A few minutes spent each shift in handling the "slick sheets" will save the mucker an amazing amount of time and energy. Rapid mucking also helps the drilling, as the muck is cleared away from the bottom of the face by the time the runner reaches his lifters and he is not forced to wait or take the valuable time at the end of the shift to scrape the muck back.

The length of the shell depends on the hardness of the ground. If it is very hard, the holes have to be inclined at steep angles in order to break the ground. To drill thus, the shell must be short so that the roof will not interfere with the crank handle. Also, in hard ground, with a long feed the gage may wear off the steels to such an extent that they will not "follow." If the rock is soft, a long feed is desirable and time is saved in changing steels.

7. In even rock the cuts and lifters should be drilled somewhat deeper than the other holes, to maintain an even face, as they are drilled at a greater angle and do not penetrate as far directly into the "face" as the "flatter" holes.

8. The gage of the bit is important. The smaller the bit, the faster will the rock be drilled. However, the hole must be large enough at the bottom to take the powder and hold enough at the bottom of the hole to break the rock. If another drill is to be compared, it is quite important to test with the same gage of bit.

It is quite obvious that attention should be given the bits and that they should not only be tempered for the rock to be drilled, but should be well formed so as not to retard the speed of drilling. If the rock is so hard that trouble is experienced in making the steels follow, give a greater difference in the changes of gage.

The breakage of drill steel should be noted. Little trouble is had with piston-drill steel breaking, but some types of hammer drills, because of the heavy blow delivered direct to the steel by the piston, cause crystallization and excessive breakage.

9. The air pressure in some mines may vary at some places and on some days 20 or 30 lb. This may be caused by a pipe line of too small diameter. When several machines are running close by or someone is "blowing off," the pressure drops abruptly. For this reason it is desirable to have sufficient air pressure in order to make a fair comparison, and absolutely necessary to have a correct record of the average air pressure.

In this connection it is surprising how little some superintendents know about the air pressure on which their drills are running. Many drills that are generally supposed to be running on 75 to 80 lb. of air are running on only 50 to 60 lb.

If two drills are tested at the same time on the same bar or on columns in the same tunnel or drift, the air gage is not so essential, as both the machines have the same air pressure. However, the pressure should be kept up to normal for the reason that one drill may give a much better performance on a low air pressure than another. Owing to this fact, the pressure should be close to that which is customary in the mine, so that the test may parallel mine conditions.

10 and 11. The time of starting and stopping work is a matter of record. In this case while the full shift was 8 hr., the time given was only 7 hr. 30 min., as this was the time actually at the face. Usually a good deal of time is "killed" around the beginning and end of a shift. In the larger mines a considerable length of time is consumed in getting the steel together and reaching the working place. Then if the work is day labor and the boss is not around, a nice long rest and a smoke are in order.

At the end of the shift the men have to be ready by the time the men in the next place to them "fire" or they have to leave the round unfinished. For this reason the runner always tries to get his place ready to shoot 15 min. or more before the usual shooting time.

12, 13 and 14. The difference between the total elapsed working time and the total elapsed drilling time (from the start of the first hole to the bottom of the last) was in this case 2 hr. About one hour was used in mucking back for the column and setting up. The other hour at the end of the shift was used to tear down the column, take the machine and equipment back to a safe distance and load and shoot the holes. The time consumed in setting up was afterward cut down from 1 hr. to 15 min. by the substitution of a crossbar.

No Nuisance Worse Than Drills Freezing

In order that the test should show up the drill fairly, any unusual delays should be recorded. In a mine, time can be lost in a multitude of ways. The steel may not have been tempered correctly and the drills may all be dulled before finishing the round. Where miners have to "rustle" their own steel, it is hard to get them to provide enough. Where the ground is soft, it is often hard to keep the bar or column tight. Hose troubles can be avoided to a great extent by running the hose on boards over the heads of the muckers. But none of the foregoing troubles can compare to the freezing of a drill. In quite a large number of mines there are too few receivers to catch the water and too little attention is given toward draining off the water from the receivers. It is left to the foreman, and as he is little bothered with freezing in his climbing up and down ladderways, the matter is neglected.

It has also been found that in wet mines, when the air is off between shifts, considerable water leaks in the submerged pipes. On a wet day outside, the freezing of the drills is more noticeable, as an unusual amount of moisture is taken into the compress. The freezing not only delays the drilling, often causing the loss of the round, but also causes the piston frequently to

kick the back head out. While numerous suggestions have been made to keep the valves from freezing in rock drills, usually none of them is of much effect. As some types of valves have less tendency to freeze, or are entirely free from freezing, it is best to use such types where much water is found in the air.

15 and 16. The difference between the net elapsed drilling time, (from collars to bottoms of holes) and the actual net drilling time (time machine is in actual operation) shows how much time is taken up by changing steels and position, if we leave exceptional delays out of our consideration. In the case cited, the difference was one hour.

How Long Do the Drills Work?

It surprises some people to know the small amount of time the drill is actually running. In this case it was 1 hr. 30 min., or less than 30% of the total time between the beginning of drilling and the end of the round. As this is unusually fast drilling for mine work, 30% is unusually low. The softer the rock and faster the actual drilling, the lower will be the percentage. And in harder ground more time will be taken up in actual drilling and the percentage may rise to 60% or higher.

17. The number of holes and their depth depend entirely upon the ground. The harder the rock, the greater the number of holes to break it and the shallower they are drilled.

18. By adding the depth of each hole the footage is obtained. The footage drilled is, roughly, a measure of the speed of the drill, and if no complete record is made this measurement should be taken.

19. The average rates of drilling, in inches per minute, tell the experienced superintendent most of what he wants to know, before looking at the rest of the test. Of these averages the actual drilling time is the most important.

20. The strength of the dynamite and the number of sticks are an indication of the hardness of the ground.

21. The final results of the whole test, which every mine manager wants to see, are the number of feet of advance and the number of cars of ore broken. Knowing this, he is able to figure his drilling cost per ton, per cubic yard or per foot of advance. If in development work, the advance is the main object and the one on which the manager figures his expenses; if in ore, the number of tons of ore broken by the shot is where the profit lies. If two tests are run in the same-sized drifts in rock of the same hardness, these figures are easily obtained and constitute an approximate but final test of the speed of the machines.

22 and 23. The names of the runner and official in charge of the test are a matter of record.

In a test of two drills at the same time, it is best to change the drillmen from one machine to the other so as to equalize their skill. If the machines run pretty close together in speed, the change may be made in the middle of the shift. If, however, one machine does considerably better than the other, the changes should be made more frequently, as there is a tendency for the drill runner who is ahead to favor that drill; and if, when the change is made, the other drill is much behind, he will most likely slow up and not try. However, if a fairly equal progress is made, the drill runners will give an unusual exhibition of energy, for it is human nature for each one to think that he is just a little better than the next one. Such a test should be conducted on the same basis as the previous one with the exception of items 20 and 21, which may be omitted, as they have no bearing in this case.

Methods Used in Testing Stoping Drills

If one stoping drill is to be tested, the method is the same as that of one rock drill. In testing two stopers against each other, the simplest and possibly the most efficient method is to place the two drills side by side, along the side wall of a heading. The positions of the holes to be drilled are marked off with a piece of chalk. One hole should be inclined as close to the horizontal as the cuttings will fall out, and about three more holes drilled at various inclinations up to the vertical. Several series of these holes should be marked.

After plenty of steel has been obtained and the runners have made sure that they will "follow" and that there will be no delay, the drills are started on the same corresponding holes and run continuously for a half-hour, over-all time, changing the drill runners frequently from drill to drill. The holes should all be drilled to approximately the same depth, unless a steel should become seriously stuck. At the end of the time, the holes are measured and it is pretty safe to assume that the drill that has drilled to the greatest depth is the fastest machine and best adapted to the ground.

Drilling Thirty Feet in Thirty Minutes

A case came under my observation at the Veteran Shaft of the Nevada Consolidated Copper Co., near Ely, Nev., where one stoper, when tested as to actual drilling speed, drilled 35% faster than the other. When placed side by side and the foregoing test run, the first stoper drilled 20 ft. in a half-hour and the apparently slower one of the two, when judged from the first test, drilled 30 ft. in the same time. This change in comparison was caused by the fact that the feed cylinder on the first machine was too large, which, although it caused the machine to drill faster, at the same time caused it to "bury" the bit in the softer ground, and in the "flatter" holes the machine drilled so fast that the cutting did not fall out fast enough and again caused the bit to stick. While the first drill would probably have been the faster one in a little harder rock, this test proved conclusively which was better adapted to drilling in the ground in question.

In this connection, I wish to say that this was the fastest drilling I ever saw. The average of a foot a minute for a half-hour, over-all time, was the result of the extraordinary pace set by the runners; the fact that the steels were handed to them and the time elapsed for changing each steel probably did not exceed a few seconds. The rock was soft, dry porphyry and unusually easy drilling.

In conclusion, the mine manager must have the following information in order to know absolutely which drill is the most efficient for his mine: First, he must have the report from the master mechanic on repair cost and air consumption; next, he must have the results of the underground tests on drill speed and work accomplished; finally, with this information before him, he must figure out the drilling cost per ton or per cubic yard of rock removed or per foot of advance.

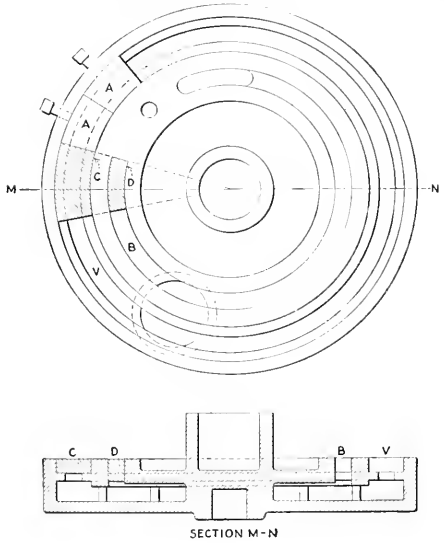
Details of Milling and Smelting

Raising Drum-Filter Vacuum

By Herbert G. Thomson*

It is sometimes necessary to run filters of the rotary-drum type with a low pulp level in the tank on rapidly settling slimes. A reduction of vacuum will result, owing to air passing through the canvas on the two or three exposed sections of the drum between the blowoff and the pulp level. The following simple method of increasing the vacuum was used at the Globe Consolidated mill, Dedrick, Calif.

A wooden block *C* was carefully fitted into the annular vacuum slot *V* in the exterior section of the head valve, of sufficient length to cover entrance holes of pipes leading to the two exposed sections of the drum. Since the



METHOD OF BLOCKING THE VALVE PORTS

blow and vacuum slots are connected below the blowoff point, it was necessary to insert a similar but shorter wooden plug *D* in the blow slot *B* covering the two corresponding pressure-pipe holes. The faces of the two blocks were flush with the face of the valve. Upon being moistened with solution the wood expanded and fitted tightly, effectually shutting off the vacuum from the exposed sections. As a result the vacuum was raised nearly three inches, with the result that the cake was held more securely on the drum and filtration was carried through more rapidly.

A glance at the accompanying sketch will show that the changes made were, in effect, merely the lengthening of the two steel blocks *AA* inserted in all machines by the manufacturer. When run normally, with the tank nearly full of pulp, these are of ample length to prevent loss of vacuum.

*Globe Consolidated Mill, Dedrick, Calif.

Concentration Formulas

By J. E. Clennell*

In certain cases some ambiguity occurs in the interpretation of the results of small-scale concentration tests, owing to the presence of factors that would be eliminated in practice. In a small test it is usually impossible to obtain a close concentration of the valuable mineral in one product, and produce clean tailings in a single operation. Usually a considerable amount of middlings is produced, which must be worked over repeatedly to obtain the desired result. This applies both to gravity concentration and to flotation.

By making certain assumptions, however, we may calculate the effect of this repeated concentration without actually performing the operation. In practice, the middlings, if produced at all, are continuously returned to the head of the machine, and it may, in general, be assumed that the assay value of the clean concentrates and tailings produced is not affected by this procedure. This assumption, which is the basis of the following formula, appears to be legitimate—at least in cases where the heavy or floatable mineral is substantially of one kind, so that the middlings are not of a different nature from the ore itself, but consist merely of a mixture of the same constituents found separately in the concentrates and tailings.

Let *C*, *M* and *T* respectively represent the percentage weights of concentrates, middlings and tailings obtained in the actual test; *X* and *Y*, the required percentage weights of concentrates and tailings that would be obtained if middlings were eliminated; *h*, *c*, *m* and *t*, the assay value (in any unit) of heads, concentrates, middlings and tailings respectively; *x* and *y*, the required percentage of total value in concentrates and tailings respectively, when middlings are eliminated. Then since

$$C + M + T = X + Y = 100$$

and

$$Cc + Mm + Tt = Xc + Yt$$

it follows that

$$X = \frac{Cc + Mm - (100 - T)\,t}{c - t} \qquad (1)$$

and

$$Y = \frac{(100 - C)\,c - Mm - Tt}{c - t} \qquad (2)$$

also, since

$$x : 100 : : Xc : 100\,h$$

and

$$y : 100 : : Yt : 100\,h$$

$$x = \frac{Xc}{h} \qquad (3) \qquad \text{and} \qquad y = \frac{Yt}{h} \qquad (4)$$

*Metallurgical chemist, Butters Patent Vacuum Filter Co., Oakland, Calif.

As an example of the application of these formulas we may take the following figures from an actual concentration test. The head assay showed gold, 0.895 oz. per ton.

DATA OF CONCENTRATION TEST

Product	Weight, %	Assay of Product, per Ton, Gold, Oz.	Per Cent of Total Gold
Concentrates	12 45	6 53	90 8
Middlings	11 45	0 35	4 5
Tailings	76 10	0 055	4 7

It is desired to find the effect of eliminating the middlings in this statement.

Here $U = 12.45$, $M = 11.15$, $T = 76.1$, $h = 0.895$, $c = 6.53$, $m = 0.35$, $t = 0.055$.

From (1)

$$X = \frac{(12.45 \times 6.53) + (11.45 \times 0.35) - (100 - 76.1) \times 0.055}{6.53 - 0.055} = \frac{83.9915}{6.475} = 12.97$$

From (2)

$$Y = \frac{(100 - 12.45) \times 6.53 - (11.45 \times 0.35) - (76.1 \times 0.055)}{6.53 - 0.055} = \frac{563.5085}{6.475} = 87.03$$

From (3)

$$x = \frac{12.97 \times 6.53}{0.895} = 94.63$$

From (4)

$$y = \frac{87.03 \times 0.055}{0.895} = 5.35$$

The result of the test then appears as follows:

DATA ON CALCULATED CONCENTRATION TEST

Product	Weight, %	Assay of Product per Ton, Gold, Oz.	Per Cent of Total Gold
Concentrates	12 97	6 53	94 63
Tailings	87 03	0 055	5 35
			99 98

Michaud & Delasson's Process of Tin Refining

A process for refining tin electrolytically has been patented by Georges Michaud and Eugene Delasson of Montreuil, France (U. S. Pat. 1,124,345). The electrolyte consists of $SnCl_2$, 100 parts; H_2SO_4, 10 parts; $MgCl_2$, 1 part; and boric acid, 1 part, made up in a solution of 20° Bé. The cathode is to have a surface equal to 2% of that of the anode, and the tin is deposited in noncoherent form and later scraped off the cathode which is preferably of copper. The solution is continuously regenerated by circulation through a tank containing tin waste of any sort whatever.

Sulphur Dioxide Recovery, Garner Process

Sulphur dioxide may be recovered from gases comparatively poor in it, according to James B. Garner, of Pittsburgh, Penn., assignor to the Metals Research Co., of New York (U. S. Pat. 1,145,579), by passing the gases at room temperature, say 11 to 24° C., over charcoal, when the SO_2 is absorbed, and later heating the charcoal to from 130° to 180° C., when the SO_2 is expelled. The enriched gas, which, the author says, may occasionally carry even 98 to 99% of SO_2, is recovered and used. He also calls particular attention to the fact that various charcoals have different affinities for sulphur dioxide, and particularly recommends the use of boxwood.

System of Zinc-Shaving Disposal

By Jesse Simmons*

At the Wasp No. 2 mill, Flatiron, S. D., the shavings cut on the zinc lathe for use in the precipitation boxes are conveyed in a short chute through a partition and thence drop to the floor of the precipitation room. The accompanying illustration shows the shavings coming through the chute and piling up on the floor.

SYSTEM OF HANDLING FRESH ZINC SHAVINGS

This, or a similar method, is essential to quick production of the material. To allow the shavings to drop into small boxes on the floor behind the lathe necessitates frequent changes of the boxes and stoppage of the lathe. This scheme gives plenty of room for an entire roll of zinc, cut into shavings, to pile up out of the way. It requires practically no attention on the part of the lathe man.

*Deadwood, S. Dak.

The Assayer and Chemist

The Ignition of Magnesium Pyrophosphate

In making determinations of phosphorus or magnesium, it has been found difficult to ignite the magnesium pyrophosphate to complete whiteness, even with greatest care, when the usual methods are followed, says S. H. Champlin in the *Chemist-Analyst*, July, 1915. The operation may be carried out quickly and easily as follows: Place the wet filter and precipitate in a Vitreosil crucible and dry over a low flame, inclining the crucible on the triangle and resting a cover against the top so as to cause the warm gases to circulate over the paper. When the paper begins to brown, place the crucible, uncovered, in a muffle below a red heat and smoke off the paper. Cool, and saturate with nitric acid (sp.gr. 1.42). Warm gently to expel the excess of acid, increasing the heat slightly until red fumes come off. Return to the muffle, now at a dull-red heat, and ignite until the evolution of red fumes ceases. Then raise the temperature to a bright-red heat and ignite until constant weight is obtained.

The use of a platinum crucible has never been attempted on account of the danger of alloying.

*

Assaying Samples Containing Coarse Gold

In a discussion of the influence of coarse gold particles on assaying, before the Institution of Mining and Metallurgy, W. H. Goodchild (*Bull.* 101) suggests that for spotty ores containing large particles of gold the best method is often to reduce 10 lb. to 40-mesh and pan the entire amount. The pannings should next be assayed separately as "metallics" and the tailings dried, cut down, ground and assayed in the usual manner. The final assay is then computed from the tailings and metallics assays.

This is very reminiscent of the method adopted by Sidney Jennings in his valuation of the Alaska Ebner mines, where 30-ton samples were put over concentrating tables and about 1½% concentrated out, carrying the free gold, pyrite, galena, etc. The concentrates were then treated in an amalgamating barrel. The tailings from the Wilfleys and from the barrel were easily sampled and the final assay was then calculated from the barrel recovery, the barrel tailings and the table tailings. In this way concordant results could be obtained.

*

Exact Determination of Sulphur Dioxide in Air

By J. R. Marston*

In the spring of 1910 it was necessary to devise a method for accurately determining minute quantities of sulphur dioxide in the air in the vicinity of the Selby Smelting and Lead Co.'s Plant, at Selby, Calif. A method was worked out and satisfactory results were obtained. Later, in May, 1913, the Selby Smelter Commission was appointed and a large amount of work was done in checking up the method, under the direction of A. E. Wells, chief chemist for the commission. All possible sources of error were investigated and different methods of manipulation studied, the degree of accuracy and technique being improved, so that the sensitiveness is one part in ten million. The method finally adopted by the commission is as follows:

Preparation of Apparatus

Take two clean glass aspirators of about 25-liter capacity, having one tubulure at the top and a second at the side near the bottom. The upper tubulures are closed with single-bore rubber stoppers carrying glass stopcocks and the lower tubulures with single-bore rubber stoppers fitted with glass plugs.

To make a determination, mix 100 c.c. of starch solution with 400 c.c. of distilled water, add 3 grams of KI and sufficient *N* 500 iodine solution to produce a good lavender tint. Divide this solution between two wide-mouth bottles of about 500-c.c. capacity each, fitted with three-hole rubber stoppers. (These will be referred to as titration bottles.) One hole carries a tube extending to the bottom of the bottle, the second carries an L-tube extending just within the stopper and the third hole is open. Insert the L-tube of each titration bottle in the rubber stopper at the side of the corresponding aspirator, close the third hole of the titration bottle with a finger and allow the starch solution to run into the aspirators. Detach the titration bottles, close the hole in the aspirator stoppers and shake the aspirators vigorously for about a minute. Return the starch solution from each aspirator to its titration bottle and compare the colors. The shade should be identical; but if not, pour the two portions together, mix, divide the solution and repeat the foregoing operation until the colors do match.

For an actual determination, the two 250-c.c. portions of colored starch solution are run into the respective aspirators. One aspirator is evacuated to a pressure determined by a mercury manometer, the stopcock at the top is opened and the sample of air to be tested drawn in. Shake the aspirators for one or two minutes and return the starch solutions to the titration bottles for comparison. *N* 500 iodine solution is added to the solution from the test aspirator until its color exactly matches that of the solution from the control aspirator. The iodine solution is drawn from a burette fitted with a narrow tip, which is passed through the third hole of the titration-bottle stopper, thus avoiding exposure of the solution to the air. If the starch solution from the test aspirator has been completely decolorized, both solutions are returned to their respective aspirators (after the addition of the iodine solution), the aspirators shaken for one minute and the comparison repeated as previously cited. This

*Chief chemist, Selby Smelting and Lead Co., Selby, Calif.

procedure is continued until the colors of the two solutions exactly correspond.

When 1 c.c. of N 500 iodine solution is equivalent to 0.0224 c.c. SO_2 at standard conditions, this factor multiplied by the number of cubic centimeters of $N/500$ iodine solution required to bring the solution from the test aspirator to the same color as that of the control aspirator gives the volume of SO_2 at standard conditions.

$$\frac{\textit{Vol. asp. in c.c.} \times 273 \times \textit{man. reading in mm.}}{\textit{Abs. temp. of the air in asp.} \times 760} =$$

volume air, standard conditions.

$$\frac{\textit{Vol. } SO_2 \textit{ at st. cond.}}{\textit{Vol. air at st. cond.}} \times 1{,}000{,}000 =$$

parts per million of SO_2.

Example:

Volume of aspirator	24,000 c.c.
Manometer reading	380 mm. Hg.
Temperature of air in aspirator	20° C.
N/500 iodine solution used	1.2 c.c.

1.2 × 0.0224 = 0.027 *c.c.* SO_2 *at standard conditions.*

$$\frac{24{,}000 \times 273 \times 380}{(273 + 20)\ 760} = 11{,}200 \textit{ c.c. air at standard conditions.}$$

$$\frac{0.027}{11{,}200} \times 1{,}000{,}000 = 2.5 \textit{ parts per million } SO_2.$$

To prepare the iodine solution, weigh out 1.27 grams of pure iodine and 5 grams of KI and make to 1 liter. Dilute 200 c.c. of this solution to 1 liter, which gives an $N/500$ iodine solution. The starch solution contains 2 grams per liter.

The control bottle is used to check a volume of air free from SO_2 against an equal volume of air which may contain SO_2. It compensates for the iodine consumed by substances contained in the water, etc. KI is added to the starch solution to increase the sensitiveness of the reaction. The lavender end-point is more sensitive than the blue.

It is impractical to evacuate a 24-liter bottle below one-half an atmosphere, as it is liable to collapse.

The two-minute shaking gives ample time for the SO_2 to react with the iodine. The two portions of starch solution are mixed at the end of each test, then divided, when the solutions are in readiness for the next test.

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Determining Lead as Sulphite

An investigation of the suitability of lead sulphite for the gravimetric determination of lead is described by George S. Jamieson, *Am. Journ. Sci.*, p. 157, 1915. Lead may be precipitated quantitatively from a slightly acid solution by sodium or ammonium bisulphite, or even by aqueous sulphurous acid, if the acidity of the solution be carefully controlled. When a solution contains much acid it should be almost neutralized with ammonium hydroxide before attempting to precipitate the lead.

A 2% solution of bisulphite should be added in excess to the lead solution, the solution thoroughly stirred and allowed to settle for an hour or longer. The precipitate is then filtered on a Gooch and thoroughly washed with cold water. The liquid should not be allowed entirely to pass out of the Gooch until the washing is complete. This is very important. The lead sulphite is then dried at 150° C. for an hour and weighed as $PbSO_3$. Alkaline-earth metals interfere, being precipitated with the lead.

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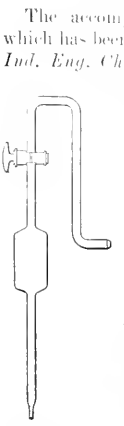
A Modified Pipette

The accompanying sketch shows a form of pipette which has been found very useful by Sidney Born (*Journ. Ind. Eng. Chem.*, July, 1915) in his laboratory. It is made by fusing a stopcock and a piece of bent glass tubing to a pipette. The advantages over the ordinary pipette are:



MODIFIED PIPETTE

1. Safety—There is no danger of sucking up acid or dangerous liquids.
2. Ease of Manipulation—The stopcock insures tighter closing and greater accuracy than use of a finger.
3. Accuracy—The line of demarcation is level with eye when using.
4. The pipette can be carried around full without losing any liquid.

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Macroscopic Etching of Steel*

The microscopic examination of steel by polishing the surface of small samples and etching with reagents has been brought to a far higher degree of excellence than has the technique of rendering visible on a large scale porosity, lack of homogeneity in composition, and other defects in steel that rolling or forging has rendered difficult to detect by ordinary optical inspection. Any improvement in the macroscopic methods would be very desirable, and such an improvement seems to have been found in etching the steel with molten zinc.

In samples described in this paper bars 10 in. by 1¼ in. by $\frac{5}{16}$ in. of openhearth iron, Norway iron, and openhearth steel, were suspended in the molten zinc of a 14-ft. galvanizing pump by means of iron wires. Later, some more samples of carbon tool steel and high-speed steel were added. On taking the samples from the molten zinc the mass of dross surrounding them could be broken off while still hot by blows from a hammer, and the coating of metallic zinc removed by immersion in dilute sulphuric acid, which does not affect the steel or iron so long as any zinc remains. High-carbon areas are rapidly eaten away by the molten zinc, and the method seems to afford a useful means of detecting such spots and, in general, lack of homogeneity in the surface. A few unsatisfactory trials have been made of etching nickel steel in molten tin, while the use of metallic mercury as an etching fluid and the extension of this method of testing to nonferrous metals are under consideration.

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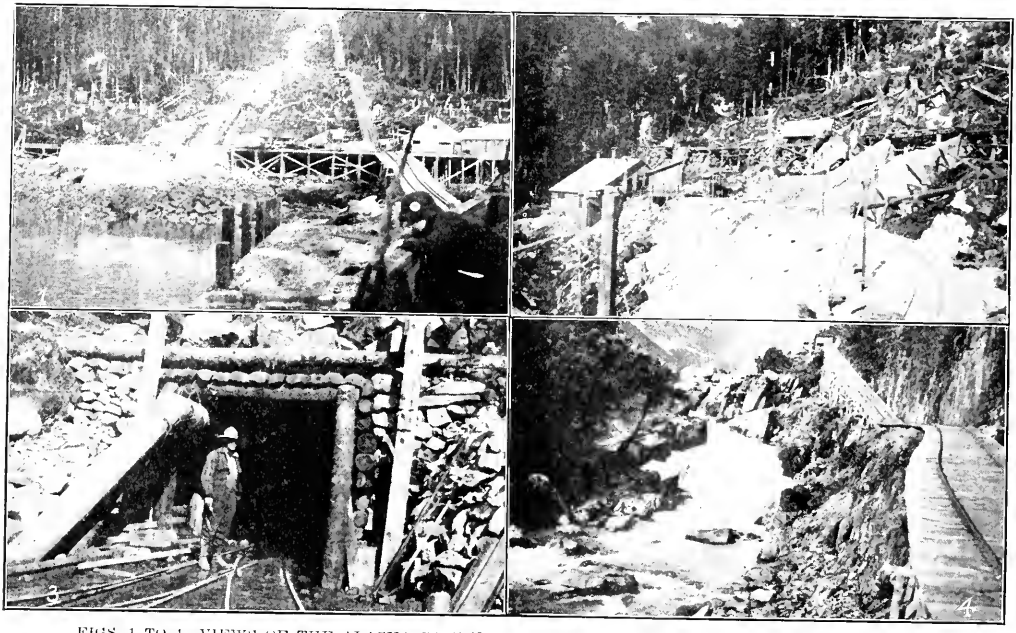
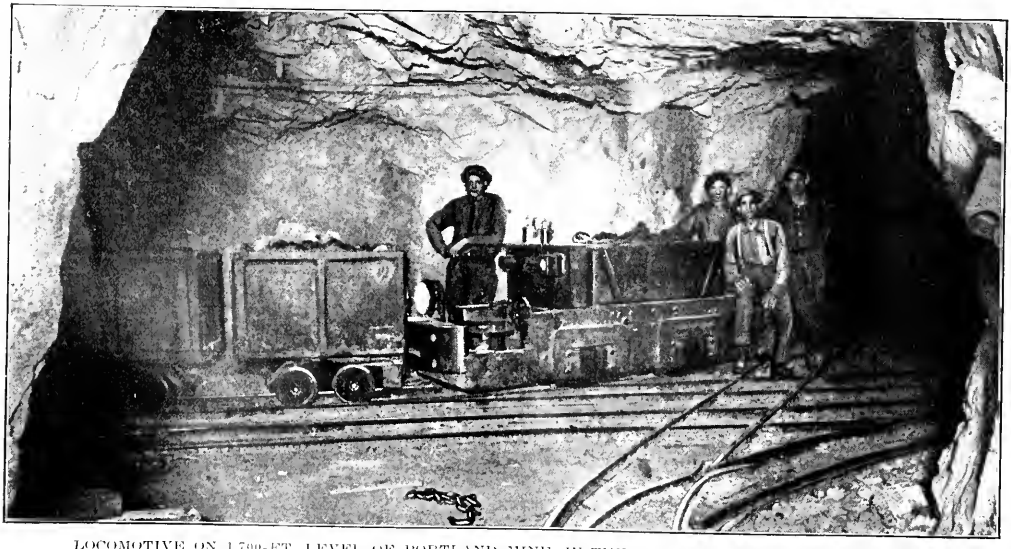
For Cleaning Laboratory Glassware, F. C. Mathers, writing in the "Chemist-Analyst," recommends a mixture of sulphuric and nitric acids, used at a temperature just too low to distil off HNO_3 or SO_3. Thick glassware should be placed in a cold solution and gradually heated. Enough nitric acid should be added to keep the mixture white or yellow in color. The combination is said to be superior to the bichromate-sulphuric acid mixture ordinarily used.

*Abstract of a paper presented at the annual meeting of the American Society for Testing Materials, June 22-26, 1915, by Jesse L. Jones.

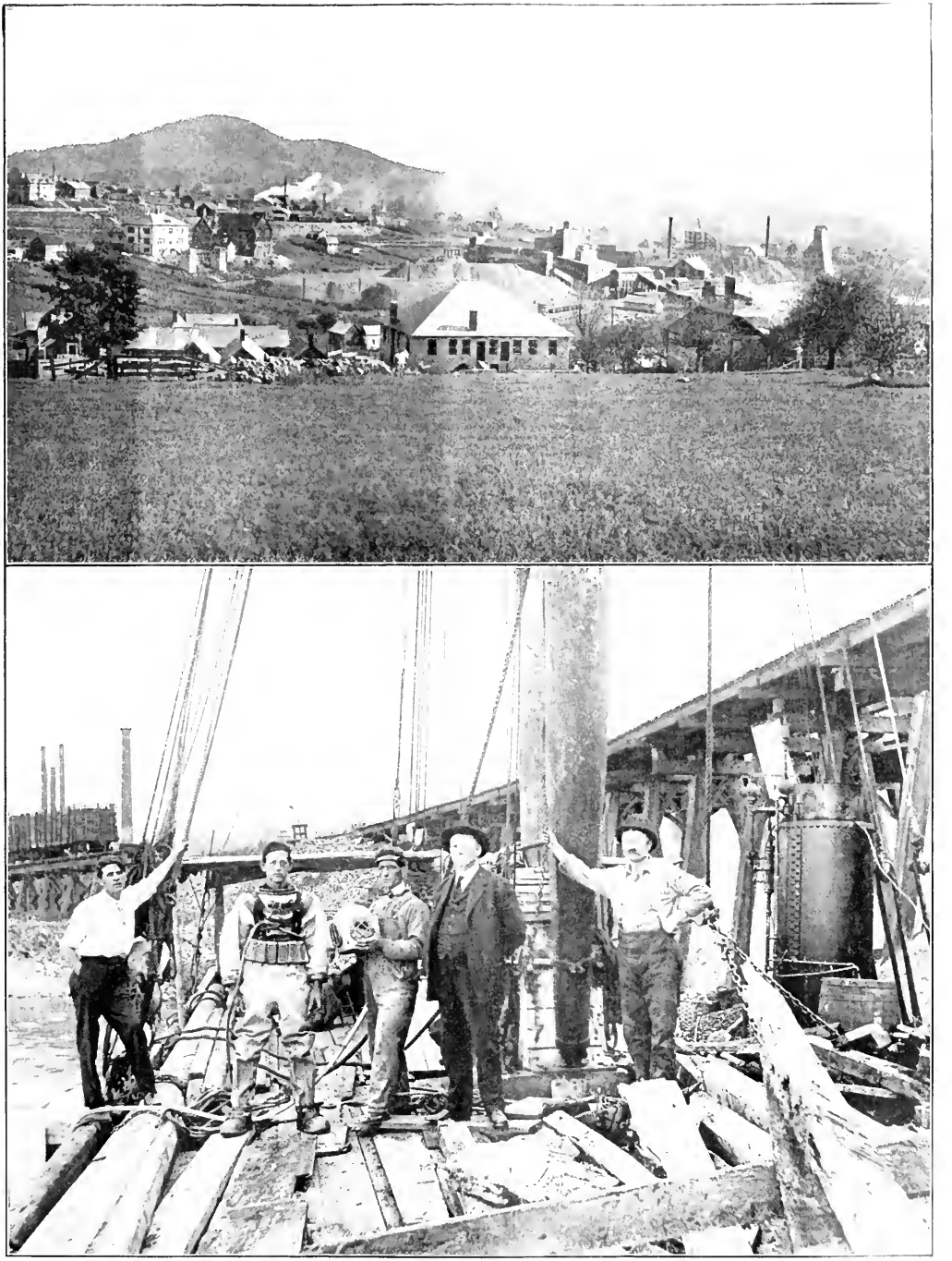
Photographs from the Field



FIGS. 1 TO 4. VIEWS OF THE ALASKA-GASTINEAU MINING CO'S ANNEX CREEK POWER PROJECT
1—Lower camp, showing power-house foundation, part of pipe line and tram to Lake Camp. 2—Upper camp at tunnel to tap upper Annex Lake. 3—Portal at tunnel. 4—Tramway along Carlson Creek



LOCOMOTIVE ON 1,700-FT. LEVEL OF PORTLAND MINE, IN THE CRIPPLE CREEK DISTRICT, COLO.
This level was opened since the drainage of the mine by the Roosevelt tunnel.



TWO PHASES OF THE IMPORTANT IRON-MINING DISTRICT OF NORTHERN NEW YORK STATE

Upper view is of the town of Mineville, N. Y., and the lower of a diver at work at the ore dock at Port Henry, N. Y. He recovers ore lost from the docks

Correspondence and Discussion

The Pamlico Placer Field

In the *Journal* of Sept. 25, in the Mining News, under head of Inyo County, California, is a reference to the Pamlico placer field at Bishop. All the data are correct, but the Hawthorne mining district is in Mineral County, Nevada. Hawthorne, the county seat, is about 10 mi. west of Pamlico camp. The *Journal* may have received its item from Bishop, but with that post office address given it might be misleading, as there are other Hawthornes.

The Pamlico company has a new gallows frame, a gravel bin, also a 25-hp. gas hoist. The water for sluicing is brought 14 mi. from the southwest through a pipe line put in many years ago for a mill. About 25 men are now working on the two shifts. The placer gold is thought to have come from the Pamlico Hill, about one mile southeast of the present workings. Twenty-odd years ago ore reported to be worth from $100,000 to $150,000 per ton was taken from this hill. Some of the placer gold is very coarse. The surface was dry-washed years ago, but this is the first attempt to placer on a large scale. The company is down 120 ft. to bedrock. Nuggets as large as three troy ounces have been found.

Hawthorne, Nev., Oct. 9. W. P. Ross.

Chain Ladders Unnecessary!

On Oct. 10, four men were working in the bottom of the 1,780-ft. 3-compartment shaft at the Oro Hondo mine, near Lead, S. D. They had completed a round of holes and given the blasting signal to the engineer. The latter responded, and the fuses on the 12 charges were lit. The four men climbed on the bucket and gave the signal to hoist. For some reason this was not done as soon as they supposed it should be, and thinking something had gone wrong with the engine, the foreman jumped off the bucket with the intention of cutting the fuses. In climbing off the bucket he dropped his lamp and it went out. In the meantime the engineer, following the signal given him, hoisted the bucket with the three men on it.

When the bucket reached a place above the main bulkhead, the men on it gave the signal to stop, and climbed out on the timbers out of danger. They then signaled the engineer to lower the bucket, which he started to do. Before the bucket reached the bottom the man who was left there tried to climb the bell rope. In doing this he gave the one bell signal and stopped the hoist, at the same time breaking the bell cord. The engineer waited a reasonable length of time and not getting any signal hoisted the bucket to the station. Not finding any men on it he lowered it into the shaft, but before the bottom was reached the shots commenced. The three men that had gained the timbers climbed to the station by means of ladders.

The man at the bottom during this time realized that there was very little hope for him and crouched behind the lagging in one corner of the shaft. The 12 shots went off and completely covered him. There was little hope entertained by those above for his recovery, but an examination was immediately made and it was found that he was alive. Superintendent Talbot, with the aid of the night engineer, went into the shaft and after 30 minutes' work was able to get the man's head out. Some more hard work and he was uncovered and taken to the surface. It was at first supposed that it would be impossible to get him out before the water came up in the shaft and caught him. It was done, however, and an examination of the man after the accident showed that he was only slightly bruised on the side of his head. What might have proved a sad affair turned out without anyone being seriously injured. It is a lesson to those employed in shafts to have some other means of exit in case of necessity.

A chain ladder had been supplied the men with which to reach the first bulkhead, but it was several sets above and had not been lowered. Someone had been careless and had not followed instructions. There had never been any occasion to use the ladder before, but when the time came it was not in its place. Fortunately no one was injured, and from the occurrence a good lesson can be had, in that two methods of getting out of a shaft are absolutely necessary. S. E. B.

Lead, S. D., Oct. 16, 1915.

[One of which methods is, not to depend on climbing the bell rope. Even though the man was not killed the entire shaft crew should have been promptly fired. Why provide *two* methods of getting out when one reliable method provided was entirely disregarded?—Editor.]

The Cost of an Ounce of Gold

Our attention has been called to an interesting article in the *Journal* of July 10, 1915, entitled "The Cost of an Ounce of Gold," in which the author, Percy E. Barbour, states in the second paragraph that "the cost of producing an ounce of gold is not only not commonly known, but is not included in the report of any gold-mining company which has ever come to the notice of the writer."

We think the latter will therefore be interested to learn that the group of gold and silver mines in the Benkoelen district of Sumatra, under the direction of our Batavia principals, Messrs. Erdmann & Sielcken, have for some years past regularly published monthly reports in which the cost of production per ounce of gold is shown and even is subdivided into various branches of the working operations. Silver is also produced, but, being of secondary importance, is reduced to its equivalent value in gold for the purpose of calculation.

We inclose copies of the monthly report[1] of the mines Redjang-Lebong, Simau and Ketahoen for December, 1914, as published in Holland.

London, E. C., Oct. 5, 1915. Aschhoff & Co.

[1]These reports show the cost of gold at the three mines mentioned to have been respectively, $15.41, $11.26 and $27.34 per oz.

Dynamite Explosion at Granite Mountain Mine

BUTTE CORRESPONDENCE

At 1:20 o'clock, Oct. 19, the explosion of 13 boxes of giant powder at the collar of the North Butte company's Granite Mountain shaft, Butte, Mont., caused the instant death of 14 men and the serious injury of four others, two of whom have since died in the hospital.

Three times a week powder is sent down into the mine. The day of the accident was "powder day." The chippy cage upon which the powder is lowered does not run to the 2,800-ft. level and one car intended for that level, containing 650 lb. of dynamite, was held back to be lowered on the big cage coming up from the 2,800 level. Three loads of 13 boxes of powder each had already been lowered on the chippy, but before the big cage came to the surface to take the last box down to the 2,800-ft. level, the explosion occurred. While numerous theories have been advanced as to the cause of the explosion, the true one will probably remain a mystery, as the men handling the powder were all killed. The damage to the plant was comparatively slight. Manager Pope, of the North Butte company, after careful investigation stated that he had no theory whatsoever as to the cause of the explosion. The accident, which marks the worst tragedy in Montana's mining history, has been a severe shock to the community. Those numbered with the dead were all men highly esteemed by their employers and friends. Expressions of sympathy have reached the bereft survivors from all quarters.

The dead: James E. Blow, assistant foreman; Richard Gendle, electrician; George Larkin, nipper; John Winston, shift boss; Ed. Carlson, top carman; Robert Watson, shift boss; Ernest Watson, shift boss; Edwin C. Bray, shift boss; John McCauley, boss ropeman; Patrick J. Morrissay, shift boss; James Powers, nipper; William Danton, electrician; William Butcher, nipper; Phileas Blanchett, miner; Lacey Grisham, shift boss; John D. Leahy, nipper.

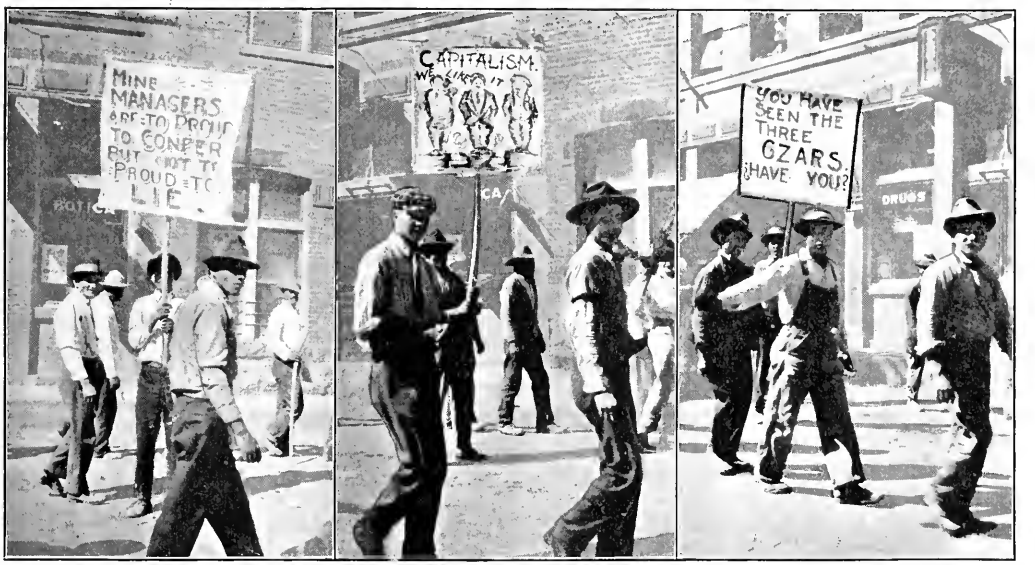
Seriously injured: Peter H. Brown, carpenter; William Vallentine, carpenter.

The Strike Situation in Arizona

SPECIAL CORRESPONDENCE

A condition of pacification reigns at Clifton, Morenci and Metcalf despite reports to the contrary. Physical damage to the extent of probably $125 has been done to the three camps, and many men have been driven from the districts and several injured.

Beyond a doubt the labor strike at the colossal mining camp has been one of the most remarkable in the history of similar events. It is different in that no strike-breakers have been brought into the camp by the operating com-



SOME TYPICAL BANNERS DISPLAYED BY THE STRIKERS DURING THE CHASE CREEK DEMONSTRATION

panies, no liquor has inflamed the minds of the strikers, no serious agitators have attempted a "stampede," and few have resisted the demands of the strikers, save by departing. There has been much of what journalists call "sob stuff" sent out from the Clifton-Morenci mining districts, but the true story of the situation is one of "watchful waiting."

The most disastrous results of the strike have been in disorganizing well-formed operating crews, stopping the movement of the wheels of industry, and the bitter taste left by the occurrence. As for the battles, dynamite destruction, starvation, etc., the accounts must be discredited.

Late in August organizers of the Western Federation of Miners entered the mining camps of Clifton, Morenci and Metcalf, Ariz., in which the Arizona Copper Co., Detroit Copper Co. (Phelps, Dodge & Co.) and the Shan-

ion Copper Co. operate. A mass meeting was held on Sept. 4 on the streets of Metcalf and again the following evening at Morenci. Banners with the inscription *Viva la Union* were displayed. The plaza was crowded with union sympathizers, and the opposition remained on the edge of the crowd. On Sept. 6, Guy Miller, organizer of the Western Federation of Miners, made an address in Clifton, after which a demonstration was held and *Viva la Union* again became the center of attraction. The crowd maintained order at all times. Mr. Miller then outlined the procedure of the Western Federation of Miners in Clifton and announced that upon the completion of organization a committee would present their demands to the officials of the three operating companies and stated that if, after a limited time, the demands were not met with, a strike would be called. Mr. Miller advised the men to conserve their savings and be prepared for the worst. Prior to this announcement many Federation organizers had gone over the Clifton labor situation, and it may be safe to say that plans for action were laid as far ahead as June. Mr. Miller's plans were followed out, and a committee requested an interview with the company managers. In answer, M. H. McLean, of the Detroit company, advised Mr. Miller that the Federation would not be recognized. J. W. Bennie, manager of the Shannon Copper Co. was in California when he received word of the requested committee meeting, and he wired his refusal. Normal Carmichael was also away at the time, but took a stand similar to that of McLean and Bennie.

On Saturday night, Sept. 11, a strike was ordered, and by 3 o'clock Sunday morning not a wheel moved in any of the mines, mills and smelteries. With the striking miners all other union employees walked out in sympathy. Guards were stationed for the protection of the company's property and pickets placed by the strikers. It was then announced that the men would demand from the companies the same wage scale as paid at Ray, Ariz. The company officials then stated that they would meet a committee of the workingmen as such, but not as members of the Western Federation of Miners. No effort was made to operate any part of the mines, mills or smelteries, and no strike-breakers were imported. This was one of the wisest moves during the entire situation. The next move made by the companies was to turn over all their property to the protection of Sheriff James Cash of Greenlee County, requesting him to protect it from any violence, and they withdrew their own watchmen. Sheriff Cash appointed about twenty deputies whom he placed over the property.

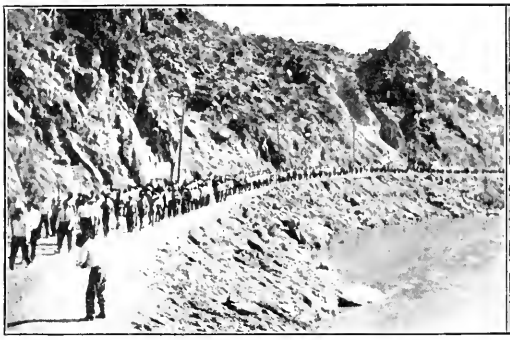
On Tuesday, Sept. 28, Governor G. W. P. Hunt arrived in Clifton shortly after 10 o'clock from Phœnix. From then on whatever violence was to take place made itself known.

On Saturday night, Oct. 2, Managers Carmichael, McLean and Bennie decided to leave Clifton, and went to Lordsburg, N. M., where they were arrested on a charge of being fugitives from justice. J. W. Bennie stated that it was his belief that the sheriff was planning to place them (the three managers) in the county jail, fearing violence of the strikers. Rather than be placed in the hands of the county, they left camp on a special train. Under-Sheriff Joe Larrieu was in Lordsburg and was informed of the departure of the managers. He made a complaint on a fugitive-from-justice charge and the three officials were placed under arrest by the sheriff of Grant County, New Mexico. At midnight Sheriff Cash arrived by automobile and held a warrant charging the managers with inciting a riot, presumably for leaving the camp. The justice of the peace dismissed the case, and the men left for El Paso, where they established headquarters in the Hotel Paso Del Norte.

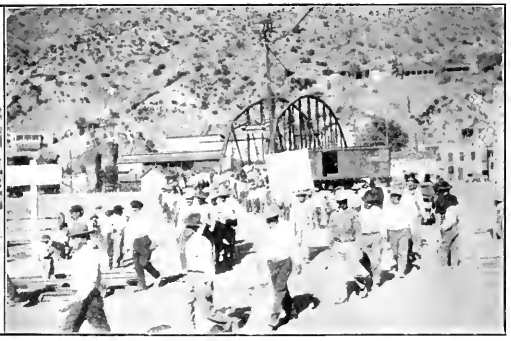
The violence that ensued in Clifton comprised the following incidents: The engineer and fireman who brought the managers to Lordsburg were severely beaten up by the strikers, as were several other workmen; windows in the Arizona Copper Co.'s office and drug store were broken; the engineer at the light plant was overpowered and the lights turned off; and a charge of dynamite was reported to have been set off at Morenci. A great many persons were ordered out of camp and many left, some forming a colony at Duncan, Ariz. Others went to other mining camps in the Southwest. Parades were held, and banners bearing glaring inscriptions were brought on the scene.

On Oct. 4 about 40 members of the Arizona National Guard were sent to Clifton by Governor Hunt, and later a request was made by the sheriff and others for more troops, which were sent. The militiamen camped near the Arizona Copper Co.'s smelting plant and at the courthouse.

Moyer left Clifton on Oct. 6, to consult with Governor Hunt in Phœnix. He said that the Federation would withdraw all requests for recognition and all that it asked was a decent wage scale for the employees. He considered the requests of the managers incoherent in regard to the "dominant influence." He agreed that if the presence of



PARADE OF 5,000 MEXICAN EMPLOYEES AT CLIFTON



THE DEMONSTRATION ON THE PLAZA AT CLIFTON

himself or any of the Federation organizers retarded a settlement they would be only too glad to leave the district. He gave the solution as being in a meeting of the managers with the employees.

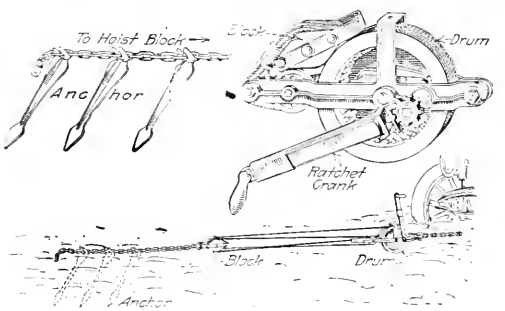
Several attempts have been made to send committees to El Paso to meet with the managers, but only one has been accepted. It consists of Hollingsworth, Hughes, Palacios, Garcia and Daley.

The latest communication from El Paso contains the information that at the conference between the managers and the committee of employees, they had not been able to agree. The managers stipulated that the Western Federation of Miners must be eliminated and that the employees must return to work under the former scale of wages. No other conditions would be considered. The employees' committee, not being willing to accept these terms, returned to Clifton.

A Little Thing with a Big Pull

An ingenious piece of mechanism devised for the automobilist to enable him to pull himself out of a hole looks as if it would be a very handy contrivance to have around a mine.

The device is known as "Pull-U-Out," and is in effect a miniature chain block, and is simplicity itself. A substantial winding drum, with gears inside, engaging a small bronze gear on the end of a long ratchet crank, furnishes the pull. At the other end of the tackle is a small double block; 40 ft. of steel cable, with a capacity



THE PULL-U-OUT DEVICE

of 5,000 lb. is used. Two 7-ft. pieces of light-weight chain, with hooks on each end, complete the outfit.

In order to furnish an anchor where there is no stump or fixed object to tie to, three light-weight steel stakes are provided with each "Pull-U-Out" outfit. These are to be set in the ground, tandem fashion, about a foot apart, leaning toward the object to be pulled—not away from it, as one would suppose. When driven in in this fashion and the chain fastened to the three stakes, it is claimed that 50 men could not pull them out with a side pull, but that when the tension is released they can be easily pulled up on the same angle at which they were driven. The manufacturers say "the device itself is clever, but these three stakes are more than clever."

Underground, this little device ought to prove of immense advantage many times. The handling of big timbers in stopes would be much facilitated or the handling of timbers in a raise or winze.

The handling of the sinker pump when shaft sinking, or the placing of additional lengths of water column, especially when the size is large, furnish other applications for this device. In fact there are so many ways in which this device can be used to advantage around the mine, both on top and underground, that it ought quickly to become the miner's friend. Its portability is as great an attraction as its pulling power.

The complete outfit is sold by the Pull-U-Out Sales Co., 2018 Market St., St. Louis, Mo., for $15. The accompanying sketch shows this interesting, cheap and promising little device.

British Prize Court Decides Against Merton & Co.

The British prize court, on Oct. 6, 1915, decided against Henry R. Merton & Co. in the matter of freight charges on 6,710 tons of zinc concentrates seized on the steamship "Bilbster." The cargo was consigned by the Australian Metal Co. to Henry R. Merton & Co., of London. The latter had advanced £5,000 to the shipowners on account of freight charges of £7,546 and brought an action against the Crown for a refund of this freight payment on the seized cargo.

The Crown contended that the concentrates were "enemy goods," and this was admitted by Merton & Co., as they had become the property of Beer, Sondheimer & Co. The shipowners, meantime, put in a claim for the full amount of their freight. An award of the balance, £2,546, was allowed the shipowners by the court, but the claim of Merton & Co. for refund of the £5,000 was disallowed on the grounds that they had acted as agents for the Metallgesellschaft of Frankfort on Main and that the money had been paid to the shipowners on behalf of the German firm with the idea of retaining the goods for the German owners.

Another zinc cargo of about 5,000 tons, shipped by the Australian Metal Co. prior to the war, on the S.S. "Manningtry," was condemned as being practically the property of the Metallgesellschaft. It was claimed by the Australian Metal Co., Henry R. Merton & Co., the Cie. des Minerais, of Belgium, and another firm.

Australian Wolframite and Molybdenite Situation

The Federal Government of Australia has recently issued a proclamation in the molybdenite, scheelite and wolframite districts of Australia, according to the *Australian Statesman and Mining Standard*. The following is an abstract of this proclamation:

The Commonwealth Government has entered into an arrangement with the Imperial Government for a period of 12 months, to acquire, for the Imperial authorities, all the molybdenite, wolframite and scheelite produced in Australia. For the purposes of this arrangement the Commonwealth Government has appointed Dalgety & Co. as its agents. The price payable to the producers at the following places is to be not less than the following amounts: Wolfram Camp—Wolframite or scheelite, 45 2; molybdenite, 90 10. Bamford, 45 6, 91 1. Cairns—F.o.b., 46 6, 91 10. Townsville—F.o.b., 47 4, 92 6. Port Darwin—F.o.b., 47 2, 92 8. Melbourne—Ex-rail or ship, 48 1, 93 10. Sidney—Ex-rail or ship, 48 1, 93 10. Prices at other fields, if any, will be fixed on a similar basis. Provision has been made for the compulsory acquisition of any of these minerals which are held back, and this arrangement supersedes all existing contracts for the sale and disposal of these minerals, but does not otherwise interfere with the position of agents or their arrangements with producers.

Editorials

The Situation in Spelter

The continued strength of the spelter market in the face of steadily increasing production and a diminished consumption for domestic peaceful purposes has been a matter for surprise among students of the situation. A few months ago it was the fashion to prophesy that the trend of spelter would be steadily downward but time has passed and the expected has not happened. This does not, however, prove the prophets wrong. It is a common mistake to misgage the time in which clearly discerned factors are going to develop.

Thus, in the case of spelter itself, when the war began, the first idea among American zinc producers and merchants was that there would be a great foreign demand for our spelter. Such a demand did, in fact, appear soon, creating what was then considered a great boom in spelter, the price rising to something like 6c., but when this demand slackened there was a relapse and pessimism reigned again. By December the great boom in spelter that had been forecasted in August was forgotten. It began in January, however, and then soon demonstrated itself as being the real thing.

A little while ago attention was focused on the additions to smelting capacity that were so extensively and so rapidly being made. The deduction was promptly drawn that this would result in a collapse in the price for spelter. When that failed to happen right away, the idea seemed to be forgotten. The price for spelter rallied, and no longer were lists published showing how many new retorts were going to become productive in October, etc.

Renewed attention is drawn to this, however, by the actual beginning of smelting at certain of the large new plants, namely, those at Donora and at Kusa. The Donora plant was put in operation on Oct. 21, just four months and ten days after construction was commenced. In antebellum days 18 months would have been regarded as a conservative estimate of the construction period of such a plant. The ratio of 18 to 4⅓ is not, however, a precise statement. Donora at present is still far short of the point where it may be regarded as complete, although it has reached the point of producing some spelter.

Besides the new zinc-smelting plants that have previously been mentioned, several other little plants are going up in a variety of places. This is natural when spelter rules so high and ore relatively so cheap, and in the end such increase of capacity will of course bring about its natural result. In considering why a weaker tendency in the spelter market has not yet become manifest, it must be borne in mind that during the extraordinary boom that prevailed from about the beginning of April to the end of July, a large part of the expected production of the smelters during the last quarter of the year was sold. Consequently, smelters are still busy in making deliveries on their old contracts, and unsold stocks of spelter have not yet begun to accumulate to any considerable extent, although there has been, without any doubt, a certain accumulation during the last six weeks. In the meanwhile the market has been supported by a renewed and extraordinary foreign demand, although this has not attained any very great proportions. Certainly there has been nothing of late to cause a revision of opinion as to what is ultimately going to happen in the spelter market.

Anaconda's Campaign for Safety First

A recent number of the *Anode,* one of the monthly magazines published by the Anaconda Copper Mining Co. in furthering its campaign for the lessening of accidents in its mines and works, contains some interesting data for the first semester of 1915. The most important part of these is a matter of pure statistical practice. The accident rates reported by state authorities are computed by dividing the number of accidents—say the fatal ones—by the number of men employed on the average. Let us say that in the mines of Butte there were 52 men killed in a year and the average number of men employed was 13,000. The fatality rate would be 4 per 1,000. It has long been recognized that this is nothing but a rough method. The divisor is largely a matter of guesswork, while even if it were correct there would enter into consideration the probability—nay, certainty—that all of the men do not work all of the time. This tends to make the division too high and the quotient too low. The correct basis is of course the number of accidents per 300 thousand man-days; that is, per thousand men if all worked 300 days—assumed to be a full year. The statisticians of the United States Bureau of Mines are trying to introduce this system. It would be rendered relatively easy if all of the big mining companies should adopt it.

The Anaconda company has adopted it in a way, reporting its "fatal and serious" accidents upon a basis of 10,000 shifts. The idea of this is correct, namely, to put things on a definite basis, but the method of doing it is rather unfortunate, preventing as it does the comparison of its figures with any others, for two reasons—the divisor and the classification both being odd.

Respecting the matter of classification, "What is a serious accident?" On this subject the committee of consulting engineers that made a report on "Rules and Regulations for Metal Mines" for the United States Bureau of Mines said: "To define properly a 'serious' accident is somewhat difficult. About the only feasible method of differentiating 'serious' from 'minor' accidents is on the basis of the length of the period of disablement. The committee has made the dividing line 14 days. This is a figure commonly so taken in reporting mine accidents and corresponds with the length of time elapsing before an injured employee receives compensation, according to most of the compensation laws of which the committee has knowledge."

In reporting accidents the one sharply dividing line is that between fatal accidents and all others. If a man be killed, that is certain and there is no question of making fine or arbitrary distinctions as to whether the accident was serious or not. But the lumping of fatal and serious accidents leaves us quite in the dark.

In the first six months of 1915 the average of fatal and serious accidents in the Anaconda mines was about 1.80 per 10,000 shifts; or we may estimate about 1.80 per 400 men per month, assuming 25 man-shifts per month or 4.5 per 1,000 men, and the rate per annum would be 12 times as much, that is, 54. However, this figure is not comparable with anything else that we know of. In the first quarter of 1915 the average of fatal and serious accidents in the Anaconda mines was 1.92 per 10,000 shifts per month. In the second quarter it was 1.69, a gratifying reduction, but the periods are too short to permit of any reliable deductions respecting the influence of the "safety-first" movement.

The same number of the *Anode* contains some interesting notes about the Washoe mine, one of the Anaconda's collieries. Loose rock on the sides of the entries and roadways are to be removed regularly by the company—a commendable thing. It having been observed that in hoisting men at end of shift they would jump off the cars before the latter had come to a stop, a gate has been placed at the main exit of the shaftway, which is opened only when the trip has come to a stop. This also is a good thing. Many shaft accidents result from the men's crowding on the cage in excess of the regulation number, from skylarking on the way up and from disobedience of rules generally.

Standardization of Data

The Mining and Metallurgical Society of America is undertaking, with the aid of a distinguished committee, work in the direction of the standardization of technical definitions and practice. The Institution of Mining and Metallurgy has already accomplished important work of this nature, and some attention to the subject has been given by the Canadian Mining Institute. The committee of the Mining and Metallurgical Society lately made its first report, which was to a large extent a review of previous reports by the Institution of Mining and Metallurgy, the idea being that the three organizations shall proceed on the same lines.

This is an important piece of work, tending toward precision of statement and clarification of ideas. Whenever a technical man gives any data, everybody should be able to know just what he means. The chances for confusion are greater than many persons realize. Thus, one zinc smelter may refer to a certain works as having four furnaces and another may tell of the same works having eight furnaces. The latter upon interrogation would explain that the works had eight furnaces, but only four blocks.

Even the definition of a word, commonly dismissed as merely a concern of the lexicographer, may become a matter of great consequence. Thus many thousands of dollars were spent a few years ago in tariff litigation that hinged on the definition of calamine, notwithstanding the fact that a long time previously it had been pointed out that trouble was likely to occur owing to the confusion about that name that existed. This question has not yet been cleared up, a change in the tariff law having removed the acute necessity for settling it.

These are merely examples. They show that the more that uncertainties can be eliminated the better will things be. Such work as the Mining and Metallurgical Society and the other organizations may do in this way will therefore be very helpful.

Zinc Smelters' Profits

Contrary to the popular idea, the zinc smelters do not always make money, no matter how extensively they "rob" the miners whose ore they buy. In fact, a good many of the ventures in zinc smelting have been disastrous to those who put their money into them. The extraordinary turn of the tide in 1915, however, has enabled almost everybody to make money in smelting, no matter how imperfect his plant and methods, and several of the concerns that previously were in a bad way have been enabled not only to get their accounts into good shape, but also to arrive in a position for the payment of dividends.

Thus the American Zinc, Lead and Smelting Co., which about a year ago was practically a derelict with neither money nor credit, has paid off its indebtedness of about $1,750,000 and ere long will probably be considering the payment of a dividend. The Lanyon Starr Smelting Co., which for a number of years has not earned enough to pay dividends, even on its preferred stock, recently declared a dividend of 21% on that class of stock, to provide for all cumulative dividends up to July 1, 1915.

Zinc smelting has been very profitable during 1915, but it has been the big zinc-mining companies, like the New Jersey Zinc Co., Granby Mining and Smelting Co., Butte & Superior Copper Co. and Interstate-Callahan Mining Co., that have earned and paid the speculator dividends. The earnings of the American Zinc, Lead and Smelting Co., moreover, are derived to a greater extent from its Mascot mines than from the smelting branch of its business.

Copper Mines in Serbia

A good deal of nonsense is being printed in the daily newspapers about the great supplies of copper that the Teutonic allies are going to gain when they have conquered Serbia. The copper mines of Serbia are, indeed, a little more important than the alleged copper mines of Poland, but they have never been largely productive. The only copper-producing concern is the company owning the Bor mines, which previous to the war produced six or seven thousand tons of copper per annum.

The shortage of ships, previously a matter of great concern, was rendered more acute by the blockade of the Panama Canal. A large number of vessels waiting at the entrances were obliged to hoist anchor and steam around Cape Horn, thus depriving commerce of their carrying capacity for two or three months. Several cargoes of Australian zinc ore were thus caught. The ships bringing it have been sent around Cape Horn, excepting one which was ordered to San Francisco, whence the ore is to be brought overland to the smelters.

BY THE WAY

Dispatches of this week again report that Villa has taken possession of the Chihuahua smeltery of the American Smelting and Refining Co. and will smelt some of the confiscated silver-lead ore that the company has declined to treat, "owing to the absence of its technical staff."

⁂

At the meeting of stockholders of the Southern Aluminium Co. in New York on Oct. 23, it was voted to dissolve the corporation. Action of the Paris directors is now being awaited. It has been rumored that L'Aluminium Française may take over the American project at Whitney, N. C.

⁂

Death Valley Scotty, the mysterious man who had the whole Western country guessing in the days of the Goldfield excitement, has again shown up, this time at San Bernardino. He carried with him the usual bag of high-grade and this time reports that his new find is located at Twenty-nine Palms, in the Colorado desert.

⁂

The new zinc-smelting plant that has been constructed at Donora, Penn., is variously described as being of the United States Steel Corporation, of the American Steel and Wire Co. and of the Edgar Zinc Co. This explanation is that the United States Steel Corporation owns the American Steel and Wire Co., and the latter owns the Edgar Zinc Co. The actual management of the Donora plant is vested in the officials of the Edgar Zinc Co., and the ore contracts, etc., are made in the name of that company.

⁂

Following the *Journal's* custom, the final standing of the chief baseball leagues is given below for the benefit of the subscribers in the "jungle":

AMERICAN LEAGUE	W.	L.	Per Cent.
Boston	101	50	0.669
Detroit	100	54	0.649
Chicago	93	61	0.604
Washington	85	68	0.559
New York	69	83	0.454
St. Louis	63	91	0.409
Cleveland	57	95	0.375
Philadelphia	43	109	0.277

FEDERAL LEAGUE	W.	L.	Per Cent.
Chicago	86	66	0.566
St. Louis	85	67	0.565
Pittsburgh	86	67	0.562
Kansas City	81	72	0.530
Newark	80	72	0.527
Buffalo	74	78	0.487
Brooklyn	70	82	0.461
Baltimore	47	107	0.305

INTERNATIONAL LEAGUE	W.	L.	Per Cent.
Buffalo	86	50	0.632
Providence	85	53	0.616
Toronto	72	67	0.518
Rochester	69	69	0.500
Montreal	67	70	0.489
Harrisburg	61	76	0.445
Richmond	59	81	0.423
Jersey City	52	85	0.380

NATIONAL LEAGUE	W.	L.	Per Cent.
Philadelphia	90	62	0.592
Boston	83	69	0.547
Brooklyn	80	72	0.527
Chicago	73	80	0.477
Pittsburgh	73	81	0.474
St. Louis	72	81	0.471
Cincinnati	71	83	0.461
New York	69	83	0.454

The post-season series, Boston vs. Philadelphia, was won by Boston, 1-3; 2-1; 2-1; 2-1; 5-1.

⁂

It is only a few years since smelting plants were being closed because they were distributing sulphuric acid over surrounding farms. Now comes the announcement that the smoke question is to be settled by the production of sulphuric acid and its application to the alkali lands of the Western States. At the engineering convention in San Francisco, Dr. C. B. Lippman, of the University of California, announced that apparent beneficial results have been obtained by the application of sulphuric acid to alkali soils. Views were presented, depicting crops grown on test plots that had received from 2½ to 7½ tons of sprayed sulphuric acid to the acre, the ground previously having been unfit for agricultural purposes on account of alkali salts. There is much alkali land around certain smelting plants in the West, and the smelters would welcome a profitable outlet for the sulphuric acid that they could produce. Thus it may be proved to them that "damage" as well as dirt is merely "matter out of place."

⁂

Bethlehem-Pennsylvania Deal

A week ago it seemed certain that the controlling interest in the Pennsylvania Steel Co. would pass to the Bethlehem Steel Co., as then stated. There seemed to be no doubt that Mr. Schwab's bid would be accepted by both the Pennsylvania Co. and the Reading Iron Co., whose holdings of the Pennsylvania Steel stocks constitute a very large majority. Indeed, it was stated on the best authority that Schwab's bid was satisfactory to the Pennsylvania people, and that it only remained for the Reading Iron board to approve of the transaction.

An unexpected obstacle has arisen, however. As is well known, William H. Donner, president of the Cambria Steel Co., has for some time held an option on the Pennsylvania Steel stock at a fixed price, with the further provision that he should have the first call on the stock in case a higher price should be offered by anyone. It now seems that Mr. Donner has given notice that he will meet the Schwab bid, and the transfer is uncertain pending further negotiations. It is said that H. C. Frick is backing the Donner party.

⁂

Utah Potash Production Begins

SALT LAKE CORRESPONDENCE

The production of potash on a commercial scale in Utah has been started. The plant of the Mineral Products Co., at Marysvale, began operating in its entirety for the first time Oct. 19. The roasters had been warmed up and tried out some time before this, and the plant was ready by the middle of September, but on account of the reconstruction of the tramway from the mine to Cottonwood Cañon, operations were delayed until this week. The capacity of the first unit, which is complete in itself, is 100 tons a day. Other units will probably be added.

The alunite contains about 11% of potash. It is roasted to form a soluble potassium sulphate, and this is leached out with water and evaporated to a solid salt from the solution. From 25 to 30 tons of potassium sulphate running over 90% will be produced daily, and the first carload shipment, according to Charles E. Macdowell, vice-president of the company, will consist of 93% concentrated sulphate of potash, and will be shipped some time during the week to a firm in Florida. The percentage is higher than that of the German product, which seldom ran above 90%. At present the output will be hauled 6 or 7 mi. to the railroad by motor trucks, but a side track will be built to the plant by the Denver & Rio Grande R.R., in the near future. Pure alumina is obtained from the residue of the alunite after leaching and is a valuable byproduct.

PERSONALS

Whitman Symmes, of Virginia City, Nev., has been in New York.

W. A. Wilson, mining engineer, has removed his offices to the Dooly Block, Salt Lake City, Utah.

Ernest J. Ristedt, chemist for the Old Dominion Copper Co., Globe, Ariz., has been paying a brief visit to his former home in Denver.

H. V. Dardier, accompanied by an engineer representing the Vickers-Maxim Co. of London, has been investigating nickel deposits near Fond du Lac, Manitoba.

A. W. Soderberg has been appointed chief mechanical engineer of the Homestead Steel Works of the Carnegie Steel Co. in place of R. H. Stevens, who has gone to the Midvale Steel Works.

Roy J. King, of Tonopah and Grass Valley, who spent August and September in Alaska and British Columbia, has returned to the States, and now is in Oregon on professional business.

F. C. French sailed from Seattle for Alaska on Sept. 14. He will be constructing engineer on the reconstruction and enlargement of the plant of the Beatson Copper Co. at Latouche, Alaska.

F. E. Marcy has resigned as local manager of the Mine and Smelter Supply Co. at Salt Lake City. He will devote his time to the sale and manufacture of the Marcy mill, which is controlled by the company.

C. E. Addams, for some time connected with the De Beers Consolidated Mines in South Africa, and later with the Ray Consolidated, has been appointed general manager of the Ray Hercules Co. in Arizona.

Jesse Lee Jones, who was chosen president of the American Institute of Metals at the recent annual meeting, is chief chemist and metallurgist of the Westinghouse Electric and Manufacturing Co. of Pittsburgh.

J. J. Warren, president of the Kettle Valley Ry., has been added to the board of directors of the Consolidated Mining and Smelting Co., of Canada, operating Trail, B. C., smelting works, and has been appointed managing director.

Thomas M. Skinner, Jr., having finished the chemical work in which he was engaged at Keeler, Calif., pertaining to the alkali waters of Owens Lake, has returned to Colorado and is temporarily engaged with the Empire Zinc Co. at Denver.

T. Hirabayashi, H. Nakamuta and S. Nakagawa, mining engineers representing the Japanese government, recently spent one week inspecting ore- and coal-dock facilities in the Duluth-Superior harbor, also the plant of the Minnesota Steel Co., near Duluth.

F. O. Williamson, who represents the Hardinge Conical Mill Co., T. L. Smith Co. and Smith Engineering Works, in Chicago and adjacent territory, is taking an extended trip through the Western mining districts, on his way to San Francisco.

H. G. Moulton, who has been with the firm of Eugene Meyer, Jr., & Co., of New York City, as consulting mining engineer for the last seven years, has recently been appointed by the Public Service Commission consulting and inspecting engineer on underpinning and excavation for the new subways in New York.

Dr. James Cole Roberts, in charge of the United States Bureau of Mines Rescue Car No. 2, with headquarters in Denver, has accepted appointment as professor of safety and efficiency engineering, the department recently authorized by the trustees of the Colorado School of Mines as a tribute to the late Dr. Joseph A. Holmes. Dr. Roberts is well fitted by experience and personality for this chair. Fifteen years ago he resigned the professorship in metallurgy in this same institution.

OBITUARY

Henry Lamy, of Paris, France, a graduate of the Massachusetts Institute of Technology in the Class of 1913 in mining engineering, was killed recently while serving in the French Army in Champagne. He was a son of Lucien Lamy, of Paris, a prominent metal broker.

George H. Abeel, whose death on Oct. 13 was briefly noted last week, was 53 years old, and had had charge of iron mines in Michigan and Wisconsin for 27 years. For a number of years he was in charge of the operations of Oglebay, Norton & Co. on the Gogebic Range. He was an active member of the Lake Superior Mining Institute from its start and was vice-president in 1913-14. He leaves a widow, a daughter and two sons, both of them mining engineers.

SOCIETIES

Texas School of Mines—Fall term has opened at El Paso with very encouraging enrollment. Special attention will be given to assay department this year.

Teknik Club—At the regular meeting of the club in Denver, Oct. 12, Mr. Eastman, of the Bureau of Mines, spoke on "Some Experiments with Basic Lead Compounds."

Utah Society of Engineers—The regular monthly meeting of the society was held in Salt Lake City Oct. 15, when W. H. Trask, Jr., deputy superintendent of the Utah Power and Light Co., gave an address on the good results to be had through the irrigation of crops by pumping systems.

American Chemical Society—The Pittsburgh Section held a joint meeting with the American Electrochemical Society at the University of Pittsburgh, Oct. 21. A large number of members attended and heard an address by F. T. Snyder of Chicago, on the use of electric furnaces. A number joined in the subsequent discussion. O. G. Schleuerderberg, chairman of the local section of the Electrochemical Society, presided. At a dinner at the University Club, before the meeting, the diners heard an address by Dr. F. C. Phillips of the University, who suggested that some technical society undertake to purchase and preserve the old Northumberland County home of Priestley, the chemist who discovered oxygen. The home is now in danger of destruction.

American Institute of Mining Engineers—The Montana Section held its semi-annual session Oct. 8, at the Silver Bow club rooms, in Butte. Between 60 and 70 members attended the meeting which was presided over by Vice-Chairman J. L. Bruce. A very enjoyable dinner preceded the technical session, at which J. A. Grimes read an interesting outline of a paper now being prepared by himself and Mr. Billingsley, entitled: "Mines in the Boulder Batholite." The paper will appear later on in the "Transactions" of the Institute. The reading of the paper was followed by a lively discussion of the theories advanced by the authors and based on facts observed in the mines so far visited by them in the district affected by the batholite. The authors are members of the geological department of the Anaconda Copper Mining Co.

American Iron and Steel Institute—The program for the meeting of the Institute at Cleveland, Ohio, Oct. 22 and 23, was: Address by President Elbert H. Gary. "Cleveland and Its Industries." Name of author, a Cleveland member, to be announced later. "Electric Furnace for Heating Billets, Castings, Etc." By Thaddeus F. Baily Alliance, Ohio. "Modern Methods of Burning Blast-Furnace Gas in Stoves and Boilers." By Ambrose N. Diehl, Duquesne, Penn. "The Development of Alloy Steel for Commercial Purposes." By Edgar D. Rogers, Canton, Ohio. "Under-Advertising of the Steel Business." By George H. Jones, Chicago. "Recent Developments in Sintering of Iron Ores." By Bethune G. Klugh, New York. "Casting Steel Ingots." By Henry M. Howe, Columbia University, New York. Moving pictures (evening). National Tube Co. and American Steel and Wire Co. The Cleveland committee arranged for plant trips and various forms of entertainment for the members on Saturday following the regular meeting day

Intermountain Lehigh Club—In Salt Lake City, Oct 16, a dinner was given to Dr. Henry Sturgis Drinker, president of Lehigh University, by this club, which is made up of Lehigh alumni in Utah and neighboring states. At the dinner Dr. Drinker spoke of the increasing interest taken in modern institutions in the personality of the student, and of the duty incumbent on such institutions to use their influence in aiding in the formation of national and local movements looking toward the public good. Touching on conservation, he said that in taking wise and broad measures to utilize best our natural resources, our woods, our mines, and waters, the need was not so much to withdraw and set them aside for the use of future generations, as to be sure they were not wasted in their use by the present generation, letting them be utilized following the natural laws of supply and demand, with due regard to the essential factor that private capital will never venture into the proper broad economic exploitation of these resources, without the assurance of a sufficiently permanent tenure to insure an adequate return for investment

Editorial Correspondence

SAN FRANCISCO—Oct. 21

The State Industrial Accident Commission has prepared a pamphlet for free distribution containing the amended Workmen's Compensation, Insurance and Safety Act. The most important of the amendments which went into effect Aug. 8, 1915, other than those relating to procedure are: (1) Extending the benefits of the law to cover injuries received in the course of employment, whether accidental or otherwise; (2) empowering the commission, in special cases, to extend the time during which medical and surgical benefits shall be furnished to injured employees; (3) providing that, in case of the loss of an eye or limb, an artificial member shall be furnished by the employer; (4) making it a misdemeanor for an employer to exact or receive from any employee any contribution, or make any deduction from his earnings, to cover any part of the cost of treatment or compensation provided by the Act. There are other changes from the original text, all of which are of general interest. Copies of the pamphlet may be had on application to the commission, 525 Market St., San Francisco.

Oil Land Suits instituted by the Federal Government involving valuable lands in Kern County are to be tried in the U. S. District Court at Los Angeles. These suits are similar to others that have been tried involving lands which are alleged to have been withdrawn from entry by the withdrawal order of President Taft, Sept. 27, 1909. The present contention of the Government is that the defendants developed oil in the land after it was withdrawn, and asks that the Government be found the owner in fee simple and that the defendants be ousted from any right they may assert; and that injunction be issued restraining defendants from further development, an accounting be had and a receiver appointed. The following named companies and corporations are defendants: Thirty-two, California Midway, Buick, Associated, Standard, California Natural Gas, and J. M. McLeod. The land is situated in section 32, and is stated to be of great value, but the value is not stated.

Midway-Sunset Oil Suits to have been tried by Judge Bledsoe in the U. S. District Court at Fresno on Oct. 18 may be assigned to another judge of the same court on account of disqualification of Judge Bledsoe who is a stockholder in one of the companies defendant. In a previous case tried, this judge made such fair rulings in favor of the Government that the Federal attorneys expressed willingness that he proceed in the present trial; but attorneys for the defendants are inclined to the notion that the cases should be tried by a jurist upon whom there can rest no shadow of bias or prejudice. These suits were brought by the Government to recover 40,970 acres of oil land in the Midway-Sunset field in Kern County, which is part of a total area of 154,197 acres included in six several suits, a part of which are to be tried in the Federal Court in Los Angeles. The land was filed on and patents issued to the Southern Pacific Co. under the act of congress of 1866 upon representation that the land was not mineral in character. The Supreme Court, however, has upheld the theory of the government geologists that petroleum oil is a mineral product. The only question now involved is whether the Southern Pacific entered upon the land in disregard of the withdrawal order of President Taft of September, 1909. That order has been upheld by the Supreme Court.

DENVER—Oct. 21

The Miner who Impounded the Water pumped from the Golden Cycle mine, Goldfield, Colo. (Cripple Creek district), collected the resulting slime and shipped his air-dried product made a close approximation to the proverbial "getting something for nothing." No other treatment was given this stuff, there was no royalty paid anybody, and the miner asserts that he has received more than $2,000 from his small shipments.

The Vanadium Mill at Vanadium, formerly Newmire, San Miguel County, Colo., controlled by the Primos Chemical Co., is operating full capacity, treating from 125 to 150 tons daily. The ore is mostly from the company's mines in Bear Creek Cañon, which have been extensively developed by several miles of tunnels and drifts. Recently diamond drilling showed the ore bed to extend westward below the grade of the cañon, and a shaft was started to cut it at 700 ft., but at about 300 ft. the flow of water was so strong that shaft sinking was for the time suspended and an incline is being driven to reach the ore. The company is also mining from its claims near Saw Pit and shipping to the mill. It is reported that the capacity of the plant will soon be greatly enlarged again.

A Real Mining Revival is taking place in Boulder County. Prospectors and miners are reaping a harvest after several years of very "slim pickings." Attractive prices for tungsten ore have led to the opening up of many prospects that were located for gold and now are found to carry appreciable amounts of the black metal. In some instances, tungsten was known to occur in these properties, but was not developed commercially. It is now believed that the presence of tungsten in some of the gold ores of this county has been responsible for the low concentration accomplished and that much of the concentrate shipped for years may have been more valuable for its unrecognized tungsten content than for its gold. The heretofore recognized tungsten area tributary to the town of Nederland has been found to have competition in an area to the northeast of that town nearer the city of Boulder. The Boulder County Metal Mining Association is arranging an excursion from Denver to Nederland to give curious persons opportunity to witness the mining of tungsten.

SALT LAKE CITY—Oct. 22

The Old Dump at the Horn Silver Mine at Frisco, estimated to contain 175,000 to 200,000 tons of tailings, is to be utilized. The Caldo Mining Co., backed by Eastern capital, was formed a short time ago to take over a lease on the dump, and finance the building of a mill of 200 tons daily capacity. Construction is in the hands of the General Engineering Co., of Salt Lake, which also has charge of the management of the property. The principal value of the tailings is in silver, with some zinc. It is hoped to have the mill completed before the end of November.

Progress Is Being Made in the Construction of the Tintic Milling Co.'s new plant at Silver City. Foundations, retaining walls, and floors of the mill are completed, the bins are almost finished, and the steel work is being erected. The crushers and rolls are in place. There are to be three Holt-Dern roasters of 45-ton capacity, of the same type as used in the mill of the Mines Operating Co., at Park City, and one Christensen roaster, which was intended for the Knight mill, at Silver City, destroyed by fire not long ago. The cost of the mill will be about $150,000. The company has taken a lease on the old Eureka mill dumps, and on other dumps and low-grade ore in the district. Sixty-five men are employed on construction, and it is hoped to have the plant in operation soon after the first of the year.

The Facilities for the Treatment of Low-Grade Ore and dumps long idle, have been much increased by new reduction mills and flotation plants recently constructed or still in the process of construction. In some cases companies have been organized with a view to utilizing dumps at individual mines, and in others custom milling plants have been established. Also individual mines like the Utah Apex at Bingham, the Daly-Judge and Silver King Coalition at Park City have added or are adding flotation plants to their milling equipment. The Big Four Leasing Co.'s mill, at Atkinson in the Park City district, has been in operation for several weeks on tailings accumulated below the town, from the various mines of the camp; the capacity is 200 to 300 tons. The Broadwater mill—500 tons—also in Park City, backed by San Francisco capital, began work on tailings on the Homer ranch, which tailings it has under lease. Other new plants are the Utah Leasing Co.'s mill at Newhouse to retreat tailings from the Cactus mine, and the Caldo mill at Frisco to treat dumps from the Horn Silver. The flotation plants added to the mills of the Daly-Judge and Silver King Coalition are being rapidly completed. There has been an increase in milling capacity at the Daly-Judge of 50 tons a day; at the Silver King Coalition of 100 tons; and at the Utah Apex, an increase of 225 tons. The first mills mentioned are using the Callow flotation system, and at the Utah Apex the Janney system is in use. At the Apex mill there are 12 cells treating

150 tons of slimes a day. This plant is in the main mill building where the vanners used to stand, and has replaced the vanners. The concentrator of the United States Smelting Co., at Midvale, has been remodeled and enlarged from 350 to 600 tons daily capacity, and the capacity of the Huff electrostatic plant increased from 60 to 100 tons.

SEATTLE—Oct. 20

The Tolovana Paystreak has been definitely located on at least seven claims along the third tier bench of Livengood Creek counting every 20 acres as a claim. Counting No. 10, second tier, pay has been located on eight claims all told However, all of the prospectors working from 2 Above to 10 Above, on the third tier, are in pay dirt which goes from $1.25 to $1.50 to the square foot of bedrock. The paystreak is 150 ft. wide in places, although in others it is not more than 60 ft. Its width on all claims, however, yet remains to be determined. Several diamond drills have been brought into the district by the operators, to prospect their ground during the winter, when it is believed many new paystreaks will be uncovered. Portions of the Circle City, Fairbanks and Rampart districts have now been combined to form the Tolovana Recording District which has its own recording office.

Valdez Mines Are Busy taking out ore and from present indications this winter will be the most active in the history of the camp. As rapidly as possible the Cameron-Johnson mine is being made ready for reopening. The veins on these claims ran into a fault and were lost, necessitating the closing down of the property, but the hot weather of last summer shrunk the adjoining glacier to a depth of 100 ft. and exposed the reefs on the other side of the fault. The Granite mine is busier now than at any time since it was opened, and the mill is running steadily. The vein has been cut in a lower level, about 500 ft. below the present workings. An up-raise is being driven to drain the water from the upper levels and there is sufficient ore in sight to keep the plant running for several years. The Cliff mine which has been operating for some time has been closed down pending the adjudication of some suits filed against "Red" Ellis, the owner. The Ramsay-Rutherford, however, is sending bullion to Valdez every two weeks and the operators have plenty of high-grade ore blocked out. The Valdez Mining Co. is doing considerable development work and Jack Miller took out about $50,000 from the State Creek placer diggings this summer. The Midas copper mine owned by the Granby company is now in much better ore and is filling the bunkers preparatory to shipping. Mark Tatum, the discoverer of the Granite mine, has discovered a body of magnetite on Valdez Bay. The ledge, which is wide, has been traced on the surface for a distance of about 800 ft. and in many places gave assay returns of more than $35 to the ton.

HIBBING, MINN.—Oct. 23

Mesabi Going Dry Is a Probability. It is reported that the Indiana Bureau is about to enforce the Indian treaty of 1855, closing the 60 saloons in Hibbing and 20 in Chisholm. The report has received no official confirmation. All saloons on the Cuyuna Range have already been closed, as well as many towns on the Western Mesabi, including Coleraine and Bovey. Operators express great satisfaction at the change from wet to dry.

LUNING, NEV.—Oct. 21

Optimism in the Santa Fé Mining District, Nevada, is fostered by all the developments during the last few months. The Calavada Mining Co. completed the cutting of a station at the 1,000-ft. level during the past week and are now crosscutting to the ledge. This property is controlled by the Giroux interests and will, on installing a new cable, sink to water which they expect to strike at about 1,200 ft. Arrangements are completed for the financing of the Luning-Idaho Mining Co., and work will be started on a large scale early in November with the purpose of fully developing the orebodies which have been exposed in several places. This property lies in the belt containing the Fermina holdings now being extensively leased. The Calavada or Giroux property and the Duffy mines were recently purchased from J. N. Bealer and associates. The New York Cañon section is a regular shipper, over 40 tons daily going out from the many leasers working there. All of this ore is high-grade copper. It must run more than 6% copper to pay the hauling, freight and smelting charges. It illustrates the possibilities of this district, when one stops to figure the tonnage of low-grade copper that is left on these dumps for future treatment. The Nevada Gold Mines Co., Ltd., operating on an extensive plan, southwest of town, is in some exceptionally high-grade gold-silver ore and has made all arrangements for a steady production this fall. R. B Todd has arranged with eastern parties for the formation of a company to take over the Luning Gold Mines Co., and work will commence there in the near future. This property has been a good producer and has a large tonnage of milling ore blocked out. The development work at the Alameda Mines Co.'s ground is going steadily forward and with its large tonnage of low-grade copper it is rumored that a leaching plant will be installed at its camp in the near future. The fact that there are 20 sets of leasers working copper properties at a profit here, shipping in most instances copper around 5 to 10% speaks well for the camp. The starting of the leaching plant at the Nevada Douglas at Ludwig where this ore will eventually be shipped is expected to start a considerable development and mining boom here.

DOUGLAS, ARIZ.—Oct. 19

Cananea is Still Operating, although railroad communication is interrupted both from Nogales and Naco. The road from Nogales is reported to be in bad shape after General Calles' retreat and that from six weeks' to two months' work will be required to put it in operating condition. Recent arrivals state that nine bridges have been destroyed. Conditions are quiet in Cananea, the town being occupied by General Beltram with 150 Villistas, while to the south General Urbalejo is in authority with his band of Yaquis, who have been Villa adherents, but who may now take upon themselves "the supreme power" in all that part of Sonora which they can command. Naco and Nogales are in the hands of Carranzistas, so that together with the railroad service being out of commission, it may be necessary to stop operations at Cananea for lack of fuel, food and supplies. It is said that enough fuel and supplies are on hand to continue operations for two weeks, after which time a shutdown is inevitable, unless the railroad can be used and freight allowed to move southward before the expiration of that time. No disturbances have lately been reported from Cananea that in any way affected the operations of the company, it being reported that peace has been made between the company and the two contending factions, as far as the company's operations are concerned, by paying export duty to both.

[Cananea was forced to suspend operations Oct. 25, on account of the cutting of the railroad line by the Yaqui Indians.—Editor.]

Reports from El Tigre have, up to within the last few days, been optimistic, the management stating that operations would be continued regardless of the approach of Villa's men and that their arrival in camp was not looked forward to with apprehension; that it was expected that no hindrance of operations or molestation of Americans would ensue from the occupation of El Tigre by Villistas. However, within the last few days reports have been persistent that operations will be stopped and the Americans will attempt to reach the border as best they may. News of a fire at the mines of the Transvaal company's mine near Cumpas reached here yesterday, the building, supposed to have been the hospital, was burned to the ground, but the fire was not of incendiary origin.

La Colorado Mine, it is reported, was entered by gambucinos after it was closed down and stripped of all high-grade ore. The Minneapolis Copper Co. has stopped operations; most of the Americans employed have reached the border. Trains are not running south from Agua Prieta over the Nacozari railroad, but no breaking of the line has occurred to date. Autocars are run almost every day over the line as far down as Nacozari, enabling the Moctezuma Copper Co. to keep in touch with the few men who did not elect to leave at the general exodus last week.

TORONTO—Oct. 22

A Strike of More than 2,000 Employees of the various mines in the asbestos district, Thetford, Quebec, was inaugurated this week. The strikers demanded that wages be returned to the scale that was in force before the war. They also ask that they be allowed to purchase their supplies at any place they wish instead of the company's stores. At the outbreak of war the asbestos market was demoralized to such an extent that the companies were having a hard time, and the employees agreed to cut in wages. Since that time, however, the market has become active, and the strikers now ask that the old scale of wages be put in force.

VICTORIA, B. C.—Oct. 19

The Trail Smeltery has handled 347,348 tons of ore so far this year. Of this production 288,000 tons came from Rossland. Nelson shipped 2,425 tons. East Kootenay shipped 20,018 tons, principally from the Sullivan mine, while Slocan and Ainsworth districts furnished 14,843 tons. The shipments from mines in the State of Washington to Trail amount to over 16,000 tons so far this year.

The Mining News

ALASKA

YUKON GOLD (Dawson)—Is reported to have purchased holdings of John Holmgren in Ruby district and will put dredge on ground this winter.

CORDOVA MINING AND DEVELOPMENT CO. (Port Wells)—New mill being installed at mine near Golden in Port Wells district. Tunnels being driven.

MIAMI COPPER (Seward)—It is reported that A. H. Case, representing the above company, is investigating the Parker-Herschell properties near Seward.

ALASKA JUNEAU (Juneau)—It is reported that Charles E. Bruff, who built Sheep Creek Mill of Alaska Gastineau Co., will shortly come north to start work on new Alaska Juneau mill.

JUALIN ALASKA MINES (Juneau)—More men being taken to work at this property and indications are that mine will soon resume full operations left off at start of the European war.

VALPARAISO MINE (Ketchikan)—Is working mill at Dolimi to capacity and is considering construction of an addition. Tunnel is now in distance of 700 ft. and is being driven an additional 100 ft. into ore to keep plant busy all winter.

MATANUSKA COAL AND COKE CO. (Seward)—J. H. Sears, James McCox, and Roy D. Fonda have filed articles of incorporation for above company. Purpose of company will be to mine and sell coal from Matanuska field which will be tapped by Government railroad running in from Seward.

MOOSE PASS CLEANUP (Seward)—Ronan and James who few weeks ago bonded Moose Pass claims located during summer by Frank Skeen and J. W. Stevenson, recently ran 4½ tons of their quartz through an arrastre, recovering 80 oz. of gold from amalgam. Stamp mill will be erected on property next spring.

ARIZONA

Cochise County

BISBEE COPPER (Bisbee)—Organized to develop Winwood group of claims lying between Denn and Copper King, both proven ore areas and lying less than 1,800 ft. from Sacramento Hill. Campaign of churn drilling and other prospecting will be undertaken.

Gila County

INSPIRATION (Miami)—Mill is reported to be recovering 28 lb. of copper from ore assaying 1.7%, and is treating 5,000 tons per day. Both recovery and operations said to be fully up to expectations of company.

ARKANSAS

Newton County

ARKANSAS MINING DEVELOPMENT CO. (Little Rock)—Filed articles of incorporation, $100,000 capitalization, to operate in northern Arkansas zinc fields. Will begin operation at Spear mine in Newton County. Company has also leased properties in Marion County and will develop any other mineral deposits in state which can be profitably secured. Company will own no properties but will develop them on lease or royalty basis. John T. Fuller is president and general manager.

CALIFORNIA

Alameda County

RED MOUNTAIN (Livermore)—Third calcining kiln being installed at this magnesite mine. Brick for structure is being hauled from Pleasanton by three-wheel traction engine. Brick for kiln lining from Livermore Firebrick Co. was hauled by same engine. Traction engine will also be used in building new road to another magnesite deposit 2 mi. from the Red Mountain.

Amador County

PINE GROVE MINING CO. (Pine Grove)—Sold 125,000 shares at 25c. per share under permit of corporation commission and granted permission to sell an additional 100,000 shares at the same price.

SUTTER CREEK MINING CO. (Sacramento)—New incorporation with capital stock at $300,000, to operate East Eureka mine at Sutter Creek. Directors are Alexander Rennie, M. A. Nurse, J. R. Farrington, J. J. White, of Sacramento and Lee Shirars, of San Francisco.

PLYMOUTH CONSOLIDATED (Plymouth)—Preliminary statement of production and costs in month of September shows 10,800 tons of ore milled; total value $52,076; total working costs, $30,302; development cost, $411. Surplus over total costs, $22,363. Additional expenditures, $250. James F. Parks is superintendent.

Butte County

FORBESTOWN district is advancing both in development and prospecting. District lies chiefly in Butte County but extends into Yuba County. Development is progressing at Gold Bank, South Banner and Solano Wonder. Activity extends from Forbestown west to Morris Ravine about 3 mi. north of Oroville.

ORO ELECTRIC (Oroville)—Purchase of this corporation by Great Western Power Co. reported to include only public-service department. Dredging department will be continued as formerly.

VILORO (Oroville)—Gold dredge No. 2 destroyed by fire Oct. 19. Fire caused by electric short circuit in transformers. Dredge had been run 7 days since last cleanup and contained a large amount of gold on tables. After burning to water's edge, hull sunk. Total loss. Viloro Syndicate Ltd., owner.

Calaveras County

MOKELUMNE HILL district is being developed and prospected actively. Recent interest is due partly to sale by Frank J. Woodward to Harry Bridge of mines and claims known as La Fortuna, Colorado, Ben Hur and other properties including dam, water ditch and flume and rights of way.

Eldorado County

RAILROAD SURVEY from Diamond Springs to Ringgold section in progress. Purpose of road is hauling lime and lime rock from deposits on 380 acres owned by Mrs. E. J. Edick, Dr. W. W. Stone and National Surety Co. Property was formerly owned by W. J. Dingee and under bond to California-Portland Cement Co. Development depends upon construction of this spur track. Much of limestone is said to be well adapted to manufacture of cement.

SACRAMENTO VALLEY COPPER (Sacramento)—Deeds from Thomas G. Patton have been recorded, conveying title to mining claims and property in Greenwood district. These are: Copper Princess, Dundee No. 2, Shamrock No. 2, Brown Bear and 17 other claims.

Imperial County

OIL DISCOVERY reported west of Salton Sea by M. V. Dutcher, of Imperial. Oil was found seeping from slight anticline on floor of desert. Three hours digging produced about 20 gal. of heavy oil. Whether prospect is sufficient to encourage development is not stated. State Mining Bureau states that according to opinion of Dr. F. J. H. Merrill, Miocene beds in this region are not especially favorable to oil formation.

Nevada County

BRUNSWICK CONSOLIDATED (Grass Valley)—Expected that new 20-stamp mill, electrically driven, will go into commission within few days.

UNION HILL (Grass Valley)—John E. Pelton and associates reported to have acquired control and arrangements being made for extensive development. Shaft will be deepened to 1,000 ft. On 800 level orebody continues with development. The 20-stamp mill is crushing ore from this level. The cleanup Sept. 1 was $6,800; Sept. 15, $5,600, a total of $12,500 for 30 days' run. New directors recently elected John E. Pelton, Daniel E. Craig, E. W. Knowlton, of Pasadena, Otto B. Johnson, of San Francisco; G. S. Johnson, of Reno.

San Luis Obispo County

KLAU (San Luis Obispo)—This quicksilver mine reported producing 30 flasks a month. Mine has been idle for three or four years following destruction of furnace by storm and fire.

Siskiyou County

KANGAROO GULCH is proving to be one of richest quartz districts developed in County for several years. Joe Davidson and Sam Sargent have recently developed ledge about 4 ft. wide, carrying ore worth $3 to $5 per ton. Claim is an old one which has been developed for several years in small way.

Stanislaus County

DRILLING FOR OIL at Knights Ferry has been resumed after suspension resulting from breakage of machinery. Well is down 1,860 ft. and in as-reported that first oil sand has been passed. Probable that second oil sand will be reached within 2,000 ft.

Tulare County

PORTERVILLE MAGNESITE CO., (Porterville)—Two cars crude magnesite shipped in last week of September. Foundations for calcining kiln have been constructed and when plant is completed ore will be treated at mine. Survey made for spur track from Southern Pacific R.R., to base of magnesite hill.

RAWHIDE (Jamestown)—Reported that property has been sold to Silver Peak Mining Co., of Blair, Nev., and that company will move its surface plant from its mine in Nevada to Rawhide. John Mocine formerly secretary of California Metal Producers Association is engaged as superintendent. Stated that 3-compartment shaft will be immediately unwatered and retimbered where necessary. The shaft has an incline depth of 1,800 ft. This is one of producing mines owned and operated by Capt. Nevills and taken over by Patterson Estate of Fresno County following death of Nevills. Negotiation for sale of property was conducted by Alex Chalmers, manager of Lightner mine at Angels Camp, representing owners.

COLORADO

Clear Creek County

HOOSAC TUNNEL (Idaho Springs)—Company owning this property is being reorganized under permission from court in bankruptcy.

ONEIDA (Freeland)—Oneida-Stag mill is now equipped to treat ore by flotation, cyanidation having been discarded. Fifty tons of ore averaging $5.50 per ton are being concentrated daily at a ratio of about 12:1. Mine and mill employ 22 men.

GEORGETOWN TUNNEL (Georgetown)—Development will be resumed in this tunnel in Columbia Mt. within next 30

days. Georgetown Mining and Tunnel Co. contemplates early installation of electrically-driven equipment to advance tunnel several hundred feet.

SUN & MOON (Idaho Springs)—Development of this property has been undertaken by Von Tilborg Mining and Leasing Co. Particular attention will be paid to Garden vein east and west of Argo Tunnel on which drifting is in progress. A 2-ft. streak of payable ore has been opened carrying gold, silver, copper and lead. Nels Holme is superintendent.

COLORADO METAL MINING AND REDUCTION CO. (Georgetown)—Has been incorporated at $1,000,000, to take over properties of former concern organized to commercialize Malm dry-chlorination process. Proposes to revive operations in plant erected, several years ago, at Georgetown, and to reduce complex, low-grade ores of that region. Dr. Frank W. Traphagen, professor of metallurgy in Colorado School of Mines, is president of new company.

Gilpin County

PITTSBURG EXTENSION (Russell Gulch)—Fortune Mining and Milling Co. has been formed to operate this group of four claims adjacent to famous Pittsburg mine. New shafthouse contains electric hoist and air compressor. Development being pushed, with fine showing in Pittsburg vein.

Lake County

EVENING STAR (Leadville)—George E. Cramer is building new shafthouse at No. 5 shaft to replace one destroyed by fire a few weeks ago.

San Juan County

SILVER CROWN M. AND D. (Silverton)—New main tunnel, being advanced on Lee vein, has opened body of payable ore 8 ft. wide. About 3 ft. assays high in gold, silver and copper, balance of vein being milling ore. Experiments indicate that ore can be treated profitably by flotation process. James Burns is manager.

BALLARD (Telluride)—Leasers Anderson and Lacey have moved aërial tramway upper terminal from Ballard tunnel down to Butterfly crosscut which will hereafter be main mouth of mine. A block of ground above this adit, 300 ft. high and 600 ft. long, averages about $7.50 per ton. Mining and milling costs amount to $2.50 per ton.

Teller County

PORTLAND GOLD MINING (Victor)—Has acquired acreage along Wilson Creek, east of city of Victor, where it proposes to dispose of its tails from cyanide mill on top of Battle Mt. Sluice, more than mile long, is being constructed down slope of mountain.

IDAHO

Blaine County

WILBERT MINING (Arco)—Will pay initial dividend of $10,000 on Nov. 15. Stockholders have paid assessments of about $65,000. Mine, located in Dome mining district, is splendidly equipped with machinery, mill and railroad for transportation of ore from mine to mill. There are 16 patented claims, considerable reserve fund, and no debts. Ore is lead-silver and large tonnage has been blocked out.

Shoshone County

CŒUR D'ALENE GALENA (Kellogg)—This property is situated just above Caledonia, near Alhambra. Strike of 15 ft. of shipping ore is reported.

REX (Wallace)—Rex Consolidated Mining Co., controlled by New York people, is unwatering Rex mine preparatory to extensive development. Shaft down 700 ft. Probably require 30 days to unwater. Company has 250-ton mill, now rented to Tamarack & Custer.

OOM PAUL (Kellogg)—At meeting of directors held in Wallace Oct. 16 funds were provided and plans were made for continuing development work during winter. Enlarging of old Echo tunnel, through which Oom Paul is working, has been completed. To reach vein will require 3,000 ft. additional driving.

INTERSTATE-CALLAHAN (Wallace)—Aërial tramway connecting mill and railroad, 2 mi., is now in operation, eliminating wagon haul. Management estimates direct saving of $1 per ton. New boarding house to accommodate 70 men just completed and also 20 cottages for married employees. Ore blocked out for 4 years

HYPOTHEEK (Pine Creek)—Contract has been let by this company to Riblet Tramway Co. of Spokane for 3½-mile tram to connect mine with proposed mill. Hypotheek vein is anomalous in that carbonate ore persists to depth of 1,100 ft., although sulphides are beginning to predominate at that depth. New mill will be designed to treat 200 tons of carbonate ore daily and will be remodelled later to treat sulphide ore; it will be built near the tracks of O.-W. R.R. & N. Co. short distance below Enaville.

INDEPENDENCE-GETTYSBURG (Mullan)—Independence Lead Mines Co., of which Stewart Mining Co. is the controlling factor, has begun extensive development of its recently acquired property lying between Morning and Hunter. In tunnels Nos. 2 and 3, on Gettysburg claim, 10 and 12 ft. of ore of fair milling grade have been opened, and tunnel on Independence also shows ore. Compressor will be installed at once at No. 4 tunnel and work will be continued in all tunnels during winter.

RAY-JEFFERSON (Wallace)—At meeting of directors held at Wallace recently details of arrangements for 250-ton mill and winter development were perfected. Construction of mill will start as soon as weather permits and management hopes to have it finished by July 15, 1916. Crosscut extended southward from No. 2 tunnel in search of big Interstate-Callahan zinc vein has cut two small zinc-lead veins but has not yet reached its objective. No. 2 tunnel is on original Callahan vein and face is nearing boundary line. Raise will be driven from No. 2 to No. 1, distance of 432 ft., in preparation for stoping operations; this oreshoot is about 900 ft. long. Leasers on Carlisle claim, owned by Ray-Jefferson, have three cars of lead and zinc ore sacked for shipment. They are driving another tunnel to tap Carlisle vein 200 ft. deeper, at point where it is expected to intersect Ray-Jefferson vein.

MICHIGAN

Copper

MOHAWK (Mohawk)—This year is going to break all records for output and for reduction of costs. Plans calculated to bring better results in 1916 are going forward with speed. At shaft farthest north, first concrete skipway has been laid. No. 4 shaft has been sunk to 22d level. No. 5 is cutting plat at 17th.

TAMARACK (Calumet)—Old Osceola amygdaloid lode, as handled by crosscut in No. 2 Tamarack, now is furnishing considerable tonnage of rock. It is not, of course, anywhere near as rich rock as Calumet conglomerate upon which Tamarack originally built its faith and hope, but it is better than average of Osceola lode.

AHMEEK (Ahmeek)—Is to resume sinking in No. 3 shaft soon. Sinking at No. 4 will start few months later. Ahmeek's costs, including construction, will be close to 8c. per lb. this year if present status is maintained. Copper return is 24 lb.; slight falling off from average of 1911 and 1912 when it ran above 25 lb., but better than 1914 when it was 23.

ISLE ROYALE (Houghton)—Ran into real problem in sinking through sand to get to bedrock at No. 7. Second of three shafts now is going down. This is necessary, to put permanent hoisting shaft in angle of lode. There has been decided betterment in lode-rock contents lately. Last month it ran better than 14 lb. refined.

COPPER RANGE CONS. (Painesdale)—In connection with improved milling methods, cheaper and better extraction and utilization of horsepower at Lake Superior mills, turbine plant at Baltic stamp mill has been in successful operation for period of over two years. At Champion mill at Freda turbine plant now is being installed. It is practically a duplicate of the one at Baltic. Power poles are being set up between mines and mills so that surplus of this power can be used. Construction work now is so well along that it can be called into service within a few months. Success of sand filling system underground long ago proven. More economical handling of sand has been brought about.

Iron

ATHENS (Negaunee)—Shaft now down about 900 ft. Cage hoist is soon to be discontinued and skip hoist installed. Both will be used when mine is operatng.

SALISBURY (Ishpeming)—Mining operations resumed this week. About 75 men employed for present. Drift has been run 2,600 ft. south from shaft. Raising is now in progress to tap new body of ore.

MINNESOTA

Duluth

MINNESOTA STEEL CO. (Duluth)—First coke was made in ovens on Oct. 20. Blast furnaces have been lined and will be started as soon as two necessary pieces of machinery arrive from East. First steel billets will be turned out on Nov. 10 if present plans do not miscarry. There are now 100,000 tons of coal and 120,000 tons of limestone in stock at plant. More is arriving daily. Merchant mill and other mills will not be ready for operation until next spring. However, there is a great demand for billets and they will be shipped East.

Cuyuna Range

CUYUNA-SULTANA (Ironton)—Soo Line trackage to property will be completed early in November. At company's concentrator it is claimed average of combined iron and manganese in product is 55% or over.

CRAFT (Crosby)—A 1/8 interest in original lease of 12c. per ton on this property was recently sold for $30,000, placing valuation of $540,000 on whole lease. Holders of this lease have re-leased to N. P. interests at 62c. per ton.

Mesabi Range

STEPHENSON (Hibbing)—Shovels started loading ore this week. First work done this year.

CROSBY (Nashwauk)—Washing plant, nearing completion, differs from others on the range in that each unit of machinery has its individual motor, avoiding necessity for shafting and belts.

TIOGA (Chisholm)—Sinking was started this week. Temporary frame buildings being erected. Work will be rushed, hoping to start mining in 1916. All machinery will be electrically operated.

MISSOURI—KANSAS

OLD VIRGINIA MINING CO. (Joplin, Mo.)—Formed with 100,000 shares $1 par value. J. F. Dexter principal owner. Has already secured several acres of valuable mining land which will be developed.

GOLDEN STANDARD (Galena, Kan.)—Lease near New Century ground will have new 200-ton mill. Will be one of most modern and best-equipped plants in district. Work on construction commenced; expect to have ready for operation within three months. This is fifth company to start mining on Wyandotte land.

ATHLETIC MINING AND SMELTING CO. (Duenweg, Mo.)—Will enlarge mill to 1,000 tons capacity per 24 hr. instead of 350 tons, formerly reported. Another compressor also to be installed and 300 hp. boilers. Will have also new slime plant, 21 James tables, 2 Dorr thickeners, Dorr classifier, and other improvements.

BRADLEY L. AND Z. CO. (Joplin, Mo.)—Found rich run of blende on lease near Chitwood. Has been driving blank drift toward drill hole which showed good run of ore; struck orebody first of week; expect to have it opened up within week or two so will be able to keep mill, recently repaired, going steadily. Two more tables being added and capacity increased to 250 tons per shift.

SUPERIOR IRON AND FURNACE CO. (Iron Mountain, Mo.)—Old Iron Mountain tract of 1,700 acres has been bought by this company which proposes to reopen property and erect small charcoal furnace. Three charcoal furnaces were operated on this property about 40 years, which cleaned up oak timber for over 20 miles in every direction; second growth of oak is now sufficiently large for cutting.

MONTANA

Deer Lodge County

WASHOE REDUCTION WORKS (Anaconda)—Work was started Oct. 14 tearing out sixth section of concentrator preparatory to installing new system including flotation. Work is also progressing on building for additional flotation plant that will take care of slimes that cannot be handled in concentrator. New roaster building is going up rapidly. Sixteen of 28 furnaces, each 25 ft. in diameter are in place. One of them will be lined with cement instead of brick as an experiment. Furnaces are combination of McDougall and Wedge types, being water cooled instead of air cooled as is Wedge. Experimental zinc plant is operating satisfactorily and process promises to be great factor in development and exploitation of zinc resources in Montana. Experiments being made with coal-dust firing in furnaces of new leaching plant and if anticipations are realized system will be installed there.

Fergus County

BARNES-KING DEVELOPMENT (Kendall)—Has purchased all property of Kendall Gold Mining Co. in Fergus County for $100,000; $40,000 cash and remainder at $10,000 per month. Acquisition settles ore controversy existing between two companies.

Silver Bow County

BUTTE & SUPERIOR (Butte)—In September mine treated in its oil flotation plant, 37,278 tons of ore at cost of $3.19 per ton, recovering 8,968 tons of concentrate, valued at $81.50 per ton.

NORTH BUTTE (Butte)—Under new compensation law in effect in Montana, accident of Oct. 19 will cost North Butte company between $75,000 and $85,000 in pensions to be paid to relatives of dead men and to injured men themselves.

ELM ORLU (Butte)—Announcement made that contract will be let for new hoist and other improvements, to approximate total expenditure of $125,000. Hoist will be similar to that at Granite Mountain shaft of North Butte. Will have capacity for depth of 4,000 ft.

TUOLUMNE (Butte)—Output to be increased from 100 to 150 tons per day. Principal operations now being carried on on 2,000-ft. level. Orebody on 2,500-ft. level is 4 ft. in width; average copper content 4.6% with about 1 oz. of silver for every per cent. of copper. Among recent improvements are trams to convey lumber and fuel from railroad tracks to workings. Has 100 men on payroll. Ore being shipped averages 4% copper with considerable silver and small amount of gold.

EAST BUTTE (Butte)—The 800-ton flotation plant is practically ready for operation. Process is similar to that employed at Butte & Superior. Plant will treat all second-class ore and tailings from old processes which carry 14 to 16 lb. of copper to the ton. By flotation, loss in tailings will be reduced to about 4 lb. per ton. East Butte is mining about 900 tons of ore per day, of which 300 tons are first and 600 tons are second class. In addition to this it is handling Butte-Alex Scott ore.

NEVADA

Esmeralda County

SILVER PICK CONSOLIDATED (Goldfield)—Station completed on 600 level and east crosscut started to intersect vein encountered on 700-ft. level. Continuing north drift on 500 level on Phelan Vein.

JUMBO EXTENSION (Goldfield)—Dividend No. 5 of 10c. share declared by recent directors' meeting, payable Dec. 31, will leave surplus of $200,000 in treasury. Estimated production for September, 2,900 tons; gross value, $102,000. Net profit, $52,000.

SPEARHEAD (Goldfield)—After about eight years' inactivity, excepting leases, work is to be resumed on company account. Shaft to be continued from present depth of 250 ft. to 950-ft. point to cut latite-shale contact. Expect to intersect Wheeler ledge at 550 ft.

GOLDFIELD MERGER MINES CO. (Goldfield)—From latite shale contact drift, which was run at a vertical depth of about 1,200 ft., northeast crosscut has been started to intersect downward extension of Jumbo Extension orebody.

DIAMONDFIELD BLACK BUTTE REORGANIZED MINING (Goldfield)—Operations at main shaft temporarily suspended. Company will participate in Marine Lease on company ground which is extracting ore. Compressor and drills will be installed.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 16 amounted to 9,761 tons, estimated at $201,658, compared with 9,583 tons last week. Producers were: Tonopah Belmont, 2,899 tons; Tonopah Mining, 2,800; Tonopah Extension, 1,850; West End, 672; Jim Butler, 1,100, and miscellaneous leasers, 440 tons.

TONOPAH BELMONT (Tonopah)—Net profit for September was $65,018 from 12,008 dry tons milled.

TONOPAH MINING (Tonopah)—Net profit for September was $51,720 from 12,057 dry tons milled; average value, $12.04 per ton.

JIM BUTLER (Tonopah)—Net profit for September, $22,232. Falling off from August, due largely to greater tonnage of low-grade ore from development.

WHITE CAPS (Manhattan)—Delinquent stock sale held in Tonopah, Oct. 16. There were 136,000 shares sold at price ranging from cost of assessment, 1½c. per share, to over 5c. per share. Practically all the stock was purchased by local investors who appear to have considerable faith in future of company. Developments in connection with future operation of White Caps, especially in connection with installation of adequate milling plant, are expected in near future.

Storey County

SIERRA NEVADA (Virginia)—On 2,500 level west crosscut at 35-ft. point exposed quartz in bottom of face assaying $11 per ton.

BELCHER-CROWN POINT (Gold Hill)—Saved 37 cars of mill rock from stopes in 1,300 Belcher raise. Jacket mill received 1,077 tons of dump rock and shipped one bar of bullion.

MEXICAN (Virginia)—Southwest drift from No. 3 on 2,500 level at 38-ft. point shows 3 to 4 ft. of low-grade quartz. No work done on 2,700 level owing to trouble at C. & C. shaft. Mill crushed 300 tons of ore, averaging $13.09 per ton.

CON. VIRGINIA AND OPHIR (Virginia)—Joint west crosscut from winze on 2,700 level reached 16-ft. point; face in porphyry. On Ophir 2,500 level, winze deepened to 15-ft. point. Saved 8 cars of ore averaging $7.80 per ton. Central tunnel north crosscut extended 5 ft. Saved 315 cars from stopes and development; milled 220 tons.

UNION CON. (Virginia)—Saved 83 cars of ore from north lateral drift stope on 2,500 level; assayed $49 per ton; last 35 cars averaged $63 per ton. In No. 1 raise, north drift advanced 4 ft. with face in ore averaging $50 per ton. East crosscut also started in hanging-wall side advanced 4 ft. with face assaying $30 per ton; 12 ft. across top at north end assays $50 per ton. Center and south end is in good milling ore.

NORTH CAROLINA

Stanly County

SOUTHERN ALUMINIUM CO. (Whitney)—Plans are under way for resumption of work on plant, about three-fourths completed, which was suspended at outbreak of European War. French interests known as L'Aluminium Francaise are in control of property in which is associated American Metal Co. Probable cost of plant on completion will be nearly $10,000,000.

UTAH

Beaver County

MOSCOW (Milford)—Deposit of zinc ore, much of it high grade, recently discovered on 200 level of old workings, is 10 to 15 ft. in width, and there are 150 ft. of backs. There is said to be about $100,000 worth of ore, and shipments are expected at rate of one car daily. New electric hoist is being installed on 600 level at Cullen shaft which will be sunk to 1,100.

Juab County

TINTIC ORE PRODUCTION for week ended Oct. 16 amounted to 124 carloads, estimated at 6,200 tons, valued at $155,000, compared with 137 carloads week previous.

Salt Lake County

ALBION MINING (Alta)—Lessees operating in old workings have made strike of good ore, and will continue work throughout winter. Eighteen men are working. Development is being done through Quincy tunnel of South Hecla.

Summit County

PARK CITY ORE PRODUCTION for week ended Oct. 16 amounted to 1,614 tons, valued at $64,000, compared with 1,498 tons week previous.

DALY-JUDGE (Park City)—Raise 200 ft. from 1,200 level has opened high-grade ore, which, it is expected, will make along contact, and develop into deposit such as found in other parts of property. Construction work on addition to mill, which is to contain Callow flotation plant has been completed, and machinery is being installed.

SILVER KING COALITION (Park City)—Shipments are being made at rate of 550 to 750 tons of ore and concentrates weekly, ore coming from 1,450 level and above. Some unusually rich ore is being mined. Eight cars, recently shipped, are reported to have assayed 84 oz. silver, 25% lead, with considerable zinc.

Tooele County

BULLION COALITION (Stockton)—Work is being continued on station at 200-ft. level below Honerine tunnel, where pumps are to be installed. All of ore produced by this property is taken out through this tunnel, which also supplies water for irrigation.

CANADA

British Columbia

BRITISH COLUMBIA COPPER (Greenwood)—September profits reported $10,000. Only one of three furnaces at smeltery in operation. This averaged 800 tons of ore per day. Development work on newly acquired Copper Mountain property continues, but production has not started.

Ontario

CONIAGAS (Cobalt)—This company has passed the dividend due Nov. 1 reason assigned being that company has limited its output on account of low price of silver.

CROWN-RESERVE (Cobalt)—This company has taken charge of Globe Consolidated mine in Trinity County, Calif. It agrees to spend $50,000 at rate of $4,000 per month to be repaid out of gross ore receipts. After all debts are liquidated Globe Consolidated will give Crown-Reserve a 55% control on 30-year lease.

MEXICO

Sonora

GREENE CANANEA (Cananea)—Closed down Oct. 25 as result of destruction, by Yaquis, of several bridges on line between Cananea and Naco, on American border, Cananea's port of entry. It is understood that no violence has been done to property, and officials of company do not expect any. Shutdown is made necessary to conserve supplies of oil at plant in order to keep pumps and other necessary machinery running.

SOUTH AMERICA

Peru

CERRO DE PASCO MINING CO. (Lima)—Will be reorganized through formation of new company with 1,000,000 shares, without par value. New company will issue $10,000,000 convertible 6%, 10-year bonds which will be bought by J. P. Morgan & Co. Of capital stock, 333,333 shares will be reserved for converting bonds after two years and up to 10 years at $30.

The Market Report

Metal Markets

NEW YORK—Oct. 27

All of the principal metals were stronger during the last week and a good business was done in each case.

The average prices for the metals in October will be reported on Nov. 3, Wednesday.

Copper, Tin, Lead and Zinc

Copper—A good business was done both with domestic and foreign buyers. By Saturday the market had advanced so that 18c., regular terms, was realized. Some of the larger producers who had previously stood aloof in the domestic market, nominally asking 18¼c., regular terms, met buyers and made sales at 18c. The Lake producers were reported as having made excellent sales at 18c. At the close the market stood at 17.90@18c., regular terms (17.70@17.80, cash, New York), most of the producers asking 18c., but being willing to make small concessions for desirable orders.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 18½@19c. per lb. at mill.

Copper Imports in the United States, week ended Oct. 9, are reported by the Department at 4,208,016 lb. metal and 426,799 lb. in ore and matte; total, 4,634,815 lb. Chief imports were from Peru, Chile and Canada. The exports for the week were 4,335,622 lb. copper; of which 2,543,102 lb. went to England and 1,412,234 lb. to Italy.

Tin—This market was steady, a fair business being reported done.

Lead—On Oct. 21 the A. S. & R. Co. advanced its price to 4.75c., and since then the market in New York has been steady at that figure. This advance was foreshadowed by the narrowness of the margin between the New York and St. Louis prices. Following the advance, the margin has continued narrow. Certain favorite brands of Missouri lead that are especially sought for the manufacture of sheet lead for sulphuric-acid chambers are temporarily unavailable, the producers being completely sold out for a month or six weeks ahead. All of the principal producers report a good business in lead being done during the last week.

Spelter—A large business was done during our last week of record, the total of sales being without any doubt in excess of 12,000 tons. Business was done chiefly with foreign buyers, especially for export to France. In the main it was done in contracts for deliveries running far ahead. These varied from contracts covering the first quarter of 1916, to contracts beginning immediately and running through the first quarter of 1916, and even further. For example, there was one very large sale covering deliveries November-June. With respect to the prices realized, conditions were rather erratic. Spelter for prompt delivery sold as high as 14c. in the latter part of the week, while the market for November at the close was about 13½c., for December, about 13c., and for January, about 12½c. Large contracts covering different periods realized a great variety of prices. The average of a little upward of 7,000 tons reported to us as sales for the week was about 12 cents.

Domestic consumers were again conspicuous by their absence. Nor was there any demand worth mentioning for spelter for early delivery. On the other hand there was no pressure to sell it. There seems to be plenty available but those who have it prefer to sell it only in conjunction with metal for later delivery.

The market for high grade and high-grade intermediate spelter is developing into an interesting situation. The supply of this is increasing but some of the producers find it difficult to sell it for the prices they think due them and are holding back their supplies until buyers become more generous. In the meanwhile the producers of these grades of spelter are increasing in number.

High-grade spelter is being offered by a new company, the American Spelter Corporation, 61 Broadway, New York. This company, in which George E. Nicholson is interested, has built a smelting plant at Kusa, Okla., near the new plant of Mr. Nicholson. The supposition is that it will refine by redistillation some of the common spelter produced by Mr. Nicholson.

The American Zinc, Lead and Smelting Co. is now producing high-grade intermediate spelter almost to the exclusion of common spelter.

The Owen Spelter Co. is building a 640-retort plant at Caney, Kan. Expected to be in operation in December.

Some of the recent demand for spelter for prompt delivery has been from new smelters who expected to be making spelter at this time, but have been delayed and have had to buy in order to fill contracts for delivery that they had entered into.

The American Zinc, Lead and Smelting Co. has opened a New York office in the Equitable Building, 120 Broadway. Charles W. Baker, a director of the company, is in charge.

Zinc Sheets—Business has been active, sales good but with no material change in quotations. The base price for carload lots is $16 per 100 lb. f.o.b. Pern, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Oct	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Spot, Cts. per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis, Cts. per Lb.	Zinc: St. Louis, Cts. per Lb.
21	4 6700	49	17 55 @17.65	33¼	4 75	4 62½ @4 67½	11.50 @13 50
22	4 6538	49	17 60 @17.70	33¼	4 75	4 62½ @4 67½	11.50 @13.50
23	4 6350	48⅞	17 60 @17.80	33¼	4 75	4 62½ @4 67½	11.50 @14.00
25	4 6200	48⅞	17.60 @17 80	33½	4.75	4.65 @4 67½	11.50 @14 00
26	4 6200	48⅞	17 70 @17.80	33½	4 75	4.65 @4 67½	12 00 @14 00
27	4 6100	48⅞	17.70 @17.80	33½	4 75	4 65 @4 67½	12 00 @14.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13 1c.

LONDON

Oct.	Silver	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic £ per Ton	Copper: Electrolytic Cts. per Lb.	Tin: Spot	Tin: 3 Mos.	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts. per Lb.
21	23¾	72⅞	73¾	88	18.35	151¾	153½	24 5/16	5 07	63½	13.22
22	23 13/16	73½	73½	88	18.29	151¾	153	24 3/16	5 02	66½	13.84
23	23⅞	.	.	.	.	.	.	.	.	.	.
25	23 15/16	72¾	72⅞	88	18.16	153¾	154½	24⅛	5.03	69½	14.35
26	23 15/16	72⅛	72½	88	18.16	154¼	154¾	24 1/16	5 05	68½	14 14
27	24	72¼	72⅞	88	18.12	154½	154⅞	24¼	5.00	68½	14 14

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.86 = £1 = 3.21c., £20 = 4.29c.; £30 = 6.13c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Oct. 27

Aluminum—Market conditions remain about the same. Stocks of imported metal are low and the chief domestic producer has none to offer for early delivery. Quotations are 53@56c. per lb. for No. 1 ingots, New York.

The action of the stockholders of the Southern Aluminium Co. is referred to on another page.

Antimony—The market has been strong and active and prices have advanced sharply. Sales have been good on the rise, and the tendency at the close is upward. Chinese and other ordinary brands are quoted at 35@36c. per lb. Cookson's, in which there is little doing, is held at 45@46c. per lb., New York.

Nickel—Quotations for ordinary forms are nominally 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—Stocks continue scarce and the market is strong and advancing. New York quotations are $95 per flask of 75 lb. for large lots and $95@97 for smaller orders. A considerable shipment from California is reported held up in the Panama Canal. San Francisco reports by telegraph a brisk, strong market, with quotations $90@93 per flask. London price has been advanced 10s. and is now £16 per flask; no discount reported from second hands.

Gold, Silver and Platinum

NEW YORK—Oct. 27

Gold and Silver Movement in the United States, nine months ended Sept. 30, as reported by the Department of Commerce:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$157,656,778	$12,936,680	$38,480,444	$35,557,489
Imports	39,941,946	265,871,213	17,791,486	25,276,972
Excess	E. $117,714,832	I. $252,934,533	E. $20,688,958	E. $10,280,517

Exports of merchandise in 1915 are valued by the Department at $2,529,575,095; imports, $1,302,281,591; excess of exports, $1,227,293,504. Adding the gold and silver gives $984,639,488 as the net export balance.

Platinum—Conditions remain about the same and no additional supplies seem to be in sight. Prices are a little uncertain, and higher rates may be asked. For the present, however, they remain at $50@55 per oz. for refined platinum and $55@60 per oz. for hard metal.

Our Russian correspondent writes under date of Sept. 24 that speculative interest in the market has decreased, owing principally to the increased difficulties imposed by the government to the export of platinum. Prices have fallen, though they still fluctuate considerably. Current quotations at Ekaterinburg for crude metal, 83% platinum, are 10@10.30 rubles per zolotnik; at Petrograd 38,000@39,000 rubles per pood—equal to $38.16 and $37.73 per oz., averages.

Iridium—This metal continues in demand and at a high price. Nominally $80@85 per oz. is quoted, but all sales are the result of negotiation and it is impossible to fix prices definitely.

Silver—Price has been maintained in London chiefly by purchases for home coinage and continental inquiry. But while the London price has advanced, the New York price has not quite held its own, owing to the decline in the rates of foreign exchange.

Imports of silver into Great Britain, nine months ended Sept. 30, were £7,178,943; exports, £5,713,480; excess of imports, £1,465,463, which compares with an excess of exports of £117,085 last year.

Zinc and Lead Ore Markets

JOPLIN, MO.—Oct. 23

Blende, high price $87.50; base per ton of 60% zinc, premium ore, $85; medium grades, $83@78; lower grades, $75@70; calamine base per ton of 40% zinc, car lots, $35@60; average selling price, all grades of zinc, $81.04 per ton. Lead, high price $56; base per ton of 80% metal content, $50@55; average all grades of lead, $50.87 per ton

SHIPMENTS, WEEK ENDED OCT. 23

	Blende	Calamine	Lead	Values
Totals this week	12,244,350	942,250	1,552,950	$564,910
Totals this year	469,530,190	35,168,430	73,035,260	20,700,840

Blende value, the week, $496,160; 43 weeks, $17,975,690.

Calamine value, the week, $29,270; 43 weeks, $812,340.

Lead value, the week, $39,480; 43 weeks, $1,912,860.

Lead prices, which sagged to around $50 base a week ago, closed tonight strong at $55. The blende market continued strong for premium ore; other grades weakened by midweek and found ready buyers at the week-end on the lower price level. The United States Smelting, Refining and Mining Co., which has been out of the market several weeks, was an active week-end buyer in the Miami camp at advanced prices.

Three weeks of excellent weather is creating a marked improvement in the production of blende and calamine, and the buying is strong enough to take up the production.

PLATTEVILLE, WIS.—Oct. 23

The base price paid this week for zinc ore was $75@72 per ton for 60% grades. The base price paid for 80% lead ore was $54 per ton.

SHIPMENTS, WEEK ENDED OCT. 23

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,584,180	406,300	530,920
Year	162,826,760	5,683,210	22,238,770

Shipped during week to separating plants, 4,669,460 lb. zinc ore

Iron Trade Review

NEW YORK—Oct. 27

The demand for finished steel continues strong and improving, domestic orders supplementing the export business. The mills are so full that deliveries are becoming uncertain.

Car orders, bridge orders and structural work are increasing rapidly, and contracts for material are now running well into and even over the first quarter of next year.

A buying movement in pig iron seems to have set in. Some large orders for basic pig have been placed or are on the market, and there are more inquiries for foundry iron. Recent advances in price are well held and more are in sight.

Exports from Baltimore for the past week included 380,885 lb. tinplates to London.

The stockholders of the Thomas Iron Co. have been notified that an offer has been made for their property and they will be asked to vote on giving an option.

The United States Steel Corporation in its preliminary report for the quarter ended Sept. 30 shows net earnings, after deducting operating expenses, ordinary repairs and renewals, as follows:

	1914	1915
July	$7,475,973	$12,048,218
August	7,584,926	12,869,099
September	7,215,083	13,793,327
Quarter	$22,276,002	$38,710,644
Depreciation and subsidiary charges		$8,864,853
Bond interest and sinking fund		5,703,631
Dividend on preferred stock		6,304,919
Total charges		$20,673,403
Surplus for the quarter		$18,037,241

For the nine months ended Sept. 30 the total net earnings were $60,727,979 in 1914 and $79,118,908 in 1915, an increase of $18,390,929. The September quarter this year showed a gain of $10,760,589 over the June quarter. The surplus for the quarter was equal to 3.5% on the common stock, but no dividend on that stock was declared, and no appropriations for new work were made.

PITTSBURGH—Oct. 26

Yesterday the Carnegie Steel Co. advanced bars, plates and shapes $1 a ton to 1.50c., Pittsburgh, just 10 days after its previous advance, and making $3 a ton advance in these products in less than a month. The 1.50c. price seems to be minimum for all the mills, but none will sell freely and some are practically out of the market. It is estimated that with the utmost reserve in accepting additional orders the mills will end the year with fully six months of obligations on books. Sheets are advancing, for delivery at mill convenience, and the leading interest is on the verge of opening its books for first-quarter contracts, at prices well above those now ruling for delivery at mill convenience.

In all finished steel products the pressure to buy has been steadily increasing, partly because prices promise to advance still more sharply in future, and partly because consumptive requirements are increasing. The railroads are faced with a car shortage not merely during the crop moving period, but afterwards, and there is inquiry in the market that may result in the placing of 40,000 to 60,000 freight cars in the next few weeks. Rail orders to date total about 550,000 tons. Car-repair material is in great demand and premiums for prompt shipment have been paid on a large tonnage altogether. The requirements of various domestic consumers are increasing, while the war demand continues very heavy and the demand from neutral countries shows further expansion. Since the mills have already been producing all the steel of which they are capable, and yet have been falling behind in

deliveries, the common prediction is that there will shortly be a veritable famine in steel.

Finished steel prices are now as high as they were at the top of the great movement of 1912, and are still advancing, more rapidly indeed than earlier in this movement. For a few finished-steel products premiums are offered for early delivery, but there is not much demand of this sort thus far, as buyers are well covered by contracts, as a rule. Since contracts are now being made in very conservative fashion by the mills there will probably be much more premium business going on in the market a few months hence. The small mills generally avoid contracts and will have steel to sell when the large mills are filled up tight for deliveries severa months ahead.

Pig Iron—All the furnaces that were quoting $14.50, Valley, on No. 2 foundry and malleable have withdrawn that quotation and are adhering to $15, the price that has ruled for weeks for next year's deliveries. Sales of about 10,000 tons of foundry and malleable have been made in this district in the past week. Bessemer and basic are strong, but without much activity. Predictions are more freely made that the pig-iron market will experience a sharp advance soon, as there are very few idle merchant furnaces, and the furnaces in blast have been reducing their stock piles, while prospects are that foundries will have larger requirements in future. We quote: Bessemer, $16; basic, malleable and foundry, $15; gray forge, $14.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The Jones & Laughlin Steel Co. has leased Josephine furnace at Kittanning, Penn., a merchant furnace stack rated at 300 tons of pig iron a day, and now idle, the intention being to transfer the manufacture of ferromanganese from one of the Aliquippa furnaces, giving the steel company so much more basic pig-iron capacity. The manufacture of ferromanganese from imported ores was started by the Jones & Laughlin Steel Co. last December. Contract deliveries by English producers have improved materially and further improvement is expected, so that buyers have less hesitancy in making fresh contracts at the $100 price quoted for some time. Domestic producers still adhere to their former quotation of $115 on contract. Odd lots for early shipment generally bring from $105 to $110.

Steel—A contract has been made for 4,500 tons of open-hearth sheet bars for delivery over the first six months of next year at a price equivalent to slightly more than $28, Pittsburgh mill, and it is reported that bessemer sheet bars have brought about $27, Pittsburgh, for first quarter. Very little is being done for such deliveries, while for early delivery there are no sellers, mills stating that the market is nominally $25 for bessemer and $26 for openhearth billets, with $1 advance for sheet bars. Rods are $32@33, Pittsburgh. There is considerable contract business for first half to be closed in the near future.

FERRO-ALLOYS

Ferromanganese is still quoted at $100 Baltimore for imported; $110@115 for domestic, early delivery.—**Ferrosilicon** is higher; bessemer 10% is quoted $21.50 at furnace for spot, $21.50 for first quarter and $22 for second quarter. Higher grades run up to $31 at furnace for 15% alloy.—**Ferrotitanium** is $@12.5c. per lb., according to size of order and delivery.—**Ferrovanadium** $2@2.25 per lb. of contained vanadium.

IRON ORE

Shipments of Lake Superior ore are still heavy, and preparations are being made for a large demand through the winter.

Imports at Baltimore for the past week included 15,400 tons manganese ore from Brazil.

British Imports of Iron Ore nine months ended Sept. 30 were 4,527,970 long tons in 1914, and 4,700,016 in 1915; an increase of 172,076 tons.

Imports of manganese ore for the nine months were 406,765 long tons in 1914, and 209,814 in 1915; a decrease of 196,951 tons.

Exports of Manganese Ore from India for the four months of the fiscal year Apr. 1-July 31 were 245,086 tons in 1914, and 78,072 in 1915; decrease, 167,014 tons.

OTHER ORES

Molybdenite, 90% MoS_2, is quoted in London at 120s.—$28.80—per unit. The Australian government takes all the ore produced in that country at 105s. per unit—**Tungsten Ore** remains high, London quotations for wolframite, 65% WO_3, being 55s.—$13.20—per unit.

NEW CALEDONIA EXPORTS

Exports of nickel ore from New Caledonia, eight months ended July 31, were 39,216 metric tons. Exports of chrome ore were 28,828 tons. In July 14,189 tons chrome ore were shipped to New York. Exports of nickel matte were 1,709 tons.

COKE

Coke production of the Connellsville region for the past week is reported by the "Courier" at 421,091 short tons; shipments, 422,645 tons. Shipments of Greensburg and Upper Connellsville districts, 40,100 tons.

Coal and Coke Tonnage Pennsylvania R.R. lines east of Pittsburgh and Erie nine months ended Sept. 30, short tons:

	1914	1915	Changes
Anthracite	8,020,105	7,603,051	D 417,054
Bituminous	33,854,642	31,678,900	D 2,185,742
Coke	7,561,858	8,378,576	I 816,718
Totals	49,446,605	47,660,527	D. 1,786,078

The total decrease was 3.6%. Coke alone shows an increase this year.

British Fuel Exports nine months ended Sept. 30, in long tons:

	1914	1915	Changes
Coal	48,116,349	33,414,212	D. 14,702,137
Coke	824,325	684,689	D. 139,636
Briquettes	1,434,938	960,636	D. 474,302
Steamer coal	14,581,962	10,722,894	D. 3,859,068
Total	64,954,574	45,782,431	D 19,172,143

The steamer coal is the fuel furnished to steamships engaged in foreign trade.

SAULT STE. MARIE CANALS

Total freight passing through the Sault Canals in September was 10,974,557 short tons carried in 3,141 vessels. For the season to Oct. 1 the total freight was: East bound, 37,739,738; west bound, 10,643,865; total, 48,383,603 short tons. The number of vessel passages was 14,907, giving an average cargo of 3,246 tons. In all 12,139 vessels carrying 44,888,436 tons passed through the American locks; and 2,768, with 3,495,167 tons through the Canadian canals. The mineral freights included in the totals were, in short tons except salt, which is in barrels:

	1914	1915	Changes
Anthracite	1,589,501	1,448,734	D. 140,767
Bituminous coal	9,714,223	8,106,063	D. 1,608,160
Iron ore	25,923,002	33,761,762	I. 7,838,760
Pig and m'f'd iron	191,361	141,051	D. 50,310
Copper	47,237	95,373	I. 48,136
Salt, bbl	565,736	481,170	D. 84,566

Iron ore was 69.8% and coal 19.7% of the total freight reported this year.

Chemicals

NEW YORK—Oct. 27

The general markets show an improved tone and more active business. The supposed discovery of a plot in New York to destroy or damage several large chemical manufacturing plants has caused a good deal of talk in the trade. How much of the reports have an actual base is still uncertain.

Arsenic—Little or no change is reported. Business is quiet. Quotations are $3.50 per 100 lb. for large lots and up to $4 per 100 lb. for smaller parcels.

Barytes—Exports from Baltimore for the past week included 61,920 lb. barytes to Manchester, England.

Copper Sulphate—Business continues fair and prices are steady, with no material change. Current quotations are $6.50 per 100 lb. for carload lots, and $6.75 per 100 lb. for smaller parcels.

Nitrate of Soda—The market shows little change. Quotations remain about 2.45c. per lb. for both spot and futures.

The official statement of production of nitrate in Chile for the two months July 1-Aug. 31 gives a total of 6,365,022 quintals—288,131 long tons; a decrease of 4,187,742 quintals, or 39.7%, from last year.

Sulphuric Acid—Acid of 66°Bé. realizes $50@60 per ton in the seaboard markets in large lots. For 60°Bé. $30@35 is paid. These prices permit acid to be brought eastward from points so far west as Argentine, Kan., whence the freight rate is $11 per ton and still leave the producers a phenomenal profit.

PETROLEUM

Exports of mineral oils from the United States in August were 232,224,014 gal. For the eight months ended Aug. 31, the total exports were 1,493,937,331 gal. in 1914, and 1,518,884,770 gal. in 1915; an increase of 24,947,439 gal., or 1.7%, this year.

Assessments

Company	Delinqe	Sale	Amt.
Aetna, Ida	Oct. 16	Nov. 15	0.001
Argenta, Ida	Oct. 11	Nov. 13	0.001
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0.01
Cash Boy, Nev	Sept. 29	Oct. 30	0.01
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah	Oct. 10	Oct. 30	0.025
Comstock, Ida	Sept. 30	Oct. 30	0.001
Copper Mt. M. & D., Ida	Oct. 28	Dec. 1	0.002
Drake-Lloyd, Utah	Nov. 14	Nov. 30	0.0025
Diamfield Black Butte, Nev.	Oct. 4	Nov. 4	0.01
Eagle Mt., Ida	Oct. 15	Nov. 15	0.0005
Eastern Star, Ida	Oct. 29	Nov. 29	0.002
E. Hercules Ext., Ida. (post.)		Nov. 11	0.0015
Enterprise, Ida	Oct. 15	Nov. 15	0.002
Four Timbers, Wash	Oct. 4	Nov. 4	0.001
Frankl-Wash	Oct. 18	Nov. 10	0.002
Giant M. & D., Ida	Oct. 7	Nov. 8	0.003
Great Western, Nev	Nov. 15	Dec. 7	0.001
Hancock Cons., Mich	Jan. 3		1.00
Idaho-Nevada Exp., Ida	Nov. 1	Dec. 1	0.002
Idora, Ida	Oct. 11	Nov. 11	0.005
Lewis & Clark, Ida	Oct. 15	Nov. 15	0.001
Lucky Swede, Ida	Nov. 1	Dec. 11	0.002
Military M. & M., Ida.	Oct. 28	Nov. 29	0.0065
Montana Standard	Nov. 15	Dec. 15	0.005
Nabob, Ida	Oct. 25	Nov. 15	0.005
Naildriver, Utah	Oct. 9	Nov. 8	0.02
New Arcadian, Mich	Dec. 1		0.50
Pacific M. & M., Ida	Jan. 15		0.50
Phoenix, Mich	Dec. 1	Dec. 2	0.004
O. K. Ex. M. & R., Utah	Nov. 20	Dec. 15	0.005
Old Veteara, Ida	Nov. 1	Nov. 27	0.002
Ophir, Nev	Oct. 12	Nov. 2	0.05
Oriental, Nev	Nov. 6	Dec. 7	0.003
Original, Nev	Nov. 6	Dec. 7	0.003
Pacific M. & M., Ida	Nov. 10	Nov. 30	0.0005
Phoenix, Mich	Jan. 1		1.00
Piedie Metals, Nev	Oct. 20	Nov. 20	0.001
Rainbow, Ida	Oct. 15	Nov. 20	0.002
Royal, Ida	Oct. 12	Nov. 9	0.0015
Silver Cliff, Ida	Nov. 8	Dec. 6	0.0025
Silver Mona, Ida	Oct. 15	Nov. 18	0.005
Silver Pick Cons., Nev	Oct. 16	Nov. 23	0.01
Sunset M. & D., Nev	Oct. 18	Nov. 22	0.02
Sunshine, Ida	Oct. 15	Nov. 15	0.0006
Ton. Gipsy Queen, Nev	Oct. 29	Dec. 6	0.01
Umatilla Too., Nev	Nov. 8	Dec. 13	0.005
Union Cons., Nev	Oct. 25	Nov. 15	0.05
Wisconsin, Ida	Oct. 19	Nov. 19	0.003
Wolf Mountain, Utah	Nov. 12	Dec. 14	0.0025

Stock Quotations

Among sales at auction during the week ended Oct. 23 were: 10 Ala. & Ga. Iron Co. com. and 10 Ala. & Ga. Iron Co. pfd., $7 lot; 10 Horn Silver Mining, $25 par, $6 lot.

COLO. SPRINGS Oct. 26

Name of Comp.	Bld.
Acacia	.02½
Cripple Cr'k Con.	.008
C. K. & N.	‡ 02
Doctor Jack Pot	.09¾
Elkton Con.	.25
El Paso	.75
Findlay	.03½
Gold Dollar	.02½
Gold Sovereign	.06½
Golden Cycle	1.77
Isabella	.16½
Jack Pot	.06½
Jerry Johnson	.05½
Lexington	‡ 005
Mary McKinney	.35
Pharmacist	‡ 008
Portland	1.68
Raven B. H	.03½
Vindicator	1.46

SALT LAKE Oct. 25

Name of Comp.	Bld.
Beck Tunnel	.05
Black Jack	‡.05½
Colorado Mining	.05
Crown Point	.01¾
Daly-Judge	6.75
Emma Cop.	.27½
Gold Chain	‡.16
Grand Central	.54
Iron Blossom	.72
Lower Mammoth	‡.04¾
May Day	.19
Opohongo	‡.00½
Prince Con.	.68
Seven Troughs	.01½
Silver King Coal'n.	3.22½
Silver King Con.	2.60
Sioux Con.	.02
Uncle Sam	.07½
Yankee	‡ 25

TORONTO Oct. 25

Bailey	.03½
Chambers Ferland	.13
Conagas	3.60
Peterson Lake	.21
Right of Way	.02
Seneca Superior	1.78
Silver Queen	.01
T. & Hudson Bay	20 00
Timiskaming	.40
Trethewey	.13
Wettlaufer-Lor.	.05

SAN FRANCISCO Oct. 25

Comstock Stocks	
Alta	.05
Andes	.11
Best & Belcher	.10
Caledonia	.08
Challenge Con.	.08
Chollar	.06
Confidence	.22
Con. Virginia	.29
Gould & Curry	.06
Hale & Norcross	.06
Jacket-Cr. Pt.	.24
Julia	.03
Mexican	.42
Occidental	.78
Ophir	.43
Overman	.13
Potosi	.06
Savage	.10
Sierra Nevada	.86
Union Con.	.76
Mise. Nev. & Cal	
Belmont	3.60
Jim Butler	.76
Lone Star	.04
MacNamara	.02
Midway	.13
Mont.-Tonopah	.27
North Star	14 00
Rescue Eula	.07
West End Con.	.74
Atlanta	.24
Booth	.35
C.O.D. Con.	.04
Comb. Frac.	.07
D'field Daisy	.03
Jumbo Extension	1.35
Pitts.-Silver Peak	.06
Round Mountain	.40
Sandstorm Kendall	.10½
Silver Pick	.08
Central Eureka	.10

N. Y. EXCH. Oct. 26

Name of Comp.	Clg.
Am.Sm.&Ref.,com	93
Am. Sm. & Ref., pf.	109½
Am. Sm. Sec., pf. A	86¾
Am. Sm. Sec., pf. B	82½
Anaconda	76½
Batopilas Min.	1½
Bethlehem Steel	580
Bethlehem Steel, pf.	480
Chino	50½
Colo. Fuel & Iron	58½
Crucible Steel	90
Federal M. & S., pf.	50½
Great Nor., ore., ctf.	50½
Greene Cananea	39
Guggen. Exp.	67½
Homestake	119¾
Inspiration Con.	45
International Nickel	193½
Miami Copper	34½
Nat'l Lead, com.	67
National Lead, pf.	110½
Nev. Consol.	15¼
Ontario Min	3
Quicksilver	2½
Ray Con.	25½
Republic I.&S., com.	54
Republic I.&S., pf.	104
SlossSheff'd, com.	60
Tennessee Copper	63½
Utah Copper	71
U. S. Steel, com.	85½
U. S. Steel, pf.	115½

N. Y. CURB Oct. 26

Name of Comp.	Clg.
Alaska Juneau	12½
Alta Con	.22
Beaver Con.	30
Big Four	.05
Blue Bell	.02
Braden Copper	10
Buffalo Mines	.50
Can. Cop. Corpn	1 13/16
Cashboy	.08
Chile Cop.	23½
Con. Ariz. Sm.	1½
Con. Coppermines	1½
Con. Nev.-Utah	5/16
Dia. Black B.	.05
Florence	.44
Goldfield Con.	1½
Goldfield Merger	.19
Howe Sound	4½
Kenneeott Cop.	53½
Kerr Lake	3½
La Rose	7/16
Magma	14½
McKinley-Dar-Sa.	30
Mines of Am.	2½
Mother Lode	.35
Nevada Hills	.21
New Utah Binghan	2½
Nipissing Mines	6¾
Oro	.06
St. Joseph Lead	14
South Utah	.25
Stand'd Oil of N.J.	486
Standard S. L.	1 1/16
Stewart	1 1/16
Success	.69
Tonopah	5/8
Tonopah Ex.	2 1/16
Tonopah Merger	.41
Tribullion	.50
Yukon Gold	2½

LONDON Oct. 11

	£	s.	d.
Alaska Tre'dwell	£6	7s	6d
Burma Corp.	1	9	3
Cam & Motor	0	14	0
Camp Bird	0	4	9
El Oro	0	7	6
Esperanza	0	7	6
Mexico Mines	3	11	3
Nechi, pfd.	0	12	6
Oroville	0	14	6
Santa Gert'dis.	0	7	6
Tomboy	1	0	3
Tough Oakes	0	6	9

BOSTON EXCH Oct. 26

Name of Comp.	Clg.
Adventure	1½
Ahmeek	396
Alaska Gold M.	33½
Algomah	2
Allouez	54
Am. Zinc	68½
Ariz. Com., ctfs.	7½
Bonanza	.40
Butte-Ballaklava	3½
Butte & Superior	65
Calumet & Ariz.	64
Calumet & Hecla	535
Centennial	17
Copper Range	56
Daly West	2½
East Butte	12½
Franklin	8¼
Granby	84
Hancock	16½
Hedley	27
Helvetia	‡ 50
Indiana	5
Island Cr'k, com.	43½
Island Cr'k, pfd.	87
Isle Royale	28
Keweenaw	2½
Lake	13½
La Salle	51
Mason Valley	2
Mass.	11
Mayflower	4
Michigan	2½
Mohawk	80
New Arcadian	10½
North Butte	29½
North Lake	1
Ojibway	‡1½
Old Colony	3½
Old Dominion	53½
Osceola	83
Quincy	82
Santa Fe	4½
Shannon	7
Shattuck-Ariz.	28½
Superior	27
Superior & Bost.	2½
Tamarack	51
Trinity	8¼
Tuolumne	.40
U. S. Smelting	43
U. S. Smelt'g, pf.	47
Utah Apex	2 1/16
Utah Con.	12½
Victoria	2½
Winona	3½
Wolverine	58½
Wyandot	1½

BOSTON CURB Oct. 26

Bingham Mines	7½
Boston Ely	.21
Butte & Lon'n Dev.	.32
Calaveras	1½
Calumet-Corbin	.02
Chief Con.	.08
Cortez	.50
Crown Reserve	.38
Davis-Daly	1½
Eagle & Blue Bell	1½
First Nat. Cop.	5
Houghton Copper	2½
Iron Cap Cop., pf.	8½
Majestic	65
Mexican Metals	23
Nevada-Douglas	65
New Baltic	2½
New Cornelia	8
Ohio Copper	14
Oneco	1
Raven Copper	.14
Rex Cons.	.48
Smokey Dev.	.15
So. Lake	6
Tonopah Victor	.30
United Verde Ext.	5½
Utah Metal	9½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28 983	26.553	22.751
February	61.642	57.506	48.477	28.357	26 573	22.753
March	57.870	58.067	50.241	26 663	26 788	23.708
April	59 490	58.519	50.250	27.416	26 958	23.709
May	60.361	58.175	49.915	27 825	26 704	23.570
June	58 990	56.471	49.034	27 199	25 948	23.267
July	58.724	54.678	47.519	27 074	25.219	22.597
August	59.293	54.344	47.163	27 335	25 979	22.780
September	60 840	53.290	48.680	27 986	24.260	23.591
October	60.703	50.654		28.083	23.199	
November	58 995	49.082		27.263	22.703	
December	57.760	49.365		26.720	22.900	
Year	59 791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.383
July	13.223	18.796	60.540	76.011	64 955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*		‡		‡	
November	11.739		53.227		‡	
December	12.801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33.360	38.790	150.790	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.323	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.378
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3 715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.550		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21 413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.566	49.588
May	5 074	14.781	4.924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	19.026	4.770	18 856	21.568	97.250
August	5 568	12.781	5.418	12.611	‡	67.786
September	5 380	13.440	5.230	13.270	‡	67.841
October	4 900		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13 90	13.45	14 13	13.95
May	14.90	14.61	13 90	13.60	14.27	13.83
June	14.99	14.70	13.90	13.67	13.96	13.77
July	14 90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14 90	16.86	13.90	15.95	14.03	15.70
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14 88		$13 78		$14.01	

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The Silver Hill Underground Hoisting Station

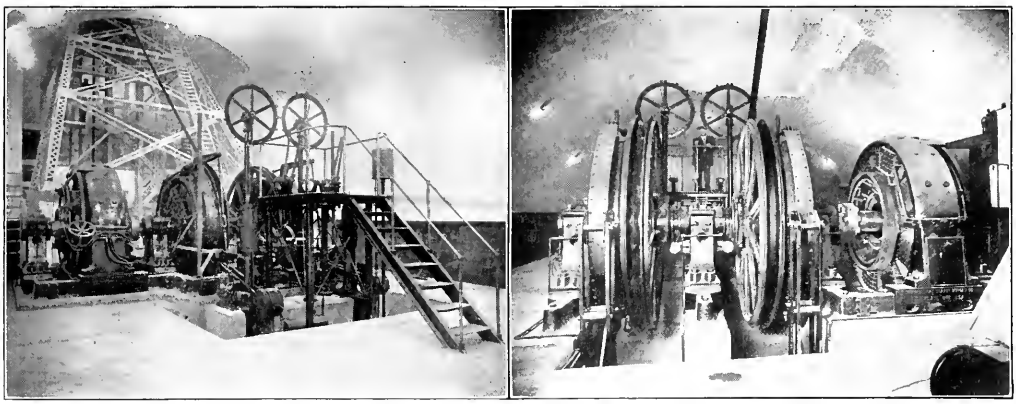
By James Humes*

SYNOPSIS—Unusually large underground shaft station cut in swelling ground traversed by a fault. Reinforced concrete used. Station is equipped with air compressors, blacksmith and carpenter shops, large hoist, all electrically driven, and a steel headframe. Total cost equipped, $104,070.

The largest underground hoisting station known to me is on the property of the Silver King Coalition Mines Co., of Park City, Utah, and is situated about in the center of the southwestern half of its holdings.

The western edge of the city limit is just about the eastern ore limit of this district, so far as known at the present time, and the King Coalition is mining 100 tons of ore per day within 1,400 ft. of the city limits and 300 ft. higher than the main street. This ore has to be hauled back into the mountain for about a mile, to the main hoisting plant, the haulage being accomplished by a 15-hp. electric locomotive, which delivers the trains of loaded ore cars at the 900-ft. level of the shaft. There is very little development work below the 900 level, east of the shaft. At this shaft, on the surface, are the shops, sampler and mill, hence all ore is brought to this point. Here also is the upper terminal of the aërial tramway that carries all crude ore and concentrates to the tracks of the Denver & Rio Grande and Union Pacific railroads. This shaft is 1,300 ft. deep and the lowest level is the mine's best producer; in fact, it is from the 1,300-ft. level that most of the shipping ore comes. The general course of this level is westerly, and the innermost workings are within 2,500 ft. of the Silver Hill shaft. This level measured along the main haulage way is about 1½ mi., and the length of the orebodies will measure fully half this distance. There are stopes working close up to the face of the main drift, and some of the ore is as high-grade as any that has been mined in the past and there is one-third of the company's undeveloped territory ahead of this level, in nearly the center of which is the Silver Hill shaft.

The Silver Hill shaft is at the inside end of the Alliance tunnel, which is 9,100 ft. long and is connected with the main Silver King shaft at the 500-ft. level by a 2,200-ft. crosscut. Both the crosscut and tunnel are laid with 30-lb. rails which make a speedy track for haulage purposes. It is intended to take all waste out to the portal of the tunnel and the ore to the Silver King shaft. The Silver Hill station is 1,650 ft. vertically below the surface.



ELECTRIC HOIST IN SILVER HILL UNDERGROUND STATION

From this description it will be seen: That the orebodies on the 1,300-ft. level as far southwest as is known show just as strong and as high-grade as any heretofore mined; that this level is getting so far ahead of the ventilating channels that it makes the ventilating problem

*Superintendent, Silver King Coalition Mines Co., Park City, Utah.

a serious one; that more than one-third of the undeveloped ground of this company lies southwest of these workings; that a large tonnage of ore will be mined above the 1,300 level and toward the new shaft, that could not be handled through the 1,300 level except at great cost. These are the main reasons for the Silver Hill shaft and the big station. The original plans evolved for a compressor and hoist room were carried out.

The plans called for a steel headframe, height to center of sheave, 38.5 ft.; sheaves 6 ft. diameter. Afterward this headframe was raised 8 ft. on concrete pedestals, making the height to center of sheave 46.5 ft. This change was a great improvement and was necessary to accommodate the skips, and it also placed the horizontal members of the headframe well up out of the way for handling long material into the shaft.

It so happened that a fault cut through the excavation, about in line with the dividing wall between the engine and compressor rooms; this added greatly to the cost of excavating and concreting these rooms.

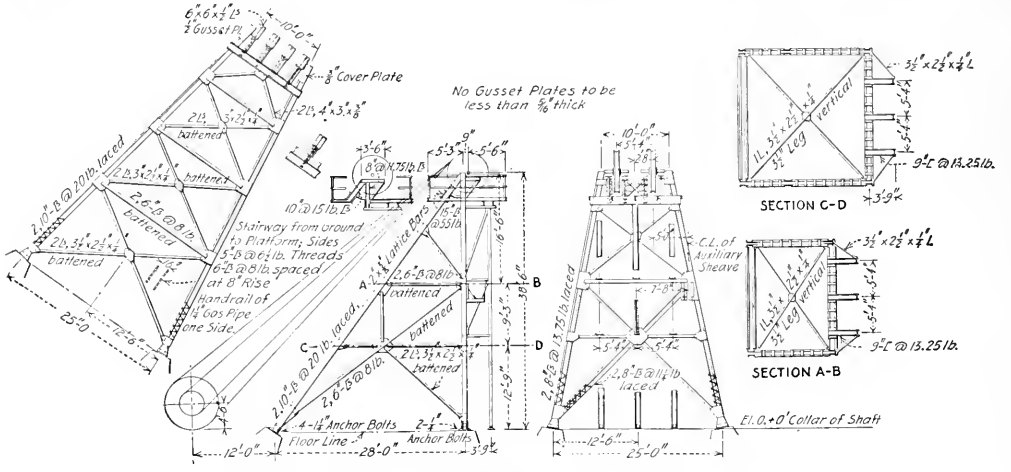
The width of the rooms being determined, work was started mining out a slice of rock the full width of the rooms and about 9 ft. high. While this undercut was being made, timber bulkheads and stulls were used to hold the back; this timber was of inferior grade, and most of it had been used in the mine before, so that it was not used for some purpose afterward. In the engine and compressor rooms were two floors of this kind of timbering and numerous stulls.

Very little powder had to be used after the undercut was taken out; indeed, the greatest concern was to prevent too much of the back from coming down. Two-inch plank was used for the wall forms, and 2x4's placed on edge over the arches.

The wall foundations were carried down below the floor level, and before placing the concrete a considerable number of holes were drilled with jackhamers, and in these holes were placed old car axles to give a bond. As the straight walls went up plenty of old rails were used for reinforcing.

A 1 to 3 mixture was used, with all the coarse rock it would cement—about 5 parts; this coarse rock was kept away from the face of the concrete about 1 in. In concreting the arches crushed rock was used which was put through the mixer with the cement. The sand was obtained from the mill, being taken from the Garfield roughing tables when the mill was running on carbonate ores. The cement used was made by the Portland Cement Co. of Utah, the works being in Parleys Cañon, near Salt Lake City.

This room is 44x25 ft. in the clear; the walls are 14 ft. to the spring of the arch and vary in thickness from 2



UNDERGROUND STEEL HEADFRAME, SILVER KING COALITION MINES

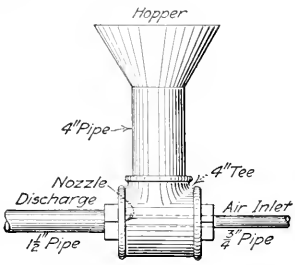
necessary to protect it from the blasts. When this undercut was taken out working lines and points were established from the shaft, which was at this time about 275 ft. in depth. From these established points sills were laid down that were to carry the false work, or timbers. These sills were level with the top of the wall plates of the shaft timber and parallel with same. All lines, angles and heights were afterward taken from these sills, hence the importance of getting them right in the beginning.

On these sills were erected square sets of the very best 10x10 Oregon fir; the caps and girts were cut the exact length of shaft posts and the posts are the right length to make end plates for the shaft, so that all of this timber will be used in the shaft. In fact, in all of this work the lumber that was used was so planned that it could be to 5 ft. The arch is elliptical, the major axis horizontal, and is supported in the center by two 18-in. I-beams, 48 ft. long. These I-beams had to be cut in two to get them into place and for transportation through the tunnel. They are supported in the center by a 12-in. extra-heavy pipe filled with cement, with a 24-in. hydraulic flange on each end. Resting on these beams and conforming to the curve of the arch are 80-lb. rails. These overlap on the beams and are spaced 3-ft. centers; the construction has the appearance of the backbone and ribs of a mastodon. Wherever the rock in the roof looked sound enough, long holes were drilled with stoping machines and an eye-bolt split at the end for a wedge was driven up into the bottom of the hole with a specially made hammer inserted in the chuck of the drill. Through the eye

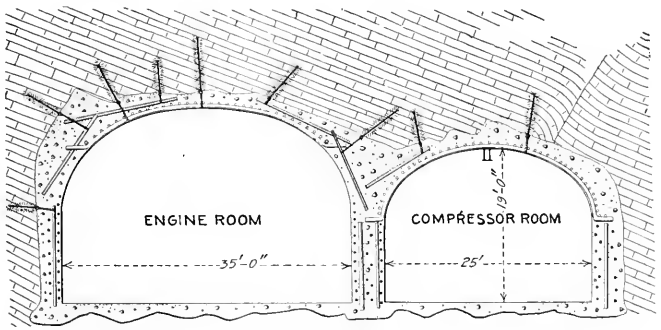
of these bolts and about the curved rails was bent steel cable; the ends were fastened together with the usual cable clamps. These loops were used wherever possible.

Discarded 4-in. boiler flues were placed on top of the curved rails, letting them lap at the ends. Thus they were 4 in. apart, except where they lapped, but before placing these tubes a network of small wire cable—discarded lacing from flat ropes—was woven from rail to rail in zigzag fashion. This network of wire was started at the spring of the arch and as it was brought up toward the center, the boiler tubes were placed in position. When a section was fixed in this manner, a coffer-dam was rigged at the open end and the pouring of the cement commenced.

The concreting of this room was a difficult matter, as the timber was set so close to hold the back that it was not easy for the men to handle the material and tools. When a man had no longer room to work above the reinforcing material, the space was filled with rock about as large as a man's hand. When the aperture was just about as full as could be of that-sized rock, a pipe was put through the forms, up through the loose rock and within ¼ in. of the rock in place; a second pipe was placed in the same manner, except that this one was pushed up against the solid back and then withdrawn ½ in. This last was the discharge pipe for the cement; the other was the discharge for the compressed air that carried up the cement which was forced up into the cavity with an air pressure of between 40 and 60 lb. This was continued just as long as any cement would be taken up. When the air would not take up any more, it was allowed to stand for 24 hr., when it was given another "shot." This was repeated several times. The concrete distributor is shown in the illustration.



CONCRETE DISTRIBUTOR



SECTION THROUGH SILVER HILL UNDERGROUND STATION

Method of Building the Engine Room

The engine room is 50x35 ft. The 35-ft. span has no other support than that given to it by the reinforcing steel. The curve of the roof, like the compressor room, is elliptical. The spring of the arch starts at the floor level and rises toward the shaft at an angle of 16° and then 37° until the ascending arch terminates with a height of 50 ft. Below the spring of the arch curved rails were placed on end and about 2 ft. apart; they extend above the spring of the arch from 7 to 8 ft. and were placed close to the face of the concrete. Long holes were drilled into the rock walls, in which were placed 1-in. eye-bolts to which the rails were tied by ⅞-in. wire ropes; some of the rails had as many as three such supports. The idea of reinforcing in this manner was to take all the strain possible off the main steel arches, or girders. These curved-steel girders were made of 4x4x½-in. angles bolted in pairs and placed 2-ft. centers. These also were supported by eye-bolts and wire ropes and laced with single strands taken out of the old tramway cables.

While the cement work of the hoist-engine room was in progress, work was carried on cutting out and timbering the space for the steel headframe. The timbers for this section had to be so spaced that the crossbeams would clear the headframe members. The first section, or floor as the miners called it, had 20-ft. posts, all timber being the best 12x12 Oregon fir. No sooner had this first floor been placed than men had to be put at work easing the rock from behind the posts on account of swelling ground, and from that time on a crew of miners had to be kept at that work. This did not look very promising for a permanent job.

When all the rock was out and the space ready for the headframe, the concreting of the engine room had been finished and all the forms were out, showing a clear space 35x50 ft., which looked so well that orders were immediately given to concrete the space required for the headframe and chutes. In doing this last, forms were put outside of the 12x12 timbers. The vertical walls of this section were well reinforced with 60-lb. rails laid horizontally; the back was arched the same as the other two sections, except the radius of the curve was less.

Several months have passed since these walls were concreted, but at no time have they shown the least evidence of the effect of the swelling ground, and there is no sign whatever of weakness in any part of the chamber. The difference between concreting and the best-known methods of mine timbering, in this instance, is the difference between success and failure. Had timber been used, there would have been no end to the cost of upkeep; as it is, the upkeep will be *nil*. Had this station been timbered, it would always have been damp, dark and cold; as it is, the temperature is just right, the walls are perfectly dry, the floors are cemented and all on the same level, the walls are whitewashed, so are the chutes and headframe, and the whole is well lighted with electric lamps; there are no dark corners and it is easy to keep it clean.

Along the tunnel and up to the shaft chutes for a distance of 160 ft., there are three tracks, and beyond the chutes there is enough track to accommodate 20 cars, which is about the size of the trains pulled by the three-ton motors. These tracks are fitted with automatic

switches so that the motorman does not have to get off the motor when he changes from the front to the rear end of the train. The chutes hold about 75 tons and are fitted with the Brunton arc chute doors. In front of the chutes there is considerable space that has been taken advantage of, by making it into a repair shop for drills and cars, equipped with a drill press, emery wheel, work bench, pipe-cutting tools and vises. Along the double tracks just mentioned are a blacksmith shop, carpenter shop and a change room for the miners, this last connected with the compressor room from which the warm air passes.

The blacksmith shop, about 100 ft. from the shaft, is cemented throughout. It was not the intention to do heavy blacksmith work in this shop, but for tools it is just the thing. It is equipped with a Leyner drill sharpener and a Case oil-burning forge, using a Utah 34 gravity oil, costing 8c. per gal. in small lots.

Compressor-Room Equipment

The installation in the compressor room consists of two Sullivan air compressors of the two-stage angle type: One 18x11x14 machine rated at 147 hp., capacity 704 cu.ft. per min., at 8,000 ft. belt driven by a synchronous motor-generator set; the other a 20x11x14 machine, capacity 873 cu.ft. per min. to 100 lb., at 8,000 ft., is direct-connected to a synchronous motor, type T. R. E. 32 poles, 225 r.p.m., 2,200 volts. These two compressors are to furnish air to run the shaft pumps and drills while sinking is going on. The sinking pumps will only be required to throw water from the bottom of the shaft to cement tanks that will be constructed every 200 ft. in the shaft. At each tank will be stationed a Jeanesville two-stage 600-gal. pump working against a head of 250 ft. At the 600 level will be placed a four-stage 750-gal. pump capable of working against a head of 600 ft.

In addition, in the compressor room, there is the belted exciter rated at 7.5 kw., 125 volts, for the larger compressor which has the usual amortisseur winding for starting. The switchboard for this machine is very simple, consisting of a single panel. The motor-driven exciter set is also in this room, and it is equipped with a standard type of starting compensator with automatic overload and low voltage protection, and is also equipped with a TD regulator for automatically maintaining constant voltage.

Engine-Room Equipment

The hoisting engine is a double-reel first-motion electric hoist built by the Wellman-Seaver-Morgan Co. The control is fine, the cages can be moved, in case of necessity, much slower than with a steam engine. The motor is 400 hp., and has ample power in reserve. The brakes and clutches are fitted with air cylinders which get their supply from a small 5-hp., G. E. direct-connected motor-driven two-cylinder 1,200 r.p.m. compressor.

The cables for the hoist are the flat-rope type, ½x4½ in., 1,600 ft. long. On the end of each rope is a 52-cu.ft. capacity skip, designed by me and built at our own shops. As these skips are too large for quick loading in the bottom of the shaft, provision was made for hanging a large bucket under them. These buckets are dumped into the chute pockets that are constructed for the different levels, and the ore hoisted at any time to the pockets at the shaft collar. The skips are provided with valves in the bottom, so that water can be bailed when necessary, and this has enabled the saving of the pumps more than once.

In front of the main hoist is a 10x12 double-cylinder single-drum hoist for handling the pumps, etc.

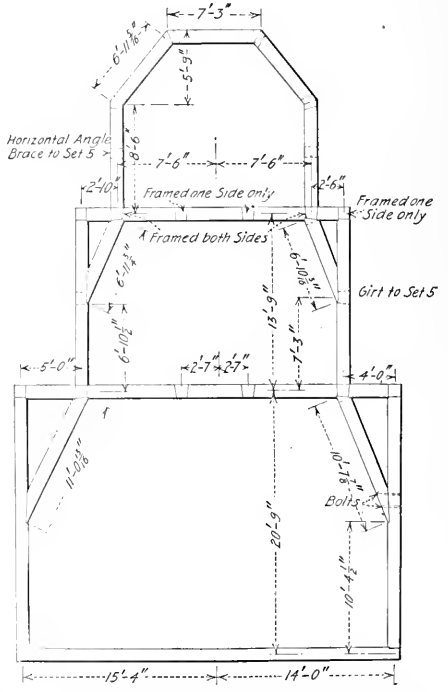
The Electrical Equipment

The electrical equipment for the control of the hoist consists of the following:

One direct-current generator driven at constant speed by the synchronous motor. Field windings consist of a regular commutating pole winding and three sets of windings on the main poles. The three sets of windings comprise a reverse series field of four turns per pole; a separately excited field giving a maximum of 5,000 ampere-turns at 125 volts; and a shunt field giving a maximum of 5,500 ampere-turns at 600 volts.

One direct-current motor direct-connected to the drum shaft of the hoist. Field windings consist of a regular commutating pole series winding, and a separately excited field on the main poles.

One drum-type controller and rheostat for controlling and reversing the separately excited field winding of the



TIMBER FRAMING FOR SILVER HILL UNDERGROUND HOISTING STATION

direct-current generator and by this means controlling and reversing the generator voltage, and hence controlling and reversing the speed of the hoist motor.

One rheostat (B) in series with the separately excited field of the direct-current generator for the purpose of making permanent adjustments of the control.

One rheostat (C) connected in series with the 600-volt shunt field winding of the direct-current generator for the purpose of making permanent adjustments in the control.

One hand-operated cutout switch for cutting out the 600-volt shunt field winding of the direct-current generator when it is required to operate the hoist at reduced speed (for repairs, examinations, etc.).

Two safety-limit switches for the purpose of automatically stopping the hoist at the top and bottom of the shaft.

One ammeter with zero at the center of the scale, for indicating the current to the hoist-motor armature and thus indicating the torque of the motor.

One voltmeter with zero at the center of the scale, for indicating the voltage across the hoist-motor armature and thus indicating the speed (and direction) of rotation of the hoist motor.

This control equipment is a modification of the standard Ward Leonard variable voltage control, the essential difference between the two being that in the standard system each notch of the controller corresponds to a certain definite speed (forward or reverse), whereas in the modified system each notch of the controller corresponds to a certain definite torque (forward or reverse).

In the operation of this system at starting, the controller can be moved instantly from zero to maximum position, resulting in maximum torque in the hoist motor. When it is required to stop the hoist, the controller may be brought back instantly to the zero position, corresponding to approximately zero torque.

The equipment is as fool-proof as a standard Ward Leonard control with mechanical limit on the controller, and by reason of the elimination of this mechanical retarding gear on the controller drum, the operation is easier and more flexible. In its characteristics it closely resembles the control of a steam or air hoist, with the advantage that the single controller handle performs all the operations corresponding to regulation of the throttle and the reversing valve gear of a steam or air hoist.

In order to provide for slow-speed operation of the hoist, a cutout switch is connected in the 600-volt field circuit, and when this is cut out the equipment operates in the same way as a standard Ward Leonard control, each notch of the controller representing a certain definite speed, except that the whole range of the controller covers speeds from zero up to about one-third speed.

The portion of the electrical equipment that is on the operating platform of the hoist consists of the controller which, as aforesaid, regulates the torque of the hoist motor; a large illuminated dial ammeter reading both ways, which indicates the amount and direction of the torque; a large illuminated dial voltmeter reading both ways, which indicates the direction and speed of rotation of the hoist; and a small cutout switch as described, for use when running at slow speeds, for stretching rope, examining shaft, etc. The total cost of the underground station is given in the accompanying table.

CONSTRUCTION AND EQUIPMENT COSTS

Excavations, including the engine and compressor foundations 144,900 cu.ft. at $0.09 (labor only)		$13,041 00
Framing and placing timber		3,150.00
Tramming 14,400 cars (18 cu.ft. capacity) by electric motors to portal of tunnel, 9,000 ft. at $0.0812 per car		1,169.28
Tramming 2,872 cars of sand from mill to station 10,000 ft. at $0.09. Cost per cu.yd. concrete	$0.15	258.48
Placing forms. Cost per cu.yd. concrete	.9572	1,650.00
Bending reinforcing steel	.1085	187.00
Power, concrete mixer, crusher, small hoist	.4266	735.00
Placing concrete and crushing rock	6.7656	11,657.19
Cement	3.9621	6,826.76
10% loss in timber and plank for forms, etc.	.2386	411.12
Reinforcing steel bought	.6828	1,176.59
	$13.2918	
Tunnel haulage, by electric motors, timber-machinery, reinforcing material, headframe, men and all other supplies		3,252.24
Transferring machinery from wagons to mine trucks, unloading same at station and placing the heaviest pieces in position and laying 9,000 ft. of electric cable		3,618.00
Railway and wagon freight		2,056.72
Lighting		293.17
Explosives		934.78
Timber for skip pockets, etc.		456.00
Iron and steel for skips, chute bottoms, bolts, etc.		585.82
Electrical consulting engineers		1,000.00
Shop labor, building skips, erecting machinery, installing electrical apparatus, headframe, etc.		4,291.32
		46,750.47
Electrical machines, compressors and hoist		57,320.00
Total cost of underground station built and equipped		$104,070.47

The portion of the electrical equipment that is on the operating platform of the hoist consists of the controller which, as aforesaid, regulates the torque of the hoist motor; a large illuminated dial ammeter reading both ways, which indicates the amount and direction of the torque; a large illuminated dial voltmeter reading both ways, which indicates the direction and speed of rotation of the hoist; and a small cutout switch as described, for use when running at slow speeds, for stretching rope, examining shaft, etc. The total cost of the underground station is given in the accompanying table.

I wish to express my thanks to Lenord Wilson, electrical engineer, and to J. B. Ambler, electrical expert for the General Electric Co., for their help in the preparation of the electrical data in this article. In the construction of the station Merrian Longmire, who was foreman in charge, should be commended. The work was done with credit to himself and profit to the company, and in all the dangerous work not a man was hurt.

*

Lead-Smelting Projects in the Coeur d'Alene

The following interesting article, slightly condensed, that appeared in the circular of Norman & Muxen, of Spokane, Sept. 20, 1915, shows how the smelting situation in the Cœur d'Alene is viewed by some eyes.

Since last month evidence has accumulated to support our analysis of the smelting situation as it affects the Cœur d'Alene district. There is now no doubt that the American Smelting and Refining Co. has so manipulated matters as to assure to itself practically undisputed sway in the district. Combination with its erstwhile rivals has killed competition, and when outside contracts expire, as they will within the next 18 months, the entire district will pass under the domination of the most unscrupulous and rapacious combination that has ever squeezed life out of legitimate business. As we see it, indications now point to a defensive and offensive alliance with American Metal Co., the last rival.

To understand the situation it is necessary to go back a little. Ohio & Colorado Smelting Co. is controlled by the American Metal Co. and the latter controls the product of the great Interstate-Callahan lead-zinc mine. Lead ores of Tamarack & Custer, controlled by the Day family, are also under contract to Ohio & Colorado, but, since Hercules closed down in May last, its ores have been forwarded to the East Helena plant of the "trust," under an amicable arrangement between the two smelting companies. Tamarack & Custer is now connected with the rehabilitation of the old Le Roi smelter, at Northport, Wash.

Some weeks ago it was rumored that the sharp drop in price of lead was due to a severe fight between the two big selling agencies, which had previously entered into a "gentlemen's agreement" to divide the European demand. However, it was not surprising when announcement was made that the "trust" had declined to divide up a big British order with the American Metal Co. Then price-slashing was commenced, and meanwhile the supposed rivals made more secure their hold upon the producer. Peace has doubtless settled down over the frenzied belligerents, and both are laughing in their sleeves at the easy conquests they have made.

A little later occurred the trouble between stockholders of Interstate-Callahan, and again is seen the light-fingered touch of the "trust" and its latest satellite. Eugene R. Day, president and general manager of Hercules, brother of Harry L. Day, president and general manager of Federal Mining and Smelting Co. (controlled by the "trust") and of Jerome J. Day, president and general manager of Tamarack & Custer Consolidated, has been named receiver by the Shoshone County courts while litigation affecting smelting contracts with American Metal Co. is in progress. It all makes a nice, compact little family party.

Harry L. Day, brother-in-law of Edward Boyce, former president of the Western Federation of Miners, multi-millionaire of Hercules making, still remains as manager of Federal. The alignment therefore seems to indicate a combination of American Metal-Guggenheim-Days against Bunker Hill & Sullivan. International Smelting Co., a subsidiary of Anaconda, which made such a drive after lead-smelting business three years ago, has lain down with the metallic lion like a

good little lamb. There is no possibility of real competition in that direction, nor from United States Smelting Co., and contracts now in effect will doubtless be dropped as they expire. This will throw Marsh and Hecla into the maw of the combination within two years.

Further, we believe that James Hill, the railroad magnate, has joined the combination with attractive freight rates and that the stage is set for a "ring-around-the-rosy" dance, with the lead production of the Cœur d'Alenes in the center and American Metal, Jim Hill, Daniel, Simon, Isaac and lesser Guggenheims, Harry L., Eugene R. and Jerome J. Day as the coryphees. It will be an all-star bill, but expensive entertainment for the Cœur d'Alene producer. Before the whirl is over we expect to see Tamarack & Custer taken in by the "trust" through Federal and an effort made to mulct the fool American public once more with this moth-eaten, disreputable and dry-squeezed stock.

The third paragraph of the foregoing strikes us as betraying imperfect information about the lead market, and there may be some misconceptions in other paragraphs, but the essay is entertaining, even if it be inaccurate.

Interstate-Callahan Fight

WALLACE CORRESPONDENCE

The fight for control of the Consolidated Interstate-Callahan company, which was precipitated at Duluth a few months ago and resulted in the election of two boards of directors, will now be transferred to the Federal court for the district of Idaho. When the Interstate and Callahan companies were consolidated several years ago, each received 170,000 shares in the new company. Those to the Interstate were distributed among the stockholders of the original company, but those to the Callahan have been held intact, the latter company still maintaining its corporate existence. Of this amount about 70,000 shares are owned by James F. Callahan, and his friends own enough to make more than a majority. Therefore they control the Callahan company. An effort was made in the district court here to force a distribution of this stock, but it failed, the court holding that it was a matter of which the directors had control. At the recent annual meeting in Duluth, what is known as the Callahan-Boutin faction attempted to vote this stock, which, with other shares friendly to them, would have given the control. The Robbers-Percival crowd, which is in actual possession of the affairs of the company, refused to permit the Callahan stock to be voted and proceeded to elect directors and officers. The Callahan-Boutin faction thereupon withdrew and also elected directors and officers.

The next move for control was made in this city a few weeks ago, when the Callahan Mining Co., Joseph Boutin and others filed complaint against the Consolidated Interstate-Callahan Mining Co., as represented by the officers elected by the Callahan-Boutin faction, and asked for the appointment of a receiver to take charge of the company's property and handle its business until such time as the question as to which set of officers was legally elected is settled by competent authority. Judge Woods, of the state court, granted the petition and appointed Eugene R. Day, manager of the Hercules mine, receiver. It was then, for the first time, that the Robbers-Percival faction, at the New York office, heard what was doing. The receiver had filed a bond of $300,000 and was about to take possession of the mine, when an appeal was made to Judge Woods to stop further proceedings until the Robbers-Percival crowd could be heard. This was granted, and a few days later a question of jurisdiction was raised and Judge Woods was asked to grant time for an appeal to the United States court for the district of Idaho. This was granted, and the appellants were also required to file a bond for $300,000 as a guarantee against damages on account of the receiver's not taking charge. The Consolidated Interstate-Callahan Mining Co. is an Arizona corporation and none of its officers are residents of Idaho. The case was submitted to Judge Deitrich, of the Federal court, who a few days ago rendered his decision granting the petition to transfer the case to the United States court. In his opinion Judge Deitrich admitted that the case involved many perplexities and that he would, if desired, hear further argument upon motion to remand, and this will doubtless be the next move of the Callahan-Boutin attorneys. The attorneys for the Robbers-Percival faction will no doubt move to have the entire proceedings dismissed and at the same time endeavor to bring the question of the Callahan stock to an issue in the Federal court, in the hope of securing an order for its distribution to the individual stockholders.

The case is one of absorbing interest here, and outside of the many interesting points involved that appear in the court record, the opinion is advanced in some quarters that the appointment of a receiver would eventually be followed by a readjustment of large interests, which might mean the obliteration of the Interstate-Callahan in the process of effecting a consolidation upon even a greater scale.

The Wisconsin Zinc District—III

In the article on the Wisconsin Zinc District—III, in the *Journal* of Sept. 4, 1915, p. 387, an error occurred

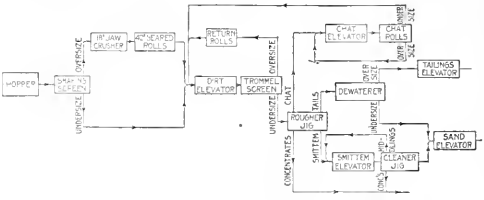


FIG. 32. FLOW SHEET OF ZINC TREATMENT

through which an entirely foreign illustration appeared as Fig. 32. The drawing shown herewith is the flow sheet which should have been shown.

Victoria Mineral Output, 1914

The mineral output of Victoria during 1914, according to the Secretary for Mines, was valued at £2,086,183, a decrease of £85,294 from the preceding year. The gold produced (113,218 oz.) was valued at £1,755,236. Other items, in descending order of value were: Coal, 617,536 long tons; antimony ore, 7,603; tin ore, 53; diatomaceous earth, 1,000; silver, 13,460 oz.; gypsum, 1,077 long tons; kaolin, 808; brown coal, 2,715; manganese ore, 20; magnesite, 23 long tons.

The Potential Waterpower of the Pacific Coast is given by J. W. Beckman at 11,504,000 hp. (San Francisco meeting, American Electrochemical Society). Of this Washington has 4,932,000 hp.; Oregon, 3,148,000 hp.; California, 3,424,000 hp. The amount developed is said to be: Washington, 306,000 hp.; Oregon, 105,000 hp.; California, 430,000 hp.

Geology of Tintic Ore Deposits*

SYNOPSIS—Early mining done about equally in igneous and limestone formations. Since 1913 all production has come from limestone in northern section of district. Monzonite, the youngest of the igneous rocks, considered the mineralizing source of all important Tintic orebodies. There are three types of ore deposits—limestone-igneous contact, limestone replacement, and igneous deposits.

The first geological report on the Tintic district to be issued was that by Tower and Smith, published in 1899, in the form of a paper in Part III of the *Nineteenth Annual Report of the United States Geological Survey*, and also as *Folio No. 65, Geologic Atlas of the United States*. About four years ago a second investigation was begun by Waldemar Lindgren and G. F. Loughlin, of the United States Geological Survey. With the exception of a paper on the oxidized zinc ores of the Tintic district by Mr. Loughlin, the results of their work are still unpublished.

Situation, Topography and History

The Tintic district lies about 65 mi. due south of Salt Lake City and on the west central slope of the Tintic Mountains, a short range which forms the connecting link between the Oquirrh Mountains on the north and the Cañon Range on the south—the group constituting the first of the Basin ranges to the west of the Wasatch Mountains.

The productive portion of the district embraces an area about 6 mi. long and 2 mi. wide, which is divided between Juab and Utah Counties. Within this area are the towns of Eureka, Mammoth, Robinson, Silver City and Knightsville.

As in most of the Basin ranges, topographic relief is strong, dropping rapidly from peaks of 8,100 ft. above sea level to elevations of 5,600 ft. in Tintic Valley on the west and 4,500 ft. in Goshen Valley on the east.

Tintic is among the oldest mining camps in Utah, being antedated only by Bingham, Rush Valley and Little Cottonwood. Ore was first discovered in the monzonite about 1 mi. east of Silver City in December, 1869, and the district was organized in the following spring. The first claim recorded was the Sunbeam, located Dec. 13, 1869, on the first discovery. This was followed in quick succession by locations in the limestone; first on the Mammoth ledge near the middle of the district, and shortly after on the Eureka Hill ledge near its northern end.

Mining operations began at once with the construction of two mills and as many smelteries during the first 12 months. Once located, the orebodies have been found to be fairly persistent.

During the early days of the district the production was about equally divided between the deposits in the igneous rocks at the south end of the district and those in the limestone at the north end. But upon the exhaustion of the oxidized ores in the igneous rocks, due to high water level, the balance of production was shifted to the deposits in the limestone; and since the closing of the Swansea mines at Silver City in 1913, the entire production has been from the latter deposits. The total production of the district to Jan. 1, 1914, was $143,398,119.

Areal Geology of the District

The rocks of the Tintic district consist of Paleozoic sediments and a variety of igneous rocks of Tertiary age.

The sedimentary rocks consist mainly of quartzite and limestone having a total thickness of 12,000 ft. or more. For economic and lithologic reasons they have been subdivided in descending section as follows:

Humbug sandstone Humbug limestone	Constituting the Humbug formation of the United States Geological Survey.
Tetro limestone Carbonaceous shale Blue Fossiliferous limestone Chief Consolidated limestone Gemini limestone White-lime-shale	Constituting the Godiva limestone of the United States Geological Survey
Centennial limestone Golden Ray limestone	Constituting the Eureka limestone of the United States Geological Survey.
Tintic slate Tintic quartzite	Constituting the Tintic or Robinson quartzite of the United States Geological Survey.

At the top of the section is the Humbug sandstone, on the east slope of the Godiva Mountain. This is 224 ft. thick, and is not known to be ore bearing.

The Humbug limestone, 378 ft. thick, consists mainly of nearly pure, coarse-grained gray limestone with a few intercalated beds of arenaceous limestone of yellowish buff color. This formation is well exposed on the upper east slope of Godiva Mountain and has carried most of the ore in the Godiva-Sioux Mountain and Iron Blossom ore zones.

The Tetro limestone, 355 ft. thick, consists with little variation of hard, fine-grained, blue cherty limestone which is not known to be ore bearing.

The Carbonaceous shale, 160 ft. thick, is essentially a thinly bedded, black shaly limestone, containing bands of black chert, and weathering to a platy or shelly surface. It is most unpromising as an ore-bearing medium and is nowhere known to be mineralized.

The Blue Fossiliferous limestone, 542 ft. thick, consists of 300 ft. of blue cherty limestone in beds from 1 to 3 ft. thick, resting upon 242 ft. of blue, highly fossiliferous limestone in thin beds separated by thin partings of impervious clay shale. This formation has been quite extensively prospected, and found to carry no orebodies of importance.

The Chief Consolidated limestone, 615 ft. thick, consists of a series of contrasted horizons which in descending order, have the following characteristics:

80 ft. of very coarse-grained, massive dolomitic limestone, on the whole quite favorable to mineralization.

64 ft. of fine-grained, siliceous, hard, brittle, black limestone, which is generally barren, though running the entire length of the ore-zone in the Chief Consolidated mine.

38 ft. of medium-grained, fairly pure, blue limestone in thin beds, but with a few black shaly partings, which appear to offer some resistance to mineralization.

31 ft. of coarse-grained, pure, white to light-gray limestone, which appears to be especially favorable to mineralization.

120 ft. blue, flaky and fairly pure limestone, which also appears to be especially favorable to mineralization.

72 ft. of coarse, mottled, light-gray, massive dolomitic limestone, readily susceptible to mineralization.

212 ft. of fine-grained, ashy-gray impure limestone with 11 or more intercalated thin beds of quartzitic sandstone

*Abstract of paper to be presented by Guy W. Crane, Eureka, Utah, at meeting of American Institute of Mining Engineers, February, 1916.

The horizon lies to the west of the ore zone proper, and its character is such as to discourage exploration for ore within its limits.

The Gemini limestone, 902 ft. thick, consists of 45 or more relatively thin alternating horizons of blue, gray, light-gray and white limestone of varying texture and hardness, but all generally distinctly bedded. The formation is especially characterized by its purity, that is, lack of siliceous members, and general susceptibility to mineralization.

The White-lime shale, 920 ft. thick, consists throughout of fine-grained, bluish-gray, thinly bedded shaly limestone with a few thin conglomeratic beds of the interformational type. It is generally extensively sheeted where folded and weathers to a yellowish white, whence its name. It is characteristically unfavorable to mineralization and is not known to be ore bearing.

The Centennial limestone, 798 ft. thick, consists of four relatively thick horizons of massive dark-blue limestone interspaced by as many relatively thin horizons of thinly bedded light-gray limestone and one 6-ft. member of thinly laminated light-green shale. Except for the shale and two 20-ft. impure sandy horizons, the entire formation is apparently favorable to mineralization.

The Golden Ray limestone, thickness 1,559 ft., consists of five thick horizons of heavily bedded dark-blue to bluish-gray dolomitic limestone interspaced by five relatively thin horizons of fine-grained light-gray to white, thinly laminated impure limestone. While this formation is not known to be ore bearing, a large part of it possesses characteristics that are apparently favorable to ore deposition in other ore-bearing horizons.

The Tintic slate, thickness 358 ft., consists essentially of thinly laminated green slate with intercalated bands of impure, gray banded limestone near the top and thin bands of brown quartzitic slate near the bottom. The formation is highly sheeted, due to folding. Its siliceous and wholly barren nature does not invite exploration.

The Tintic quartzite, the lowest member in the stratigraphic series, is not fully exposed, but has an estimated thickness of 5,000 to 7,000 ft. It is for the most part a pure, compact, fine-grained quartzite, white to pink in color. Bedding is indistinct and readily confused with a pronounced sheeting due to folding. Occasional interspaced thin beds of pebble-quartz-conglomerate break the general massive nature and lend a clue to the structure.

The Igneous Members

The igneous rocks consist of rhyolite, andesite, tuff and breccia, and monozite, all of Tertiary age.

The Packard rhyolite, locally referred to as porphyry, occurs as surface flows and intrusive dikes. It occupies a large area in the northern end of the district and, underlying the town of Eureka, extends to the north and east in a range of hills of which Packard's Peak is the most prominent. Its thickness at this point probably exceeds 1,000 ft. The rhyolite varies in color from pink and light purple to light and dark gray. In texture it ranges from glassy to highly granular, with flow banding as a common characteristic.

No metalliferous deposits are known to occur with the Packard rhyolite. Its chief economic interest lies in the numerous springs issuing from the lower slopes, from which the entire water-supply of Eureka and the mines in that section of the district is obtained.

Large areas of andesite with associated tuff and breccia lie to the east and south of the productive portion of the Tintic district. They are for the most part older than the metalliferous deposits and have no genetic relation to the latter.

The Sunbeam monzonite is confined to the southern half of the district, where it forms the country rock over an area 4 mi. in length, north and south, and 2 mi. wide. It is the youngest of the igneous rocks and occurs in the form of an intrusive stock, cutting and enveloping fragments of all the earlier formations. On the north it lies in an irregular but nearly vertical contact with the limestones, which it has metamorphosed through a zone varying from 300 to 500 ft. in width. On the east and south it is in irregular contact with the andesite. Its western boundary is obscured by the overlapping, alluvium-filled valleys, Ruby Hollow and Diamond Gulch, which show it to have been deeply eroded.

In color it is light to dark gray, usually with greenish-brown tinge. In texture it is normally evenly granular, but varies from porphyritic on its east and west boundaries to granitic where it is in vertical contact with the limestones.

What is known as the Swansea rhyolite is probably a rhyolitic phase of the monzonite and belongs to the same period of intrusion. The monzonite is a formation of first importance, since it has been the mineralizing source of all the important orebodies in the Tintic district.

Structure Mainly Synclinal

The sedimentary formations are folded into a simple and fairly symmetrical overturned syncline, the major axis of which strikes north and south and pitches slightly to the north. The axial plane of the fold dips about 60° to the west, resulting in vertical and often overturned dips in the beds of the east limb of the syncline, while the angles of the dip of the beds in the east limb are correspondingly low, rarely exceeding 40°. By reason of its pitch, the syncline becomes wider to the north where the trough is folded into a series of crenelations, forming a wide synclinorium. South of the Ajax fault, which extends from the Mammoth mine east to the Iron Blossom No. 3 mine, no synclinal structure is obtained. While the beds on the north of the fault are steeply inclined, conforming to the normal structure of the syncline, those on the south are relatively flat, lying with gentle dips to the east, in which direction no return dips are observable, because of a thick covering of volcanic rocks.

The folding of the sediments was accompanied by extensive faulting, fracturing, fissuring and sheeting. The major faults are of the transverse type, striking in a nearly east-west direction across the line of the major fold. These faults show lateral displacements ranging from 500 to 3,000 ft. The direction of throw is usually to the east on the south. Connecting the major faults at various angles are numerous minor faults showing displacements ranging up to 200 ft. Rotary faulting is common, as is shown by marked disparity in the attitude of the beds along the plane of the faults. The major faults are usually accompanied by one or more parallel faults, inclosing a breccia or sheared zone. The occasional occurrence of breccia zones and slickensides parallel to the bedding planes must be interpreted as evidence of some faulting of this type. None of the faults are known to extend into the igneous rocks, which are evidently of later

origin. While it is probable that most of the faulting occurred during the period of folding, it is not unlikely that some faulting and fracturing accompanied the intrusion of the monzonite, though none of this origin has been recognized.

Fractures and fissures occur in both the igneous and the sedimentary rocks. Sheeting is confined to the latter.

In the Sunbeam monzonite and its porphyritie phase, the Swansea rhyolite, are numerous ore-bearing fissures which have a general north-south direction, but vary from as much as N 20° W to N 45° E. These fissures are of the stretch type, due to shrinkage accompanying the consolidation of the igneous intrusives. For this reason they do not extend into the adjacent sedimentary rocks.

The sediments during the period of their deformation were extensively fractured and sheeted, generally along shearing planes. The fractures, which are usually steeply inclined, are most numerous in the steeply dipping beds and in the vicinity of the major faults. They trend at all angles, those in the northeast and southwest quadrants being the most abundant.

Sheeting has occurred in the quartzite, slate and more impure shaly limestone beds, where these have been closely folded. It is best developed in the Tintic slate, and the White-lime-shale, along the western limb of the syncline. The Tintic quartzite also is extensively sheeted.

The Ore Deposits Are of Three Types

There are three types of ore deposits in the Tintic district: limestone-igneous contact deposits; limestone replacement deposits; and deposits in igneous rocks.

At numerous points along the contact of the limestone and the igneous rocks, particularly the Packard rhyolite, are thin deposits of iron and manganese oxide associated with more or less red and greenish jasperoid and clay-iron stone. The jasperoid has been observed to grade into the limestone of which it is a replacement. The iron-manganese deposits occur both at the contact and filling cavities in the limestone near the contact.

Deposits of this type are widely distributed over the district, particularly its northern end, where because of the resemblance of the associated jasperoids to certain phases of the quartz in the productive limestone replacement deposits, they have received considerable attention from prospectors.

Locally, small quantities of silver and gold have been reported, but except for the iron ores that have been mined intermittently for fluxing purposes, these deposits have no economic importance.

The ore deposits in the igneous rocks are confined to the southern half of the district, where they occur as veins in well-defined stretch fissures in the Sunbeam monzonite and Swansea rhyolite. The veins are as a rule nearly vertical, with frequent croppings at the surface. They have general north-south courses but vary from N 20° W to N 45° E. One, the Sunbeam, has been worked through a length of 2,000 ft. on the strike, but most of them pinched out at a distance of a few hundred feet.

As shown by the old workings, the veins vary in width from a few inches to 10 ft., usually pinching with depth. The average width is about 2 ft. The ore in its unaltered state consisted of silver-lead sulphides and sulpharsenides, occurring in bands and lenses in a gangue of quartz and pyrite. These materials constituted about three-quarters of the mass of the vein. Considerable copper occurred in some of the southern mines, while those in the north have produced lead and silver almost exclusively. Gold occurred sparingly in but few of the deposits. Ground-water level was usually encountered at a depth of from 200 to 700 ft., depending upon the proximity of the sediments. Above water level, the ores assumed the usual oxidized character, with some secondary enrichment. Below ground-water level there was marked decrease in the value and size of the orebodies. This and water troubles usually caused an early cessation of mining, and today all these properties with one or two exceptions are indefinitely abandoned. Since the closing of the Swansea mines in 1913, there has been no noteworthy production from deposits of this type.

Four Ore-Bearing Zones

The orebodies formed by replacements in limestone are confined to the northern half of the district and include all the now productive mines. Mining operations have developed four nearly parallel ore-bearing zones, within which the orebodies appear to be virtually continuous, though at intervals the connections may be mere seams of quartz. These zones have a general north-south direction and may be defined as follows:

The Eureka zone, including the Centennial Eureka mine on the south and extending through the Eureka Hill, Bullion Beck and Gemini mines to the Ridge & Valley mine on the north.

The Mammoth zone, beginning at the Black Jack mine on the south and extending through the Lower Mammoth, Phenix, Gold Chain, Mammoth, Grand Central, Victoria, Eagle & Blue Bell mines to the Chief Consolidated mine on the north.

The Godiva-Sioux Mountain zone, beginning at the North Star mine on the south and extending through the Red Rose, Carisa, Northern Spy, Utah, Uncle Sam, Yankee, May Day and Apex mines to the Godiva mine on the north.

The Iron Blossom zone, beginning at the Dragon Consolidated mine on the south and extending through the Black Dragon, Governor, Iron Blossom Nos. 1 and 3, Sioux Consolidated, Colorado Nos. 1 and 2, and Beck Tunnel No. 1 mines to the Beck Tunnel No. 2 mine on the north.

The Eureka zone is the shortest and at its northern end is divided into two or more channels. At its southern end it appears to connect with the Mammoth zone through the Grand Central mine, in which case it is a branch of the Mammoth zone. These two zones lie on the west limb of the syncline, where the beds are nearly vertical and their orebodies have great vertical range.

The other zones are well defined throughout their length of about 2 mi. and apparently have no interconnections. They lie near the trough of the syncline, and their orebodies are correspondingly shallow.

Like replacement deposits in general, those of Tintic are very irregular in form, but in both shape and size they are governed within certain limits by the associated structures. This explains the dissimiliarity in occurrence of the orebodies in the different zones.

In the Eureka and Mammoth zones, which are in the nearly vertical beds of the west limb of the syncline, ore has been mined from the surface to the depth of 1,800 ft.; the orebodies as a rule conforming very closely to the bedding in both strike and dip.

If any one form of orebody can be said to be typical of these zones, it is that of an irregular sheet, pinching and swelling along the line of the beds and feathering upward into chimneys, or pipes.

Where the ore channel is crossed by faults or zones of fracture, there is usually an enlargement of the orebody along the line of intersection of the faulting and the bedding. This gives rise to another very common type of orebody, characteristic of the western zones, where it is usually the most largely productive form.

At the intersection of the ore channel by a fault, it is not an uncommon occurrence to find that the line of mineralization turns from the plane of the beds and follows the fault for distances up to 100 ft. or more, before again taking the usual course along the beds. Occurrences of this kind probably also account for the occasional division of a single ore channel into two or more parallel ore channels.

In the Godiva-Sioux Mountain zone, the known orebodies have smaller vertical extent but greater lateral variation than do those in either the Eureka or Mammoth zones. This is probably due to the fact that the Godiva-Sioux Mountain zone lies nearer the trough of the syncline where the beds dip at relatively lower angles, seldom exceeding 60° and sometimes as low as 15°.

In the Iron Blossom zone, particularly in its northern half, we find still greater restriction in both vertical and lateral extent of the ore than of the other ore zones. This, again, can be attributed to the controlling influence of the structure, since this portion of the zone takes a course directly in the trough of the syncline. The south half of the zone traverses beds dipping at angles up to 30°, and here the orebodies resemble more closely in form those of the Godiva-Sioux Mountain zone.

Among the several formations described, there are only four which are known to be ore bearing. These are the Centennial, Gemini, Chief Consolidated and Humbug limestones. In each case the ore-bearing formation contains several horizons of coarse, soft and relatively pure limestone, while the remaining formations are more generally fine-grained, hard and siliceous, in that they carry varying proportions of shale and sand.

The influence of magnesia in the limestone is not clearly shown. One dolomitic horizon in the Chief Consolidated formation is quite generally mineralized, while another is only sparingly so. The dolomites are usually coarse-grained—a favorable factor, which may offset the disadvantages of difference of solubility.

By reason of the folded and broken state of the limestone beds, the ground-water level is extremely low (about 4,765 ft. above sea level) in the sedimentary rocks. This puts it at depths beneath the surface of from 2,300 ft. in the higher properties to 1,500 ft. in those having shafts at relatively lower positions. This condition has led to more or less complete oxidation of the original sulphide ores, with some downward segregation of the ore minerals, and some enrichment due to shrinkage in volume.

Origin, Distribution and Character of the Ore

Very little ore has been mined below ground-water level; but developments have demonstrated its continuity into that zone, and something as to its original sulphide character. Above the water level the ore is largely oxidized.

From the earliest days an important variation in the north and south distribution of the ore minerals in the several ore zones has been noted. It appears that gold-copper ores predominate at the south end of the zones, gradually giving place to increasing proportions of silver-lead ores to the north, where the latter minerals predominate. As a result the mines in the vicinity of Mammoth have been chiefly producers of copper and gold, while those in the vicinity of Eureka are chiefly producers of silver and lead. Zinc is found associated with the ore of both ends of the district, probably more frequently in the mines at the north. Vertically the ore zones show no such striking variation in mineral content; but generally the good gold stopes are in the upper levels.

The vertical extent of an ore zone is governed primarily by the accompanying structures. The more nearly vertical are the inclosing beds, the greater the vertical range of the orebody. The presence of faults and fissures also favors greater vertical range, irrespective of the angle of the bedding. Their influence is greatest, of course, where the bedding is nearly vertical. The large orebody in the south end of the Chief Consolidated mine, which has a vertical range of 1,000 ft. or more, rakes along the inclined line of intersection of vertical beds and a large cross break.

Importance of the Monzonite

The occurrence of the Tintic deposits both within the monzonite and in the immediately adjacent limestones; the character of the mineralization, which is now generally considered to be due to the action of hot solutions; the progressive change in the mineral composition of the ore with increased distance from the monzonite—all point to this rock as the prime factor in the mineralization. In this respect the deposits of Tintic are like the many others in the southwestern part of the United States, and particularly in western Utah, which are as a rule closely connected in origin with igneous (commonly monzonite) intrusions.

The localization of the deposits within the monzonite was determined by the formation of stretch fissures within the congealing magma, which furnished channels of circulation for the hot solutions that were given off during the period of cooling.

The localization of the deposits in the limestone was controlled in part by the attitude and character of the beds and in part by the presence of fissures, some of which were probably produced during the period of monzonite intrusion.

Following the fissures caused by the intrusion, the hot mineral-bearing solutions found their way through the fractured and metamorphosed zone into the unaltered limestone, where they naturally took the easiest avenue afforded. This, in the absence of open faults and fissures, was the plane of the bedding.

Where the dip of the beds approached the vertical, the solutions found channels at various elevations, ascending or descending as conditions allowed, but laterally confined to relatively narrow limits. Flat-lying and low-pitching beds, on the other hand, have tended to confine the solutions to a more nearly horizontal course, at the same time permitting greater lateral shift.

At the intersection of faults, the solutions were allowed to spread out both vertically and laterally, producing orebodies of large size and great vertical range. The

process of mineralization has been primarily a replacement of the limestone with quartz and varying proportions of copper, lead, zinc, and silver sulphides, presumably due to decreasing temperature and pressure in the solutions as they run their northerly course.

Soft, coarse-grained, nearly pure limestones have been much more readily replaced by the solutions than the harder, fine grained, and more siliceous beds. Certain horizons of the latter type, even where directly in the course of the mineralized zone, are found to be uniformly barren.

Of the four zones so far developed, not one has been traced to a logically demonstrated terminus, and it is by no means established that similar and equally productive zones do not exist, still undiscovered, in the district.

Power to Condemn Land

By A. L. H. Street*

The right of a mining or ore-milling company to condemn land for use in its operations is recognized by the Nevada Supreme Court in the recent case of Goldfield Consolidated Milling and Transportation Co. vs. Old Sandstorm Annex Gold Mining Co., 150 Pacific Reporter, 313.

It is a well-settled principle of constitutional law that private property cannot be condemned for private use, but that, on payment of full compensation to the owner, it may be taken for "public" use. It is also well recognized by the courts that it is within the power of a legislature, acting in good faith, to determine what shall constitute "public" use. Acting under this authority, the Nevada legislature has declared that mining for valuable minerals is the paramount interest of the state, and therefore a public use. Applying this statute, the Supreme Court holds in the case above cited that the use of land as a place upon which to deposit tailings from an ore mill is a public use for which land may be condemned.

It is further decided in the same case that since it is a general rule that, when a corporation seeks to exercise the right of condemnation, its discretion in the selection of land will not be questioned by the courts if it acts in good faith and not capriciously, it is no defense to proceedings to condemn certain land that there are other tracts available for the purpose; and that an absolute necessity for taking the particular land is not necessary to authorize its condemnation.

Another point adjudicated is that the facts that the land sought to be taken in this case had been located and patented as mining ground, and that there was a possibility that it might be used in the future for mining purposes, no work having been done on it for several years, did not prevent condemnation, especially in view of the fact that the condemning company expressed willingness that the order of condemnation should provide that the owners of the ground might carry on mining operations so far as the same would not interfere with the company's operations, and especially since it is likely that the land will be freed from the tailings, for the deposit of which the land is to be used by the company, after being retreated.

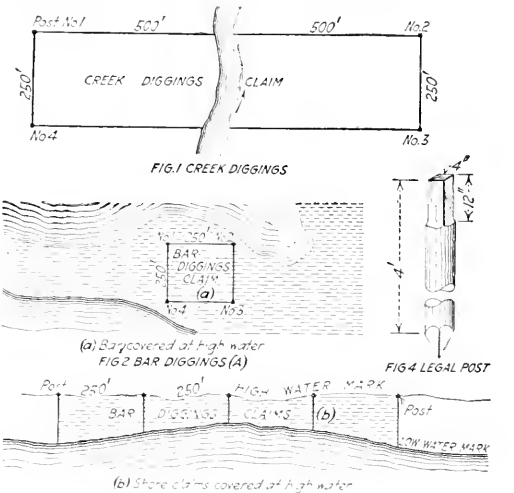
Seaweed Potash is reported to be under investigation in Monterey County, Calif., by the Hercules Powder Co. A launch is being used for gathering the seaweed or kelp, which will be shipped to San Francisco for experimenting.

*Attorney, St. Paul, Minn.

Acquiring Placer-Mining Claims in British Columbia

By J. A. Macdonald*

The rules and regulations for prospecting and laying out mining claims in British Columbia differ materially from those of the Yukon and the other provinces under federal jurisdiction. While under the Dominion regulation a miner or prospector may stake out a 500-ft. claim along a creek, in British Columbia only 250 ft. is permitted; while for "bar diggings" as well as "dry diggings," the area is limited to 250 ft. square, with important distinctions, of course. As in the other provinces, every person over 18 years of age, as well as every joint-stock company, is entitled to all the rights and privileges of a "free miner" and shall be considered a "free miner" upon taking out a free-miner's certificate, which is not transferable. This certificate, for which the



STAKING PLACER CLAIMS IN BRITISH COLUMBIA

fee is $5, runs from the date of issue to midnight on May 31 next after its date. The certificate is brief:

> This is to certify that.....of..... is entitled to all the rights and privileges of a free miner from midnight on the [date of issue] day of.....19.... until midnight on the thirty-first day of May, 19..
>
> Issued at..... on the.....day of.....19..
>
> [Signature of issuing officer.]

In case a person allows his free-miner's certificate to expire, he may, at any time within six months from the date of such expiration, obtain from the proper officer—the Gold Commissioner or the Recorder—upon payment of a fee of $15, a special-miner's certificate. Every free miner shall be entitled to locate and record only one claim on each separate creek, bar or dry diggings.

Placer-mining claims are divided into three classes, with a subclass: (1) Creek diggings, which claim shall be 250 ft. long, measured in the direction of the general course of the stream, and shall extend in width 1,000 ft., measured from the general course of the stream,

*Topographical Surveys Branch, Department of the Interior, Ottawa, Ontario.

500 ft. on either side of the center, see Fig. 1; (2) bar diggings, which shall be (a) a piece of land not exceeding 250 ft. square on any bar that is covered at high water, see Fig. 2, or (b) a strip of land 250 ft. long at high-water mark, extending in width from high-water mark to extreme low-water mark, see Fig. 3; (3) in dry diggings a claim shall be 250 ft. square, similar to bar diggings shown in Fig 2. On the discovery of a new locality, however, a free miner is entitled to a claim 600 ft. in length, or a party of two, 1,000 ft. Abandoned claims are treated as a new locality, on the discovery of a new stratum of earth containing precious metals.

"Placer mine" and "diggings" are synonymous terms and mean any natural stratum or bed of earth or gravel mined for gold or other precious metals. "Creek diggings," Fig. 1, means any mine in the bed of any stream or ravine; while "bar diggings" means any mine between high- and low-water marks on a sea, river, lake or other large body of water, as in Figs. 2 and 3. "Dry diggings" means any mine over which water never extends.

Locating and Recording Placer Claims

Every placer claim must be, as far as possible, rectangular in form and be marked at the corners by four "legal posts" firmly fixed in the ground. One of these is called the "initial post," and on this is written or attached this notice:

> Take notice that [set out name of each locator] have this day located this ground as a placer claim (or as a set of placer claims), to be known as the "..... Placer Claim" ..... feet in length. Its general direction is .....
> Dated this.....day of.....19...

On one post mark "Initial Post" and fix the notice on that post. On the notice is written: (a) The name of the locator; (b) the number of his free-miner's certificate, the date of the location and the name given to the claim.

In timbered localities all boundary lines of a placer claim must be blazed so that the posts can be distinctly seen, and the locator shall also erect "legal posts," not more than 135 ft. apart on all boundary lines. In localities where there is no timber, monuments of earth or rock may be erected, but not in the case of the legal posts marking the corners. These must be as shown in Fig. 4. Any location made on Sunday or any public holiday shall not for that reason be invalid, any law or statute to the contrary notwithstanding. The free miner on locating a placer claim must record the same in the office of the Mining Recorder for the Mining Division, within 15 days if located within 10 miles of the office, and one additional day is allowed for every 10 miles additional. The application for such record shall be under oath. Any claim not recorded within the prescribed time shall be deemed to be abandoned. A free miner, having duly located and recorded his claim, is entitled to hold the same during the existence of his record or re-record of such placer claim.

Every placer claim must be represented and worked in *bona fide* by the holder or some person in his behalf, continuously, as nearly as possible, during working hours, and is deemed abandoned and absolutely forfeited when it shall remain unworked for a period of 72 hr., except during the close season, lay-over or leave of absence, or during sickness, or for some other reasonable cause shown to the satisfaction of the Gold Commissioner. A leave of absence for one year is obtainable upon giving the Gold Commissioner satisfactory evidence that such is necessary, or upon the application for such leave being signed by all the holders of the claim or set of claims.

Every free miner "shall, during the continuance of his certificate but not longer, have the right to enter, locate, prospect and mine for gold and other precious metals upon any land in the province, whether vested in the Crown or otherwise, except upon government reservations for townsites, land occupied by any building, and any land falling within the curtilage of any dwelling house, and any orchard, and any land already lawfully occupied for placer-mining purposes, and also Indian and naval and military reservations." Previous to any entry being made upon lands already lawfully occupied, the free miner must give adequate security for any loss or damage which may be caused by such entry and shall make full compensation to the occupant or owner of such lands for any loss or damage which may be caused by reason of such entry; such compensation, in case of dispute, to be determined by a court having jurisdiction in mining disputes in British Columbia, with or without a jury.

Any free miner has liberty, at any period of the year, while actually prospecting or engaged in mining, to kill game for his own use. As a general right, every free miner is entitled to locate and record only one claim on each separate creek, bar or dry diggings, though he may hold any number of claims by purchase. In the event of a discovery of a vein or lode on his placer claim, he shall have no right to the same, unless he shall have located and recorded the ground as a mineral claim; and until he shall so locate and record such ground, as described in the Mineral Act, the same shall be open to any free miner to locate and record as a mineral claim in accordance with the provisions of that act.

A free miner, having located and recorded a claim and finding that it is of no value, may abandon it by posting notices to that effect on the four corner posts of his claim and recording such notice with the Mining Recorder, and forthwith shall thereupon be entitled to locate and record another placer claim upon other ground in lieu of the abandoned claim, and the abandoned claim shall then be open to relocation.

Leases on Occupied or Unoccupied Lands

A free miner in British Columbia is entitled, through the Gold Commissioner, to obtain a lease of any unoccupied and unreserved Crown land and even land already lawfully occupied, for placer-mining purposes for a term not exceeding 20 yr. Any free miner desiring to obtain a lease of any placer-mining ground marks out such ground by placing a legal post at each corner and by posting a notice on the post nearest to the placer claims then being worked in the immediate locality (if any), and within 30 days posts a notice in the office of the Mining Recorder, setting out: (1) The name of the applicant or of each applicant; (2) the locality of the ground to be acquired; (3) the quantity of ground; (4) the term which such lease is applied for. On making application, the free miner must deposit with the Mining Recorder a plan of the ground in triplicate and also deposit the sum of $20, which may go toward the payment of the first year's rent. Applications shall

not be greater than the following distances: In creek diggings on abandoned or unworked creeks ½ mi. in length; any other placer mining ground, 80 acres; but in no case must a lease extend along any creek or river more than 500 yd., creek diggings excepted. Leases are granted for placer mining only. A lease is not granted for any mining ground any portion of which is actually occupied by free miners, unless with the consent of such occupiers. Every lease provides for securing to the public reasonable rights-of-way and water, nor shall it prevent free miners from entering upon such ground to mine for veins or lodes.

The Gold Commissioner, with the sanction of the Lieutenant-Governor in Council, may grant a lease for any term not exceeding 20 yr. on the bed of any river below low-water mark for dredging purposes, for a distance not exceeding 5 mi. upon such terms as he shall think fit; provided always that every such lease shall reserve the right to every free miner or mining company to run tailings into such river at any point thereon, also to mine 2 ft. below the surface of the water at low-water mark, by putting in wing-dams, whether such miner shall locate before or after the date of such lease, nor shall the holder of a dredging lease interfere with free miners from constructing wing-dams into any such bars, banks or benches for the purpose of conducting mining operations, either by sluice or rocker. It is not lawful, however, for any free miner to construct wing-dams within 1,000 ft. of any dredger while working nor to obstruct any dredger in any manner.

Brazilian Monazite

Owing to the war the mineral production of Brazil is attracting more attention in the United States and Great Britain than seemed likely a short while since, says the *Mining Journal*, Oct. 2, 1915. In particular, the high price of monazite is bound to attract attention to all known deposits.

The export of monazite from Brazil is the subject of a concession to a French banker, M. Chouffour, for a period of 15 years dating from 1912. Of the profits 50% goes to the Government, in addition to a royalty rising to £120,000 when a stipulated tonnage has been shipped. According to official particulars, a stock of about 8,000 tons was held in Hamburg shortly before the war. Previous to the control acquired by the French Syndicate, the exploitation of the deposits was shared by two concessionaires, who fixed the price of thorium oxide at £5 15s. per unit.

The best-known deposits are those of Bahia, a concession over which was first granted to a Mr. Gordon in 1896. There are also important deposits in the State of Minas Geraes, more especially at Corrego da Onca, Dattas, as well as in the Casa and Jequitinhonha Rivers. A dressing plant is employed on the Parahyba River, where the sands are dressed on Wilfleys and the concentrates passed through magnetic separators to remove the iron in the sands. The raw material contains about 2% of thorium oxide, and the plant has a capacity of about 50 tons per month. Previously the cost laid down in Hamburg was put at between £15 and £20 per ton, and the value of the concentrate £28 15s. Exports in recent years have been: 1910, 5,437 tons; 1911, 3,686 tons; 1912, 3,398 tons.

Physical Control of Employees

The physical examination of employees to prevent the placing of unfit men in responsible positions has been instituted by many firms and corporations. It has always been attended with good results so far as efficiency in the work and satisfaction to the employee have been concerned; nevertheless, the practice has always been more or less opposed by the laborers themselves. In instituting the practice at the works of the Nevada Consolidated Copper Co., the authorities have taken pains to explain the reasons for doing so and the effect it will have upon employees. This explanation is so clear and reasonable that it is worth while reproducing here.

Men seeking employment, or having secured positions through the employment department, will be put to work "subject to medical examination." It will be required of every man employed to submit himself for physical examination immediately upon entering the service of the company, or during the time he is seeking employment if he so desires.

It will also be requested that employees now on the payroll shall take advantage of the opportunity to be examined. This task of examining employees will be commenced at once and will be spread over such period of time as may be necessary to its accomplishment, taking into consideration the convenience of the medical department and of employees. Employees need not worry over the result of physical inspection, nor need they horrow any thrills of terror of its "hurting" them in any way, physically or financially, in the assurance that no man now on the company payroll will suffer the loss of employment because of any ailment or physical defect; and in the further assurance that the results of individual examinations will not under any consideration be made public.

Nor will men now in the employ of the company who may take the examination be requested or required to sign any release or undertaking which will affect in any way their present hospital agreement or existing relations with the Nevada Industrial Commission.

It is intended that such examination as will be made shall be of as great, if not greater, benefit to each individual than it will be to the company. It will be practically in line with the scheme of the big life-insurance companies, which are making provision for free medical examination for their patrons and urging all their policy holders to submit to medical examination at least once a year. The object is to enable men to anticipate and ward off the approach of physical ailments, on the theory that "a stitch in time saves nine."

So far as the company is concerned, it is a safety-first proposition, a measure to promote accident prevention by trying to fit a man to a job wherein he will not be a menace to himself or to his fellow-workers. Relatively speaking, the hazards of every workman's occupation are affected by many elements of chance, human error, negligence and ignorance—but there is no reason why an employee should be subject to the further danger, the unseen, invidious menace of a fellow-employee's physical unfitness for his job. You, Mr. Miner, would not like it, would you, to risk your life daily on a cage controlled by a hoist engineer who might be subject to heart disease and who might collapse at any moment and drop you into the sump or drag you up into the sheaves. You would not like it, would you, Mr. Smelter-man, if a dinkey engineer should run amuck with his engine and a train of molten slag around the yard, endangering the lives of employees, because he could not see or was unable to determine the color of signal flags or lamps? You, Mr. Millman, would not want to work around a machine or machinery operated by a man who was not thoroughly fit physically, as well as mentally, to control that machine in case of emergency, would you? If hazards of this nature can be done away with, you would be willing to help, wouldn't you?

Many of the employing industries in this country and in Europe have required their medical departments to render this service, and not one word of protest has been made by employees, because men have come to see and understand that physical examination has largely eliminated a serious hazard in their daily work, a hazard to which they might otherwise, unknown to themselves, be subject.

Russian Nickel Deposits in the Urals, which have not heretofore been worked on account of the low grade of the ore, are now being exploited. The ore mined is being treated at the Redwinsk smelting works, which are reported to be turning out at the rate of 600 tons yearly of nickel matte.

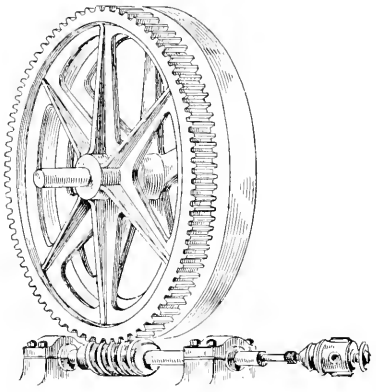
Details of Practical Mining

Facing-Off a Brake Wheel

By A. E. Hall*

The accompanying sketch shows a scheme used for surfacing off a brake wheel without dismantling the hoist to any extent. It sometimes happens that a job of this sort must be done around a mine, and usually the machinery for handling a piece of this size is not to be had, so that the wheel would have to be returned to the factory for repairs.

The brake band in the present case was lined with asbestos blocks which were bolted to the band. The blocks became worn, and the bolts cut into the brake wheel. When the brake was repaired the wheel had to be surfaced.



DEVICE FOR TURNING BAND WHEEL

There was no machine tool big enough to take the wheel for machining and besides there would have been the trouble of removing the wheel. There was no small cog-wheel on hand, and the machine shop was not equipped to make one. We were, however, able to make a worm gear with teeth only about ½ in. high. The teeth on the large drive wheel are about 3 in. The small teeth on the worm prevented any binding. The whole of the tooth on the drive wheel was never engaged by the worm teeth, but only a part of the tooth. The worm was mounted on a shaft supported on two bearings, as shown, and the shaft was extended at one end and shanked to fit an air twist drill such as most mines have in their shops.

For the purpose of facing the band-wheel one of the lathes from the machine shop was moved to the power house. The whole lathe was moved, including the frame; simply taking the legs off. The frame of the lathe was secured to the base of the hoist. With this arrangement it was possible to move the lathe-tool, by its own carriage and feed screws, across the face of the slowly turning band-wheel.

The hoist was turned by means of the air drill set on the shanked shaft of the worm gear which turned the main drive wheel. This is a fairly large hoist with three drums 5 ft. in diameter. The same idea can be applied to any hoist, and by making the worm gear correctly, the hoist can be made to turn at the desired speed.

*Creighton Mine, Ontario.

Constructing a 70-Mi. Water Conduit in Alaska

The construction of a conduit comprising 21 mi. of flume, 37 mi. of open ditch, and 12 mi. of pipe was the subject of a paper recently presented by H. H. Hall before the San Francisco Association of Members of the American Society of Civil Engineers.

The conduit leads from the Ogelvie range of mountains southwesterly to the Klondike mines near Dawson City, Alaska. Its purpose is to convey 125 sec.-ft. of water, or about 80,000,000 gal. per day. The conduit was constructed under separate organizations during three seasons of about 120 days each (1907-1909). Ditch construction was used wherever possible—7 ft. wide on bottom, 1½:1 slope, and 3½ ft. deep, with a gradient of 4 to 7 ft. per mi., the greater portion being 6 ft.

The right-of-way was first cleared of trees and the moss scraped off, as fast as it thawed, with teams and slip scrapers. The latter work presented the most troublesome problem from a construction standpoint owing to the uneven thawing of the muck and the consequent miring of the horses. Thirty miles of ditch were dug with six 30-ton steam shovels, the remainder with horse scrapers. As the shovels required a working space at least 16 ft. wide, no side-sloping was done with them. Small patches of frost were removed with 40% dynamite, but the larger patches were passed over, and after thawing were taken out with scrapers.

The record performance for one shift was 410 ft. of ditch, or about 1,200 cu.yd., with an average performance of 14.7 ft., or 51 cu.yd. per working hour. The season was from Jan. 15 to Oct. 15, with work usually slow the first and last weeks. The finishing gang followed the shovels—truing the grade, sloping the banks, clearing the berms, building a path along the top of the soil bank for watchmen, and constructing turnouts and overflows alternately every half mile. Common labor was paid $4 per day and board.

Mr. Hall stated that under operation the ditch had proved satisfactory, leaks being caused usually by ice seams.

Flume construction was adopted where the side slopes exceeded 15 deg. or where the muck was over 2 ft. thick. The flume construction was of the board-and-batten type, 6x4 ft. in cross-section, and built of native lumber, made up in 16-ft. sections and set on trestle bents of hewn timber placed 8 ft. on centers. Most of the bents were carried on mudsills, laid below the black muck (about 4 ft. deep), great care being taken not to disturb the moss

blanket unnecessarily, and to replace it as quickly as possible over the backfillings in order to preserve the ground in a frozen condition.

It was attempted to found some of the bents on piles driven into earth that had previously been thawed out by means of 16-ft. miner's steam points. In this manner the moss was broken only to admit the pile. Where the depth of muck would require very deep mudsill pits, the experiment was tried of placing gravel ballast directly on top of the moss and laying the flume stringers on crossties.

According to Mr. Hall, several years' operation of this flume has shown that the pile foundation is the best. Mudsill bents show continual settlement, caused by water flowing down the posts (either from the flume or from natural drainage) and thawing out the substrata.

Pipe lines were employed for pressure sections. For pressures not exceeding 200 ft. redwood stave pipe was used; for over 200 ft. or less than 1,000 ft., standard-riveted; for over 1,000 ft., lap-welded steel pipe. One section was constructed of spiral riveted pipe with patent bolted couplings.

In operation it has been found that the wood pipe has given considerable trouble, owing to the fact that between Oct. 1 and June 1 lines are drained and not used. The sand and gravel carried by the ditch water have worn the bottom staves badly. All intakes are now provided with sand boxes. Accumulations of ice at the discharge ends have caused considerable trouble by increasing the pressure on sections of the pipe. On high-pressure lines the sediment cuts the steel rapidly, and in one instance a ¾-in. rivet was cut away in two weeks.—*Engineering News.*

Hints on Loading Drill Holes

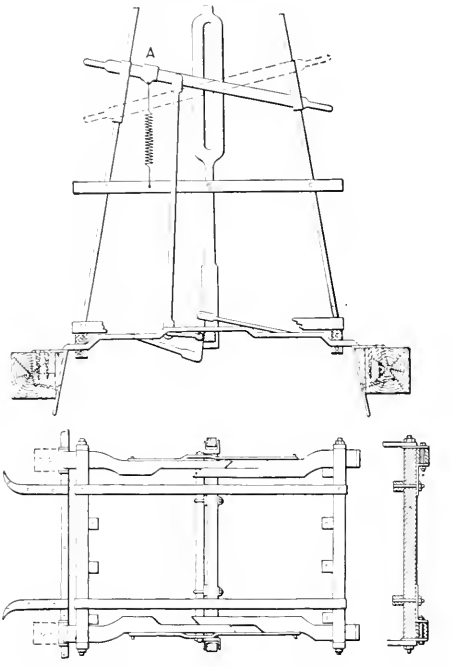
In loading short holes with a tamping stick, many blasters make a mark or notch on the stick, to indicate the distance from the collar of the hole to the top of the pocket or chamber. By this means they can tell when the pocket is loaded and when the charge begins to raise in the borehole. It is also a good idea to make a mark, or place a rubber band around the tamping stock, opposite the collar or mouth of the hole when the stick rests on the top of the charge when finished. The distance between this mark and the end of the tamping stick will give the amount of tamping in the hole so that in the event of a misfire it will be possible to remove nearly all of the tamping without danger of digging into the explosive.

The tamping stick, of whatever material, should not be a close fit in the borehole, as in loading holes full of water, where the tamping stock fits the borehole snugly, misfires have occurred, in tamping the hole, from the piston effect forcing the water into the electric blasting cap.

In loading deep well drill holes where it is not practicable to use a pole, a tamping block of hardwood attached to a rope is used. This block should not be weighted unless the holes have water in them. When weighted, a hole of about 1½ in. diam. is bored in the center of the block. A quantity of molten lead or babbitt metal is then poured in and the opening plugged with a wooden plug in such a way that no metal is exposed. These plugs are usually about an inch less in diameter than the diameter of the drill bit and from 3 to 4 ft. long. The rope for convenience and safety is passed over an open block or pulley, supported by a tripod 7 or 8 ft. high over the center of the borehole.—*Du Pont Magazine.*

Automatic Landing Chairs

An arrangement of automatic landing chairs devised by John Martin, of Taviche, Oaxaca, Mexico, which proved very satisfactory at the San Juan mine of that place, is described in the *School of Mines Quarterly.* The operation of these chairs is evident from an inspection of the sketch. A weight or spring at *A* automatically withdraws the chairs when the cage is raised and its weight taken off from them. The cage man holds the lever against the action of the weight or spring until the protruding chairs rest upon the landing and when stopping at a station, they are held in that position by the weight of the cage. The advantage claimed is that this type avoids the expense and danger of having sets of chairs at each of the levels from which hoisting is being carried on.



AUTOMATIC LANDING CHAIRS

Illuminating Powder Magazine*

The most suitable method of illuminating a magazine is by incandescent lamps with reflectors, set at some distance from the explosives. To require this, however, would work a hardship on mines that have no electric-light service. The portable electric lamp is equally safe, but is not yet sufficiently well developed to be practicable. The portable acetylene lamp is the most dangerous device

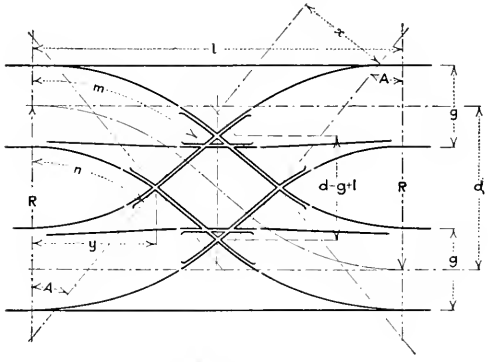
*Bulletin 75, U. S. Geological Survey.

for this purpose; the simple candle is a close second. The large acetylene lamp set some distance from the explosives is not very unsafe, but is not wholly reliable. It is strongly recommended that electric lighting be used.

Calculating Diamond Crossover for Shaft Bottom

In reply to a question as to how to put in a crossover, at the bottom of a shaft, with four frogs, *Coal Age* gives the following, the data given being the gage of the tracks (42 in.) and the distance between the two inside rails (42 in.):

The only dimensions given in this case are the gage of the track ($g = 3.5$ ft.) and the distance between track centers, which is twice the gage, or $d = 2 \times 3.5 = 7$ ft. In order that such a crossover can be operated successfully, it is necessary that the two frogs on the straight rails of the two tracks shall be constructed, as shown in the accompanying figure, with a small triangle of solid iron in the center of the frog. The purpose of this is to sufficiently separate the three points where the gage lines of the three rails cross each other. It will be sufficient if the gage lines of the two switch rails cross



A DIAMOND CROSSOVER

each other 6 in. inside of the gage line of the straight rail. This will make the distance measured straight across the rails, between the two points where the gage lines of the switch rails cross each other, $d - g + 1$, as indicated in the figure. All the dimensions in the following calculation are made to gage lines.

The first step in the solution is to find the angle A, which subtends the curved rail of each of these switches. This angle is found by substituting the values for d and g in the formula

$$\cos A = \frac{g}{d - g + 1} \times \frac{3.5}{7 - 3.5 + 1} = \frac{3.5}{4.5} = 0.7778+$$

Hence, $A = 38^\circ\ 57'$.

The second step in the solution is to assume a convenient radius, say in this case $R = 10$ ft., and calculate therefrom the entire length of the crossover, from point of switch to point of switch, which is marked l in the figure. This distance is found by applying the principles of trigonometry, which gives the formula

$$l = 2\ R \sin A + \frac{d - 2\ R\ (1 - \cos A)}{\tan A}$$

Then, substituting the known values in this formula, gives for the total length of the crossover

$$l = 2 \times 10 \times 0.6286 + \frac{7 - 2 \times 10\ (1 - 0.7778)}{0.8083}$$

$$= 15.73\ ft.$$

Since the angle of curvature of each of the switch rails is $38^\circ\ 57'$ and the radius of the outer rail in each switch is $r_1 = R + \frac{1}{2}g = 10 + \frac{1}{2}\ (3.5) = 11.75$ ft., the length of the outer curved rail, indicated by m in the figure, is

$$m = \frac{38^\circ\ 57'}{180^\circ} \pi r_1 = \frac{38.95}{180}\ (3.1416 \times 11.75) = say\ 8\ ft.$$

The radius of the inner curved rail is $r_2 = 10 - \frac{1}{2}\ (3.5) = 8.25$ ft., and the length of this inner rail, indicated by n in the figure, is therefore

$$n = \frac{38.95}{180}\ (3.1416 \times 8.25) = 5.6\ ft.$$

The length of straight rail in the switches, indicated by x in the figure, is found by substituting the known values in the formula

$$x = \frac{l - 2\ R\ \sin A}{\cos A} = 15.73 - \frac{2 \times 10 \times 0.6286}{0.7778}$$

$$= 4.06\ ft.$$

The two frogs in the loaded and empty tracks respectively are located midway between the switches, or at a distance of $\frac{1}{2}l$ from either switch. It now remains to calculate the distance of the two frog-points lying between the tracks, or the distance marked y in the figure. This distance is measured on the line midway between and parallel to the two tracks, from the line joining the switches to the point of frog. This distance is calculated by substituting the known values in the formula

$$y = \sqrt{r_2\ (d - g) - \tfrac{1}{4}\ (d - g)^2}$$

Since the radius of the inner curved rail (r_2) is 8.25 ft., the frog distance at each end of the switch is

$$y = \sqrt{8.25\ (7 - 3.5) - \tfrac{1}{4}\ (7 - 3.5)^2} = 5.08\ ft.$$

It is possible to lengthen out this crossover by adopting a longer radius than $R = 10$ ft. The angle of curvature (A), however, remains constant, for the same values of distance between track centers (d) and track gage (g), as appears from the formula given for finding this angle. For example, for a radius $R = 15$, the length of this crossover would be $l = 19.27$ ft. It is also possible to have the crossover rails cross each other outside of the track rails instead of arranging to have them cross within these rails, as in the foregoing figure.

Blueprinting Typewritten Matter

It is often desirable to blueprint a typewritten sheet. Whether this can be accomplished satisfactorily depends on a very small kink which is not generally known. It is almost impossible to get a satisfactory blueprint from an ordinary typewritten sheet; but if, when the sheet is being written, a piece of carbon paper is put behind it so that the carbon transfers to the back of the paper, the typewritten sheet will give a perfect blueprint. This is because the impression of the typewriter ribbon is reinforced by the carbon on the back, neither one being heavy enough alone to give a satisfactory print.

Details of Milling and Smelting

Measuring Sand and Stone for Concrete Roads

Measuring sand and stone for concrete at the time it is loaded into wheelbarrows at the storage pile by the use of 2-cu.ft. measuring-boxes is called for in the specifications of the Coleman du Pont Road now being built in Delaware. The specifications are as follows:

Great stress will be laid on the method of measuring the materials used in the concrete. It will not be allowed to measure the materials in ordinary wheelbarrows unless each load is struck perfectly smooth with a straight-edge. This is to insure perfect proportions in the concrete. Contractors shall use measuring-boxes or other similar device if so ordered by the engineer.

The engineer so ordered, says *Engineering News*.

Bottomless boxes, or frames, are placed in a flat-bottomed wheelbarrow and filled with sand or stone. The

LOADING WHEELBARROW WITH CRUSHED STONE AND MEASURING LOAD AT SAME TIME

frame is then lifted up and the wheelbarrow wheeled to the mixer. In the accompanying view the boxes are being used to measure stone.

At first the contractors did not favor the boxes, but now, according to Charles Upham, chief engineer of the Coleman du Pont Road, Inc., they swear by them. A boxful does not overload the wheelbarrow.

Fluming Granulated Slag

Among the many improvements being introduced at the Washoe smeltery, Anaconda, Mont., is the handling of furnace slags by an electric railroad. Cars of 20-cu.yd. capacity will be hauled to slag dump by 40-ton Westinghouse electric locomotive using 500-volt current. The cars have one new feature—sides dropping outward in a plane with the floor of the car to form an extension that will dump material further from the track, thus preventing clogging of rails. This change became necessary as a result of the introduction of the flotation process. In the past, water from the concentrator used to granulate the slag previous to its being flumed to the slag dump, contained a great deal of slime that acted as a coating to the slag, so that water carried it a great distance over the dump. Now that slime is being re-treated, water sinks as soon as it strikes the slag pile, which, without its coat of slime, has become much more pervious and as a consequence accumulates rapidly at the discharge end of the flume. The new system of hauling is expected to solve the problem of spreading the slag over a larger area.

Tests for Screen Selection

By Fred Meinke, Jr.*

In running several old dumps through the Gold Bluff mill, at Downieville, Calif., it was found that the tailings ran unusually high. A 30-mesh screen was being used. This screen had been used in the mill before with satisfactory results, and it was also being used in the mills in the immediate vicinity. To find the cause of the high tailings, as well as the height of discharge and height of drop best suited to the ore, the following tests were made.

The screens used were No. 1, 30-mesh perforated tin, a 24-mesh No. 27 crimped-wire screen and a 27-mesh, No. 27 wire screen. Of these it was found that the 27-mesh, 27-wire screen gave the lowest values to the tailings with a decrease in tonnage which was not prohibitive.

The tests were made in a five-stamp battery of the 900-lb. type. A screen area of 6x48 in. was used. The stamps were dropped at 100 and the height of drop fixed at 7 in. The ore consisted of coarse hard quartz broken to 2 in. with very few fines. The values were mostly in free gold, so that inside as well as outside amalgamation was practiced.

In making the tests the tailings were run into a 46-gal. barrel and the time of filling noted. The water was then decanted, the pulp thoroughly dried and weighed, and the tonnage determined. Before each test the battery was run for a certain length of time in order to give the screen time to build up and the battery to get down to its normal output.

TONNAGE AND VALUE OF TAILINGS

Test No.	8-In. Discharge Tonnage	8-In. Discharge Tails	5-In. Discharge Tonnage	5-In. Discharge Tails
1 and 4—30-mesh perforated-tin screen	3.05	$1.30	3.48	$0.90
2 and 5—24-mesh crimped-wire screen	3.00	1.00	3.34	.40
3 and 6—27-mesh crimped-wire screen	2.90	.80	2.97	.20

The first three tests—Nos. 1, 2 and 3—were made with an 8-in. discharge and gave an average value of $1 for the tailings. In making the next three tests—Nos. 4, 5 and 6—the discharge was lowered 3 in., making it 5 in. With this set of tests the tailings averaged 50c., a saving of 50c. over the first tests.

*Mining engineer, Downieville, Calif.

Comparing the individual tests, it is seen that the tonnage varied but little with the different screens and the high discharge, there being only 0.1 ton per stamp difference between the 24- and 27-mesh screens. This is easily accounted for by the sizing tests, which showed 75% of the pulp passing through 80-mesh. This indicates that the size of opening or character of screen had but little to do with the size to which the ore was crushed. The particles, when fine enough, are simply held in suspension by the water and are carried out through the screen openings.

With the 5-in. discharge there was a marked splash against the screen and, as the tonnage shows, there was a greater amount put through with the coarser screens. There was an increase of 0.37 ton per stamp between the 24- and the 27-mesh screens.

SCREEN SIZING TESTS

	With 8-In. Discharge			With 5-In. Discharge		
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Screens	%	%	%	%	%	%
Through 100	49.2	51.0	51.7	42.9	38.4	50.9
On 100	24.0	26.3	26.0	23.4	24.6	26.9
On 80	5.7	5.4	5.5	4.9	10.7	6.29
On 60	4.9	6.0	4.5	6.0	6.7	6.9
On 50	7.9	7.5	6.8	14.5	10.9	6.74
On 40	8.3	3.8	5.5	8.3	8.7	2.3

Tests Nos. 1 and 4, 30-mesh perforated-tin screen. Tests Nos. 2 and 5, 24-mesh crimped-wire screen. Tests Nos. 3 and 6, 27-mesh crimped-wire screen.

The sizing tests were made to find out if the loss in values was not on account of excessive sliming due to the high discharge. Although there is no marked difference between the percentages of pulp that passed the 100-mesh with the high and low discharge, these assays showed a greater value with the high than they did with the low discharge, thus proving that the increase of slimes was causing the loss. The fine particles of gold go off in the water without coming in contact with the mercury inside the battery or the amalgam on the plates.

Another test was made to show the increase in tonnage with an increase in the height of drop of the stamps. The battery running with an 8-in. discharge and a 6-in. drop produced 2.66 tons per stamp. With the same screen and discharge, but with a 7-in. drop, an increase of 1 in., the battery produced 3.05 tons per stamp, or an increase of 0.39 ton per stamp in 24 hours.

Some Data on the Burning of Powdered Fuel

In the *General Electric Review* for October, 1915, Arthur S. Mann gives some notes on the use of powdered coal. A hot stream of coal and air driven at high speed against a wall will cut it out—a low-fusing-point brick is melted down, a refractory brick is cut away mechanically. He has cut away carborundum brick by misdirecting a fire that did not approach the melting temperature of the brick, but such action is unnecessary. The remedy is to avoid high velocity along the brickwork. If a wall must take the full force of the current, protect it with loose brick or pass the current of combustion air along its face, which will deflect and protect. An arch can always be treated in this way. Some of the combustion air is cut off from the burner and sent along on top and over it. The total volume of air used is not increased, and a reducing fire can still be carried; heat distribution is noticeably good.

The design and building of the furnaces is an undertaking that calls for a high class of engineering skill. Feed, volume and current must all be considered. Sizes and areas influence the generation and distribution of the heat. The position of egress ports, if many, may defeat the purpose of the furnace. It does not do to build a furnace in the haphazard way of "apply a burner somewhere, and if it does not work, put in enough fuel to make it work." There is probably no other fuel so sensitive to correct use as is coal dust.

Some fuels can be burned without care on the part of an operator. Gas is one and oil virtually another. There is no economy in such ways, but the furnace is undeniably hot. Powdered fuel may run all day with no change in adjustment, but the fire should be looked at every half-hour or so. Slag and some fine ash are always forming, and it is well to know where these are going. On the other hand, a wrong adjustment of either coal or air makes itself apparent. Powdered coal burns best with 200 cu.ft. of air per pound of fuel. It can burn and burn clearly with 160 cu.ft. and even less, but the extra air pays. As the supply exceeds 200 cu.ft., efficiency begins to fall. There is even a noticeable loss at 208. The eye cannot discriminate between a 200-ft. and a 208-ft. fire, but it can recognize the 250-ft. or even a 220-ft. blaze. There is a marked change in appearance and unless a cutting fire is really wanted, there is no excuse for such bad mixture. The powdered-coal fire begins to snort and wheeze when it has too much air.

Cementing Out Copper on Copper-Nickel Matte

In a recent patent (U. S. pat. 1,128,313) of N. V. Hybinette of Christiansand, Norway, assignor by mesne assignments to the National Trust Co., Ltd., of Toronto, Canada, it is stated that copper can be cemented out of copper-nickel solutions on an anode of copper-nickel alloy containing 4 to 8% of sulphur, providing that the anode has been previously corroded in an electrolytic bath. Where an anode has not been corroded previously, this is at present an impossibility. It furnishes a convenient method of depleting a copper-nickel solution of copper while simultaneously enriching it with nickel, by the use of a purely chemical reaction.

The anode itself and its production by blast-furnace smelting are covered by Mr. Hybinette's U. S. pat. 1,128,316.

Baggaley Method to Neutralize Smeltery Fumes

Ralph Baggaley has been granted a patent (U. S. pat. 1,135,488) for neutralizing smeltery fumes and preventing the escape of dust resulting from the treatment of sulphide ores by cooling the fumes to below 300° F., bringing them in contact with ore or other value-bearing material and passing the gases through a neutralizing bath. One method of carrying out the process is to deliver the fumes into a body of neutralizing material such as a bath of milk of lime. It is also proposed to cool the gases by passing them through a multiplicity of cooling flues. This idea may be applied to the gases and fumes from converters by passing them through moving bodies of ore and in contact with fresh ore material to preheat them, depositing thereon the metallic particles and heat contained in the fumes, and then passing the gases to a neutralizing bath.

Correspondence and Discussion

Civilian Engineers and Military Service

The recent editorial[1] on "Civilian Engineers and Military Service" contains valuable observations that deserve earnest consideration by engineers generally. Indeed, it is to be regretted that the proposition of enlisting the civilian engineers into an army reserve corps could not have been broached a few months earlier, so that a greater number of engineers could have been induced to attend the Plattsburg training camps of last summer. Under the circumstances, the Plattsburg movement was not sufficiently advertised in engineering circles and the attendance of engineers at the camps was noticeably small in comparison with that of other professions. In the first two battalions of the "business men's regiment," with a combined strength of 1,200 men, during the August-September encampment, probably less than 1% were engineers of any branch, while physicians, lawyers, bankers and brokers were present in great numbers. Even diplomats were almost as numerous as engineers.

It is to be hoped that other, similar training camps in the future may attract a greater attendance by engineers, even by those who may not be prepared to identify themselves with a permanent army reserve corps.

While the mining engineer, as you have pointed out, in a war emergency may prove useful to the army authorities because of his familiarity with matters of organization and administration and experience in handling large bodies of men, still in these very matters the army can give the engineer, and particularly the younger engineer, a valuable object lesson that may prove useful to him in his own peace-time pursuits. Apart from the "rudiments of military training," there was much to observe and learn at Plattsburg that was useful, both to engineer and ordinary citizen, in everyday life. The modern methods of camp sanitation and the instructions in hygiene and personal cleanliness of the soldier were highly interesting and alone well worth the time expended and the hardships endured. The system now used by the army for construction and care of camp kitchens, eating houses and latrines, with disposal of waste, etc., may well be adopted in many mining camps. Similarly also, the provision for general typhoid inoculation. The clean, airy, screened eating houses at Plattsburg, seating 125 men each, would have proved a revelation to some boarding-house bosses and proprietors of Chinese restaurants or other fly-infested eating places in our Southwestern mining camps.

During the nine days' maneuvers, when several regiments of the regular army, of all arms, participated with the "business men" in a combined force of over 4,000 men, with some 2,000 horses and mules, highly instructive demonstrations were furnished daily in the remarkably rapid and orderly manner of occupying and evacuating bivouac camps. The length of the column, with wagon train, was such that it required one hour's time to pass a given point, while on the march. But within less than half an hour of the arrival of the last detachments on the new camp site, the vast fields were occupied by the streets and abodes of an orderly community of more numerous inhabitants than even the neighboring towns; tents were raised in their allotted places, arms and equipment put away, wagons unloaded, horses and mules picketed and, best of all, company kitchens ready for business. Even more impressive was the early morning sight of the tented city disappearing, within less than one hour's time after the order to strike had been issued, leaving on the stubble of the field not a scrap of paper, nor a vestige of human, animal or kitchen waste.

These maneuvers also furnished an excellent demonstration of the value of motor trucks and motor cycles in warfare and on a larger scale than any previous army maneuver in this country. The motor trucks were used for a number of special purposes such as for searchlights, radio apparatus, machine guns, field hospital and ambulance and water wagon, but the 2-ton Autocar trucks that were used to transport the commissary supplies and company baggage of the "business men's regiment" were decidedly popular with the latter organization. These cars went wherever the mule wagons could go—on sandy hill roads, over fields and ditches, boulders and hummocks—and they made two or more trips for each trip of the mule wagons over the same distance. Sometimes, when a bridge would break down, a preceding truck would pull the other out of the hole and the succeeding ones turn into the creek, leaving the bridge to be repaired in a substantial manner by the following engineer train.

Of great interest, also, were the daily evening lectures on military subjects by officers of the regular army, each a specialist in his particular field. On one of these occasions the regiment had the pleasure of listening to an address by President H. S. Drinker of Lehigh University, who represents the A. I. M. E., on the "Joint Committee of the National Engineering Societies on the National Reserve Corps of Engineers" and also the Associated Student Societies now working to spread the propaganda of the Plattsburg idea.

OLOF WENSTROM.

Boston, Oct. 20, 1915.

[1] "Engineering and Mining Journal," Sept. 11, 1915.

Why Not Call Things by Their Right Names?

In reading the article on "Calamine Mines of Sardinia," by Charges W. Wright, published in the *Journal* of Oct. 16, 1915, I was somewhat surprised to run onto the sentence, "The term calamine is applied to the ore, though technically it is essentially smithsonite." Inasmuch as the ore is "essentially smithsonite," would it not have been much better to have so designated it in the title of the paper? This would have avoided the chance of a misconception of the nature of the zinc ore in the mines described and would have made the title much more satisfactory to the bibliographer. I am aware that some good writers use the terms *calamine* and *smithsonite* interchangeably,

probably following the custom of the miners, but for the sake of clearness such usage should be avoided.

Nashville, Tenn., Oct. 21, 1915. A. H. PURDUE.

[Professor Purdue raises an old question, namely, as to the correct definition of the oxidized minerals of zinc. In spite of the pronouncement of the United States Geological Survey to the contrary and the testimony of the government expert witnesses in the calamine tariff litigation, the term calamine has been used commercially and metallurgically for more than 100 years to include both the carbonates and both the silicates of zinc, and it was so used before mineralogists had made any distinction among these minerals. Mr. Wright, who is a mining and metallurgical engineer, apparently described the Sardinian ore from the professional viewpoint. Among zinc miners and smelters there would not be the least misunderstanding of what he meant. There are times, however, when the absence of a precise name for certain of these minerals is troublesome. What the mineralogists ought to do, we think, is to get together, talk the thing over, discard calamine as the name of a mineral species and formulate definite names for the hydrous silicate and the anhydrous carbonate. There is not any misunderstanding about willemite (the anhydrous silicate) or hydrozinkite (the hydrous carbonate). If mineralogists should agree to call the anhydrous carbonate smithsonite and the hydrous silicate hemimorphite—using Dana's second name—confusion would disappear.—Editor.]

Newfoundland's Mineral Resources

In an article by P. B. McDonald on "Newfoundland's Mineral Resources" in the *Journal* of Oct. 23, I find the statement that there are "12 seams of ore (iron) interstratified with shales and sandstones." This refers to the Wabana beds of iron ore on and adjacent to Bell Island, Conception Bay.

There are three chief beds of iron ore that outcrop on Bell Island and exist under the adjacent ocean floor. In addition to these three are a few others, of much less moment, that may be classed as parts of the three, separated from them by shale partings of greater or less thicknesses, or as entirely separate and distinct beds that may reach the dignity of minable seams in places yet to be discovered. It is difficult to classify these thinner seams, but all of them appear to be parts of certain definite ferruginous strata, the main development of each of these strata being one or the other of the three chief beds before mentioned. It would seem, therefore, that the minor seams are but portions of the chief beds. Each ferruginous stratum is separated from the other by considerable thicknesses of shales and sandstones devoid of iron.

The lowest of the three beds is that which is called the "Dominion"; above it lies the "Scotia" bed, and above that the "Upper" bed. The first outcrops along Bell Island for a length of about four miles and has a thickness varying from 4 to 14 ft. and an average of 10 ft. of clean ore. The Scotia bed outcrops for about two miles and has an average thickness of about 7 ft. Still higher is the upper bed, and its outcrop is about a mile. It is of varying thicknesses and, where now mined, runs from 4 to 8 ft. At the breast of the Nova Scotia company's submarine slope, 7,500 ft. out at sea, the Dominion bed shows in places a thickness of 28 and 30 ft., almost without shale partings, and this immense thickness forms a most impressive sight.

Mr. McDonald quotes the colonial geologist as estimating a total of three billion tons for the amount of this iron ore of Conception Bay and Bell Island. I notice that some estimates, notably that of E. C. Eckel, are much higher. The geologic work of Hayes and VanIngen, however, seems to indicate the probable tonnage to be somewhat less than either of the mentioned estimates, and I have considered that there is not far from two billion tons in the Dominion and Scotia beds. But whether there are two thousand million or five thousand million tons in this deposit is of little economic interest to the present generation. The deposits are of the utmost importance and of great moment in the consideration of the future of the Atlantic-coast iron trade.

DWIGHT E. WOODBRIDGE.

Duluth, Minn., Oct. 29, 1915.

NEW PATENTS

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

ALLOYS—Improvements in the Manufacture of Steel Alloys. Soc. Anon. des Acieries et Forges de Firming, Firming (Loire), France. (Brit. No. 3,427 of 1915.)

ALUMINUM—Process of Treating Aluminum Screenings, Dross, Slags, or Analogous Aluminous Materials. James Wright Lawrie, Aurora, Ill. (U. S. No. 1,156,606; Oct. 12, 1915.)

AMALGAMATOR. Erastus B. Bennett, Denver, Colo. (U. S. No. 1,157,836; Oct. 26, 1915.)

CHROMIUM OXIDE—Manufacture of Chromium Oxide. Albert Edward Gessler, Clifton, N. Y. (U. S. No. 1,158,379; Oct. 26, 1915.)

CHROMIUM SALTS—Producing Chromium Salts. Johann Heinrich Boner, Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. (U. S. No. 1,157,668; Oct. 26, 1915.)

CRUSHING—Ore-Grinding Machine. Charles O. Michaelsen, Omaha, Neb. (U. S. No. 1,158,259; Oct. 26, 1915.)

DRILL—Percussive Drill. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,154,921; Sept. 28, 1915.)

DRILLS—A Débris-Removing Device for Percussive Rock Drills. G. Mairet, London, England. (Brit. No. 24,109 of 1914.)

DRILLS—Improvements in Power-Driven Rock Drills. M. Kellow, Penrhyndeudraeth, N. Wales. (Brit. No. 13,067 of 1914 and 11,564 of 1915.)

ELECTRIC FURNACE. Ernesto Stassano, Turin, Italy. (U. S. No. 1,157,819; Oct. 26, 1915.)

ELECTRIC FURNACE. Sigmund Guggenheim, Berlin-Wilmersdorf, Germany. (U. S. No. 1,157,691; Oct. 26, 1915.)

FILTERING APPARATUS. David J. Kelly, Salt Lake City, Utah, assignor to Kelly Filter Press Co., Salt Lake City, Utah. (U. S. No. 1,158,056; Oct. 26, 1915.)

FILTERING PROCESS. David J. Kelly, Salt Lake City, Utah, assignor to Kelly Filter Press Co., Salt Lake City, Utah. (U. S. No. 1,158,055; Oct. 26, 1915.)

FIREPROOF UTENSILS—Process for the Manufacture of Fireproof Utensils from Refractory Oxides. Hans Arnold, Charlottenburg, Germany, assignor to the Firm of Dr. O. Knöfler & Co., Plötzensee, near Berlin, Germany. (U. S. No. 1,157,682; Oct. 26, 1915.)

FLOTATION—Apparatus for Concentrating Minerals by Flotation. George C. Stone, New York, N. Y., assignor to The New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,156,041; Oct. 5, 1915.)

FLOTATION—Improvements in or Relating to the Separation of Metallic Sulphide Ores. Minerals Separation and de Bavays Processes Australia Prop., Ltd., Melbourne, Australia. (Brit Nos. 19,373 of 1914 and 19,374 of 1914.)

FLOTATION—Separation of Metallic Sulphides from Ores. Thomas Mackellar Owen, Sydney, N. S. W., assignor to Edward William Culver, Sydney, N. S. W. (U. S. No. 1,157,176; Oct. 19, 1915.)

HYDRAULIC NOZZLE. William A. Doble, San Francisco, Calif., assignor to Pelton Water Wheel Co., San Francisco, Calif. (U. S. No. 1,157,853; Oct. 26, 1915.)

INGOT MOLD. Harry E. Sheldon, Pittsburgh, Penn. (U. S. No. 1,158,311; Oct. 26, 1915.)

IRON-ORE TREATMENT—Process of Extracting Iron from Its Ores. Herbert Haas, San Francisco, Calif. (U. S. No. 1,156,775; Oct. 12, 1915.)

August Foreign Trade in Metals

Advance reports from the Department of Commerce give imports and exports of the principal metals in the United States during the month of August, which are of special interest at the present time.

Imports and exports of copper in August were as follows, copper in pounds, ore in tons:

	Imports		Exports	
	Tons	Contents	Tons	Contents
Ore and concentrates	50,511	10,890,762	7,274	272,218
Matte, etc.	1,877	954,439	..	.....
Unrefined in bars, etc.	....	18,225,578	....	.....
Refined bars, plates, etc.	....	439,050	....	37,240,920
Old and scrap	....	592,569	....	7,364
Total		31,102,398		37,520,502

The wire included in the total exports was 2,907,110. In addition to the exports above manufactures of copper valued at $794,069—quantities not given—were exported.

Imports of lead into the United States in August in all forms are reported by the Department of Commerce as follows, ore in tons, bullion and lead in pounds:

Lead ore, tons:	Ore	Lead, Lb.
Canada	107	103,000
Mexico	5,883	1,089,071
Peru	464	289,331
Total	6,454	1,481,402
Lead bullion, lb.:		
Mexico	8,643,080	8,439,972
Peru	20,385	19,376
Total	8,663,465	8,459,348
Lead, pigs, bars and old		15,820
Total lead imported		9,956,570

The total imports reported up to the end of July were 59,312,137 lb., making the total for the eight months ended with August 69,268,707 lb., or 34,634 short tons.

Imports and exports of zinc in all forms are reported by the Department of Commerce for August, as below; ore in tons, zinc in pounds:

Imports:	Ore, Tons	Contents, Lb.
Zinc ore, Canada	813	724,400
Zinc ore, Mexico	6,277	4,207,503
Zinc ore, Australia	524	587,412
Total	7,614	5,519,315
Blocks, pigs, etc.	.....	116,675
Total		5,635,990
Zinc dust		85,657
Exports:		
Pigs, bars, etc.		2,820,728
Plates and sheets		12,568,422
Total metal		15,389,150
Zinc dust		43,550
Zinc dross		732,785

The exports of zinc dust were all reëxports of foreign material. In addition to the exports given manufactures of zinc valued at $499,214 were exported.

Japanese Mine Output, First Half of 1915

The mineral production of Japan in June, 1915, was: Gold, 646,402 kg.; silver, 13,225,353 kg.; copper, 5,757,884 metric tons; iron, 3,999,841; coal, 1,413,838; sulphur, 6,051,507 metric tons; petroleum, 47,925,720 liters.

The total production for the first half of 1915 is given by the *Japan Advertiser* as follows: Gold, 3,728,413 kg., an increase of 19.9% over 1914; silver, 72,826,696 kg., an increase of 3.3%; copper, 32,746,382 metric tons, an increase of 4.5%; iron, 23,958,758 metric tons, a decrease of 28.8%; coal, 9,093,917 metric tons, a decrease of 9.1%; sulphur, 28,522,199 metric tons, a decrease of 6.1%; and petroleum, 227,295,940 liters, an increase of 18.6% over 1914.

Elm Orlu-Butte & Superior Apex Suit at Butte

BUTTE CORRESPONDENCE

The ore controversy between the Elm Orlu Mining Co. and the Butte & Superior Copper Co., which was on trial the past week in the Federal court in Butte, Judge George M. Bourquin presiding, involves an orebody variously estimated by the experts for the Clark (Elm Orlu) and the Butte & Superior interests at $15,000,000 to $20,000,000. It is stated that if Clark wins he will get practically all of the Butte & Superior vein and orebody lying west of the Blackrock shaft, which contains enough ore to keep the Butte & Superior mine and mill running at their present capacity for a year and a half.

The Clark contention is that the big Rainbow lode has its apex in the Elm Orlu claim, which lies south of the Blackrock and Jersey Blue of the Butte & Superior Co., and that on its strike to the east it forks, the northern branch entering the south side line of the Blackrock and passing through the claim and out of the north side line, thus giving to the Butte & Superior no extralateral rights to that vein. The main contention, however, is that the Rainbow vein, on its depth, dips north into the Jersey Blue and Blackrock claims and that the Butte & Superior has been mining on the Rainbow, or Elm Orlu vein, on its dip to the north, and that between 700 and 800 ft. of that vein under the Blackrock surface belongs to the Elm Orlu. The claim of the Butte & Superior, of course, is that it owns the apex of the veins upon which it is mining, known as the Jersey Blue and Blackrock veins.

Many of the most noted geologists and mining experts of the country and learned and experienced mining lawyers appeared in the case for one side or the other. In the complaint only a nominal sum is mentioned as the value of the ore already mined from the disputed vein, but should Clark get a judgment there will follow an action for accounting. By mutual agreement the Butte & Superior has stopped mining in the ground in controversy. Beside the disputed vein the Butte & Superior has other good ore deposits and is developing more.

Iron-Mining Fatalities Reduced Two-Thirds

The annual report of the mining inspector of St. Louis County, Minnesota, containing the major portions of the Mesabi and Vermilion Ranges has just been filed. It shows that 830,469 tons of iron ore was mined and shipped for each fatal accident.

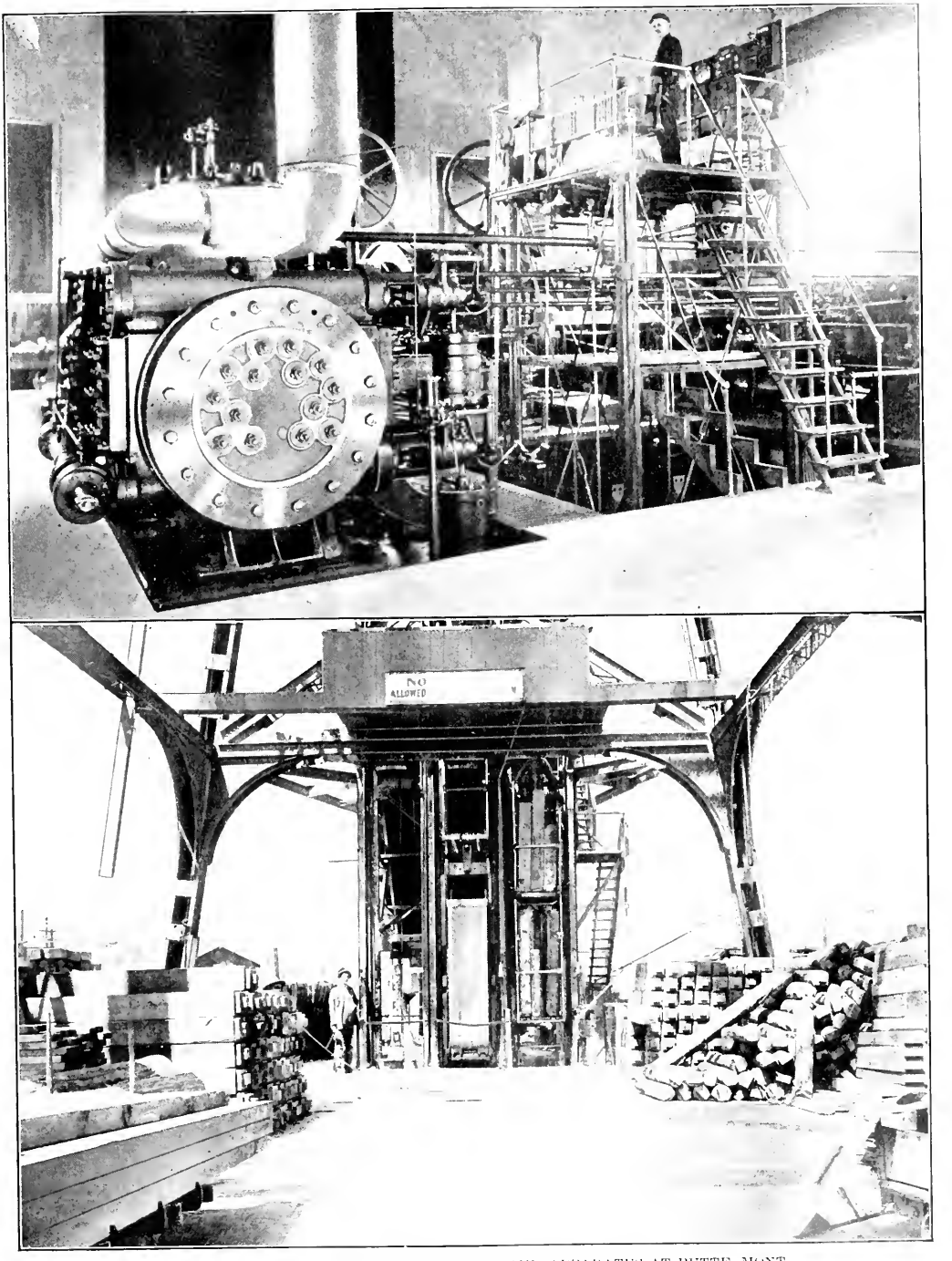
The following tabulation is taken from the report and indicates the success of the "safety-first" movement inaugurated several years ago:

Year Ended June 30	No. Employed	No. of Killed	Fatalities per 1,000
1906	12,838	96	7.48
1907	15,525	81	5.21
1908	13,313	54	4.05
1909	13,206	61	4.56
1910	17,613	71	4.02
1911	19,981	78	3.90
1912	15,398	51	3.31
1913	16,048	44	2.75
1914	16,660	43	2.59
1915	11,436	24	2.09

Of the 11,436 men employed, 5,830 were in underground mining, 1,910 in openpit mining, 1,722 in stripping and 1,974 on surface work. The average wage paid miners was $2.96 per day.

Photographs from the Field

HIGHLY DEVELOPED HOISTING METHODS AND APPARATUS AT BUTTE, MONT.
Illustration shows the cage- and skip-changing device of a modern hoisting plant



HIGHLY DEVELOPED HOISTING METHODS AND APPARATUS AT BUTTE, MONT.

Upper view shows a typical compressed-air hoist. The lower view is of the 5-ton skip and cage at the Tra[illegible] mine, Butte

Kyshtim Corporation and the Effect of the War

The profits of the Kyshtim Corporation last year showed a decline as the result of conditions arising out of the war. The company, however, now seems in a position to recoup these losses by reason of the stimulation of the demand for certain of its products. At the sixth annual meeting held in London recently, Chairman C. F. H. Leslie stated that the company's mines and plants in Russia were now in a position to produce under normal conditions 10,000 tons of copper per year. The war created certain new situations affecting the company and its operations. The company is erecting, at the request of the Russian Government, works for the annual production of about 8,000 tons of sulphuric acid. The cost of erecting this plant will be advanced by the Russian Government, and the first two years' output purchased at a price that is regarded as satisfactory. The company has also received orders from the Russian Government for pyrites, and has increased its output of this mineral to about 1,000 tons a week. From one-third to one-half of the employees have joined the colors, but notwithstanding this fact, the production of copper this year up to Oct. 2 was approximately 6,000 tons.

In 1914 the abnormal conditions increased the cost of producing copper by about £6 per ton. The profits on copper operations, according to the *Financial Times*, showed a decrease for the year of £67,000; from iron operations a decrease of £32,000; from forests a decrease of £3,500, and from barren pyrites a decrease of £2,500—a total decrease of £105,000. The net earnings for the year were were approximately 3s. per share as compared with 5s. during the previous year. The dividend recommendation was 1s. per share. Remittances to the English company in the form of gold and silver residues, the product of the electrolytic refinery in Russia, have finally become impossible owing to the order of the Russian Government prohibiting the export of gold-bearing residues. As there is no plant in Russia suitable for separating the refinery products, the directors of the Russian company are negotiating with the Ministry of Finance in Petrograd in regard to a solution of this problem. Nevertheless, since the beginning of the war the British company has distributed in dividends £250,000 without impairing the financial situation of the Russian operating company. The company's operations in 1914 were considerably hampered by the mobilization by the government of more than one-third of the regular employees of the company, the shortage of railway and other transport, and the commandeering of coal supplies. On account of the last circumstance, the company exercised an option on a coalfield it had been investigating. This is about 2½ miles from the railroad and is estimated to contain several million tons of coal above the 200-ft. level. Connections have been made with the railroad, and it is expected that in a few weeks this colliery will be able to supply all the coal required by the company.

During the 12 months ended April, 1915, the company extracted 352,000 tons of copper ore, but disclosed by development and drilling 558,000 tons, so that the ore reserves in April, 1915, were 2,667,000 tons. Since that date a new borehole at the Smirnoff mine has cut the lode at a vertical depth of 1,100 ft., or 500 ft. deeper than the previous depth proved at this mine. The east vein of massive pyrite was 6 ft. in width, and the west vein for 41 ft. contained nearly 3% copper and about 10s. per ton in precious metals. It was considered that this borehole had indicated an additional two years' life to the mine, or a total of approximately 10 years of ore reserves at the present rate of production.

Homestake Mine-Rescue Teams

At the third national field meet, held Sept. 22-24, at the San Francisco exposition, an interesting set of contests between mine-rescue and first-aid teams was held. There were 26 first-aid teams and 15 mine-rescue teams competing. Probably the most interesting of them

HOMESTAKE FIRST-AID AND MINE-RESCUE TEAMS

Reading from left to right, top row: A. E. Aldalo, J. F. Peters, J. Letcher, B. Hardwick, M. Ellis, Wm. Yeager. Bottom row: C. L. Ayer, captain, First-Aid team; R. W. Bonney, manager, Mine-Rescue team; Dr. F. E. Clough, manager, First-Aid team; C. A. Brooks, captain, Mine-Rescue team

all was the team representing the Homestake Mining Co., of South Dakota. This team won first place in the first-aid contest and fourth place in the mine-rescue competition. A photograph of the team is shown here.

California Oil in September

The California production of petroleum in September amounted to 7,370,430 bbl., a decrease from August of 300,000 bbl. The total shipments for 30 days in September, amounted to 7,718,807, as compared with 8,077,586 for 31 days in August. The amount of oil shut in was 18,000 bbl., the same as in August, and 500 bbl. less than in September, 1914. The amount of stocks Sept. 30 was 59,624,905 bbl., a decrease of 537,372 bbl. from August. This reduction in field stocks was insufficient to have an appreciable effect on the general situation, but it confirms the opinion of oil-trade experts that stocks of crude petroleum in pipe lines and field storage were being drawn upon to the extent of approximately 20,000 bbl. per day in September, because of the excess of shipments over production.

Field reports show that 30 new wells, with an initial output of about 10,000 bbl. per day, were completed in September; 17 of these wells are in the Midway-Sunset district. This is an increase of 18 new wells over August. The wells in active drilling in September numbered 145, a decrease of 7 from August. Drilling activity was due to obligations of leases. There were 6,438 wells producing in September, a total average daily production of 245,681 barrels.

Schedule of prices paid at the wells for crude petroleum remained the same as in the last four months.

Editorials

Revival of the Mining Industry

Unless all signs are fallacious, the mining industry of the United States is experiencing a real revival. This is not to say that it has been inactive or sick, for there has been scarcely a year during the last decade when there has not been an increase in the production of iron, copper, lead and zinc; but ever since 1907 there has been a sluggishness in gold and silver mining, an absence of interest in the development of new mines and an alarming decline in prospecting. Moreover, the troubles in Mexico during the last three or four years brought mining in that country to a standstill, seriously affecting the interests of American investors and manufacturers, engineers and operators.

Several things have combined to bring about a new and favorable turn in the mining industry. In the first place the huge demand—and consequent high prices—for copper, lead, zinc, antimony and quicksilver, due to the war, greatly stimulated the mining of those metals and required the services of a good many more men and the addition of a good deal of new machinery. Take the case of zinc smelting, for example. A very large sum has been invested in new plants since the beginning of 1915.

Similarly the extraordinary prices commanded by some of the rare ores, such as tungsten and molybdenum, sent hundreds of prospectors into the field to look for them. With tungsten ore selling at $2,000 and upward per ton, the discovery of a deposit yielding a carload or two is enough to give the lucky prospector a fortune. The *Journal* has heard of a case where samples from Mexico were exhibited to an adventurer in Arizona. He recognized them as wolframite and organized an expedition to go into the inferno of bandits and revolutionists to get some of it. His man came back with a cargo of 30 tons that sold for $75,000. Prizes like that inflame the prospector of '15 as nuggets of gold did the fortyniners. Not one out of a hundred, or a thousand, will be so lucky in tungsten, but some of the 99 or 999 are likely to stumble upon some previously unknown deposits of the other metals that may eventually develop into producing mines.

Other favorable conditions are developing, especially the reawakening of the spirit of speculation among the American people and the hopefulness as to restoration of law and order in Mexico.

The *Journal* has repeatedly expressed the opinion that there would be no general revival in the development of prospects and small mines, participation in the business by the thousands instead of by the few, until there had been a prolonged and successful bull movement in Wall Street. The great exploration companies and firms seldom develop mines. They are looking for sure things—huge deposits of ore developed by somebody else, too low in grade to be worked by any little concern, which they can make profitable by the use of immense capital and the application of professional skill. Such operations create but little semblance of activity in mining. What gives the tone is when hundreds of little companies are gambling in all directions upon the finding of ore. Ordinarily it is hard to find persons to go in for such gambling. Clergymen and widows are prone to it, but those classes alone are unable to keep the game going. As for the Guggenheims and mining capitalists of their ilk, anybody who tried to get them into a prospecting venture would probably receive the cold shoulder. They know too much and don't want to take chances. But let a promoter go around among his Wall Street friends who have just made a million or so in Bethlehem Steel or Crucibaker, and they will take a hundred-thousand-dollar chance on developing a mine without even asking what or where the mine is. In 1915 we have had for the first time since 1906-7 a bull market that has inflamed the popular imagination, that has aroused a speculative fever that already gives signs of spreading into mining.

As for the bearing of the Mexican situation upon the American mining industry, no dissertation is necessary. A mere statement that there seems to be a probability that stable government will soon be existent in Mexico is sufficient. Following that, the return of the mine operators, the reopening and reëquipment of the mines may be seen with the mind's eye. The resumption of mining in Mexico would alone be sufficient to work a revival in the mining industry of the United States.

International Gold Exchanges

Under the conditions that prevail in international trade it seems inevitable that from time to time there should be balances that can be settled only by the actual physical transfer of gold from one nation to another. These occasions arise in normal times, so that every year considerable amounts of gold have been shipped from New York to London or Paris, probably to be returned some months later. At the present time there is a specially striking illustration of this, the abnormal war conditions having brought about an extraordinary balance of trade in our favor. The great loan that has just been made here is partly an attempt to adjust matters through credit and to avoid further unusual shipments of gold.

We do not wish to discuss here the higher problems of finance involved in the loan transaction, but to call attention to a certain amount of waste and loss which is involved in this physical transfer of gold. The loss of interest during the period of transfer, the cost of transportation, the necessity of guarding and insuring the metal in transit, the danger of loss from theft or accident, the waste of metal by abrasion—all combine to make up a perceptible sum, which in the case of large shipments amounts to a considerable tax on the transactions. This cannot be avoided as long as we must cart our gold back and forth as the balance of trade fluctuates one way or the other.

There is also a further cause of loss of which we do not always take account. These transfers of gold are often necessarily made in coin that is foreign to the country in which it is delivered. A shipment of gold from Eng-

land to this country, for instance, may be all in American eagles, but more often it is all or in part in British sovereigns. Thus in a recent shipment of about $20,000,000, two-thirds was in British coin. Under existing American law foreign coin can be held and counted in current bank and treasury balances as gold bullion, but there are rather stringent regulations as to weight, allowance for alloy and other matters, so that bankers usually prefer to undergo the expense and trouble of recoinage. The case is very much the same when American gold coins are sent abroad. If it seems probable that they are to be retained in England or France for any length of time, a considerable part of them will be recoined into sovereigns or 20-franc pieces, notwithstanding the accompanying loss.

It has been proposed many times that this loss, or discount, might largely be avoided by the agreement of the chief commercial nations upon an international gold coinage. In advocacy of this suggestion it is argued that the values of an English sovereign, an American half-eagle, a French 25-franc piece, a German 20-mark piece, a Russian 10-ruble piece and a Japanese 10-yen piece are so nearly alike that a coin which would represent them all could be made with such slight variations from the original that the coinages of the various countries would not be perceptibly affected. It would not be necessary to change the names of the coins or to make more than very slight variations.

We are disposed to regard this idea, however, as impracticable, believing that careful consideration of it would bring to light as many difficulties as there are in the case of the proposal to discard the existing system of weights and measures in the English-speaking countries and substitute the metric system. What would be more to the point, we think, would be an international agreement respecting the fineness of the several coins and acceptance thereof, so that it would be unnecessary to remelt and recoin them so often after an exchange, merely through simpler regulations as to weighing and valuation.

Comparison of Crushing Tests

Some system for comparing crushing tests so as to give real information is badly needed. Many suggestions have been made, but none of them has met with universal approval. The difficulty of getting a satisfactory basis insures a welcome for every new plan. The latest is a suggestion by M. K. Rodgers, in a paper to the American Institute of Mining Engineers. The data Mr. Rodgers wants to include are these: Descriptions of the machines employed; the method and material used in foundations; the locality from which the rock or the ore was obtained and its geological, mineralogical and physical characteristics; power consumption of the machine running with no load and with full load, the units of power being 1 hp. per 24 hr.; the capacity of the machine in tons of 2,000 lb. per 24 hr.; the duty in tons per horsepower-day, and a careful statement of the screen analysis of both the feed and product, in accordance with the proposed A. I. M. E. standard-screen scale. It is proposed that whenever a rock-crushing test is reported, all of the factors mentioned shall be given in detail.

There is no doubt that Mr. Rodgers' suggestion ought to be acted upon, though it could be amplified. It does not go far enough. All operators are well aware that, aside from the factors mentioned, there are many others that have more or less influence upon results. They ought to be considered. Besides, there is not much profit in finding out what kind of ore you have by working it in a certain machine. It seems better to find out how good the machine is by testing it upon the ore to be crushed, and this process requires some unit for expressing the character of the ore itself. In other words, a unit factor must be found that will explain the character of the rock; then the work done upon it by different machines can be intelligently compared. Consequently it will be possible to select the best machine to do the required work. Unfortunately, the basis for comparison has not yet been agreed upon.

Those interested in the subject are aware of the discussion, which has been occupying a prominent place in the technical press for the last three or four years, regarding the accuracy of the laws of Rittinger and Kick, one of which has been advocated by Stadler and the other by Gates. The discussion is still on. A universal standard, mathematically true, is the logical beginning, so it must be first decided which of these laws is the correct one to apply and which system of units to use. Stadler's energy-unit is advantageous if it be proved that Kick's law is true. Gates' unit, using the crushing-surface diagram, is also easily applicable and readily useful if it can be proved that the basis of his argument, which rests on Rittinger's law, is correct. In a general review of the situation, then, it may be said that while we welcome every step, no matter how small, toward standardizing test reports, the field of rock-crushing comparisons will never be complete until a permanent foundation has been laid.

The many current reports of steel consolidations carry one back to the days of the formation of the Steel Corporation and other well-known combinations. As nearly as can be stated with any approach to precision, three strong financial groups are in the field. The most prominent of these is the Schwab, or Bethlehem Steel, party, which is believed to have the backing of the Carnegie interests; the second is the Corey-Midvale group, understood to be supported by Standard Oil interests; and the third is the Downer-Frick party, which now controls the Cambria Steel Co., and is contending with Bethlehem for the ownership of the Pennsylvania Steel Co. The outcome is still far from certain.

The discussion of the first report of the Committee of Standardization of the Mining and Metallurgical Society of America, by the members of the New York section, as reported in the September bulletin of the society, brought out some excellent ideas. The discussions that take place at the meetings of this society are always frank and illuminating and show the benefit to professional men of meetings where such discussions may be developed. The monthly bulletin of the Mining and Metallurgical Society is a relatively small publication, but it is one of the most useful issues of our technical literature.

An increased use of shoveling machines and greater activity in their invention and perfection may be looked for as a result of the present involuntary restriction of immigration. In good times one of the classes of mine labor hardest to get is muckers. We may look to see an aggravated scarcity in the near future.

BY THE WAY

A summer-school mining student was assigned to investigate the details of breast mining at the colliery visited by his class. Recalling an engagement with a demure maiden of Hazleton, he made a short day of it; but, to his consternation, upon emerging from the shaft he encountered the instructor in charge. Without waiting for an accusation, he hastily exclaimed, "Why, Professor Bell, I learned everything there was to know and I'm on my way to work up my notes." "Ah, Mr. Morris," was the reply, "just this morning I met an old fellow who has been mining for twenty-five years, and he tells me that he learns something new every day. But you have mastered it all in a few hours. I congratulate you."

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Must we furnish a wire-gauze jacket for the mule-barn cat or shall we ground him? asks the *Colliery Engineer*. In other words, must we furnish "permissible cats as well as permissible explosives"? An accident reported from New York City seems to suggest an unsuspected danger lurking in the cat's fur. According to the newspapers there was an explosion in a gas chamber used by the Society for Prevention of Cruelty to Animals to asphyxiate stray cats and dogs, ordinary illuminating gas being used. The formation of an explosive mixture in the chamber could easily be accounted for, but what fired it? Someone who had seen pussy's fur snap when stroked suggested that the cause was an electric spark caused by the rubbing together of the frightened cats. Thus another indictment is laid against our childhood's friend.

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The new British budget, which provides for a supertax of 50% on the profits of all British companies, has already caused the removal to the United States of the headquarters of several companies representing South and Central American gold mines, says a London dispatch to the *Times*. Mining men assert that unless the tax be reduced, this movement will become so great that New York, instead of London, will become the mining capital of the world. Mines whose production is just beginning are particularly hard hit. Unlike tea and rubber companies, mining companies have not been enabled by the war to raise their prices. The excess of profits is determined under the new ruling by subtracting from the income for the current year the average income for any two of the last preceding three years. Mining companies just coming into the field have no such opportunity, and will be compelled to pay 50% of their total profits for the year. The tendency to remove headquarters to the United States is becoming so pronounced that mining interests in London are bringing pressure to bear on Chancellor of the Exchequer Reginald McKenna to have the supertax modified in favor of gold mines. A correspondent to the *Financial Times* points out that Rand gold-mining companies are already heavily taxed. In the first place, a profits tax is payable by the mining companies to the government of the Union of South Africa, and, secondly, a special war tax has been levied on the mines as a contribution toward the recent campaign. In addition, the shareholders resident in the United Kingdom have to bear the income tax (which is deducted in the ordinary way as unearned income from the dividends); as this rate will now be subject to a further increase, surely the shareholders are already bearing more than their legitimate share of the burden.

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October Mining Dividends

Dividends disbursed in October, 1915, by 31 United States mining companies making public reports amount to $5,911,591, as compared with $3,551,160 in October, 1914. Industrial and holding companies allied to mining paid $3,315,458, as compared with $2,479,629 a year ago. Canadian and Mexican companies paid $1,359,588, as compared with $1,078,241 in October, 1914.

The totals for the first 10 months of the year are as follows: Mining companies, $57,311,674, as against $49,242,100 in 1914; metallurgical and holding companies, $65,441,802, as against $50,127,102 in 1914; Canadian and Mexican mines, $7,441,708, as against $13,680,365.

The drop in metallurgical and holding companies' disbursements is less, considerably, than the difference made by the passing of the dividends on United States Steel common. The returns from Mexican and Canadian companies for the first time this year show an improvement over the corresponding month of last year. As to the position of this country we are not yet in position to throw up our hats and shout with disturbing loudness, for in 1913 United States mining companies paid $62,175,610 in the first ten months of the year.

United States Mining Companies	Situation	Per Share	Total
Anaconda, c	Mont.	$1 00	$2,331,250
Arizona, pfd A, c	Ariz.		5,769
Bunker Hill Con., g	Calif.	02½	5,000
Bunker Hill & Sullivan, l s	Ida.	25	81,750
Bingham-New Haven, c	Utah	20	45,738
Butte-Alex. Scott, c	Mont.	15	11,100
Cardiff	Utah	25	125,000
Center Creek, z	Mo.	15	15,000
Champion, c	Mich.	2 00	200,000
Daly-Judge, s l	Utah	25	75,000
Golden Cycle, g	Colo.	02	30,000
Goldfield Con., g	Nev.	10	355,915
Homestake, g	S. D.	65	163,254
Hecla, l s	Ida	07	70,000
Interstate-Callahan, z	Ida	50	230,000
Iron Blossom, s l g	Utah	05	50,000
New Idria, g	Calif.	50	50,000
New Jersey Zinc, z	U. S	2 00	700,000
North Butte, c	Mont	50	215,000
Portland, g	Colo.	03	90,000
Prince Con., l s	Utah	02½	25,000
Silver King Coalition, s	Utah	15	187,500
Silver King Consolidated, s	Utah	10	62,758
Success, z	Ida.	06	90,000
Tonopah, g s	Nev.	15	15,000
Tonopah Ext., g s	Nev.	07½	70,757
Tennessee, c	Tenn.	75	150,000
Utah Apex, c	Utah	12½	66,000
Vindicator, g	Colo.	03	45,000
Wasp No. 2, g	S. D.	10	50,000
Wolverine, c	Mich.	5 00	300,000

Industrial and Holding Companies	Situation	Per Share	Total
Am. Smelters Sec. pfd. A	U. S	$1 50	$255,000
Am. Smelters Sec. pfd. B	Mex.	1 25	375,000
Bethlehem, pfd	U. S.	1 75	239,625
Brier Hill Steel, pfd	U. S.	1 75	83,452
California Exploration	U. S., Ont.	12	28,136
Cambria Iron	U. S.	2 00	169,360
Guggenheim Exploration	U. S., Mex.	1 00	833,732
Canyon-Starr, pfd., z	U. S	*24 00	*120,000
Penna. Salt	Penna.	2 00	100,000
Republic Iron & Steel pfd	U. S	†2 00	†408,338
Sloss-Sheffield	Ala	‡1 75	‡117,250
St. Mary's Mineral Land	Mich.	1 00	160,000
United States Sm., Ref & Min	U. S., Mex.	87½	425,562

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Beaver, g	Ont.	$0 03	$60,000
Butters-Salvador	C. A	25	36,450
Canadian Mining, s	Ont.	12	259,375
Consol. Min. & Sm., l s z	B. C.	2 00	116,098
Hollinger, g	Ont.	20	120,000
La Rose, s	Ont.	.05	37,466
Lucky Tiger, g s	Mex.	09	64,380
McKinley-Darragh-Savage, s	Ont.	03	67,431
New York & Honduras Rosario, s g	C. A	.30	60,000
Nipissing, s	Ont.	25	300,000
Peterson Lake, s	Ont.	01½	63,000
Porcupine-Crown, s	Ont.	03	60,000
Rambler-Cariboo, l z s	B. C.	01	17,500
Seneca-Superior, s	Ont.	10	47,888
Standard, s l	B. C.	02½	50,000

* In payment of deferred cumulative dividends to July 1, 1915.
‡ Scrip. † 1½% paid on account of back dividends.

PERSONALS

J. Ernest Snelus left London recently for Nigeria.

R. S. Innes, of London, has gone to the Belgian Congo.

Frank Rowley has left London on his way to Tasmania

R. V. Barton has gone from New South Wales to Chosen.

W. R. Feldtman is in West Africa on professional business.

J. Kobuse has been examining mining property in Chosen.

A. G. Wolf, of Denver, is in Gunnison County, Colo., on professional business.

H. C. Hoover, who is doing such wonderful work for the Belgians, is spending a week in New York.

William Thomas left London recently on his way to the Champion Reef Mine in the Kolar District, Mysore, India.

Frank Reed, inspecting engineer of mines in New Zealand, has been appointed also chief inspector of coal mines.

Charles Botsford, of New York, has placed two Kirkwood exploration propositions with Michigan Copper Country people.

W. H. Wright, of the Malm-Wolf Co., has completed the examination of placer properties near Alma, Colo., and has returned to Denver.

L. F. S. Holland has returned to Los Angeles, Calif., after making examinations in Pioche, and Cherry Creek, Nev., and in San Bernardino County, Calif.

Lieut. J. Cameron, mining engineer of Toronto, who enlisted for service abroad in the first Canadian contingent, was wounded in a recent engagement.

C. W. Whitley, manager of the American Smelting and Refining Co., in Utah, and W. H. Howard, metallurgist for the company in the West, are visiting New York.

John Daniell, mining engineer of Laurium, Mich., is home from the new Kirkwood district in Canada, having secured a property which will be financed by Laurium people.

James J. Ormsbee, formerly superintendent of the El Paso smeltery, and more recently of the Tacoma and Hayden plants, is spending a couple of weeks in New York, with headquarters at the A. S. & R. Co.'s offices.

H. J. Rahilly has returned from the Matanuska coal field in Alaska, where he spent six months on professional business for the General Land Office. He has accepted a position with the Bureau of Mines and is now stationed at Pittsburgh

L. Selmi, chief chemist-metallurgist of the Otis Steel Co., Cleveland, has resigned, effective Nov. 1, when he will take charge of the chemical and physical laboratories of the new steel plant of Corrigan, McKinney & Co., Cleveland, Ohio.

Angus W. Smith, largely interested in the White Pine Extension in Ontonagon County, Mich., is in the district with Frank McM. Stanton of New York, superintending the construction of the shafts and continuance of diamond drilling.

R. B. Bostwick, superintendent of the openhearth steel department No. 3 of the Homestead works of the Carnegie Steel Co., has resigned to become associated with the Upson Nut Co., Cleveland T. J. Jamison has succeeded Mr. Bostwick at Homestead

OBITUARY

Charles Smith died recently at Hubbell, Mich. He was chief clerk of the Calumet & Hecla smelting plant at Hubbell, and one of the oldest employees of that corporation. He was employed at the smelter from the day it started. He served many years in the legislature and on the county board of supervisors. He was prominent in Masonic circles.

Howard E. Burton, well-known assayer, metallurgist and operator of Leadville, Colo., died Oct. 16 at Glenwood Springs, of typhoid-pneumonia after a very brief illness His death was a shock to his host of friends, for he was a man in the prime of life and in good health He was born at Lake Geneva, Wis., in 1870 He graduated from the University of Wisconsin in 1893. In 1895 he located in Leadville as chemist of the Elgin smeltery and he has lived there continuously since that date. Upon the closing down of the smeltery he opened a custom assay office that he maintained to the time of his death. He was known by his liberal advertising that resulted in a large mail-order assay and analytical business. He was largely interested in many of Leadville's important discoveries and projects. Recently he has been exploiting molybdenum deposits a few miles north of Leadville. He was one of the owners of the new smeltery at Leadville erected for custom treatment of the non-sulphide zinc ores of the district. During the early years of cyanidation he erected a leaching plant at the Penn mine north of the city and attempted to treat the enormous mine dumps without crushing, but his efforts were only partially successful. In a similar way he has ever been foremost in inaugurating projects for furthering the interests of the Leadville region. He was a member of the Masons, Elks, Phi Delta Theta, Woodmen of the World and the Royal Arcanum. His funeral was held Oct. 19 under the auspices of the Masonic fraternity, at Leadville.

SOCIETIES

New Mexico School of Mines is building new metallurgical building and other edifices at Socorro, N. M. Power plant with 50-kw. generator and two oil engines to be installed.

American Society of Mechanical Engineers—A meeting of the New York Section will be held at the Engineering Building, Nov. 9. Charles Meigs Ripley, will present the paper of the evening, which covers an investigation of the size, age and performance of gas-producer power plants in New York City and neighborhood. The paper reports the results of a census showing the owners' opinions regarding repairs, labor and depreciation; satisfaction and dissatisfaction which they have experienced with their plants; and future policies.

American Institute of Mining Engineers—The Columbia Section will hold its annual meeting at Wallace, Idaho, Nov. 19 and 20. The first day and evening will be devoted to technical papers and discussion, and the second day will be given over to sightseeing, probably a visit to the great Interstate-Callahan zinc mine. The program will include a paper on "Progress in Ore Dressing" by D. W. Buckby, superintendent of the Stewart mill. "Zinc Smelting and Smelting Rates" is the subject of a paper that will be presented by W. L. Henry, of the Empire Zinc Co., of Denver. J. E. Chapman, chief accountant of the Federal Mining and Smelting Co., will read a paper on "Mine Accounting." The Columbia section includes Idaho, Eastern Washington, Eastern Oregon and part of British Columbia and has 104 members. Members of the Montana section have been invited to attend.

INDUSTRIAL NEWS

The Carbo Steel Post Co. of Chicago has changed its name to the Carbo Corporation. No change in the personnel of the organization has been made.

Industrial Works has established a Philadelphia office in the Widener Building. Complete data and information can be obtained there regarding the Industrial Works line of locomotive, wrecking and freight-handling cranes, pile drivers, grab buckets, etc.

On Oct. 1 the property and business of E. I. du Pont de Nemours Powder Co., of New Jersey, was sold and transferred to E. I. du Pont de Nemours & Co., of Delaware, a corporation organized for the purpose of taking over and carrying on the business. The new company assumes all liabilities of the old company (except capital stock and funded debt) and will carry out all contracts of the old company, there being no change in the personnel of the management, operations or methods of handling the business. It will issue capital stock to the amount of $120,000,000. E. I. du Pont de Nemours & Co. the new corporation, bears the name of the original Delaware concern established 1802 by E. I. du Pont de Nemours. The return to the original name is a tribute to the founder and emphasizes the long establishment of the business. The incorporation was made in Delaware because Delaware was where the business originated and the main offices are located in Wilmington. Although the du Pont facilities for manufacturing and selling explosives have materially increased, explosives are no longer the only products of the organization. The chemical business has entered many industrial lines and further extensions are inevitable. Du Pont Fabrikoid Co. a controlled concern is making exceptional progress, and enlargement of its productive capacity has been and probably will be continuous as a result of steadily increasing sales.

Editorial Correspondence

SAN FRANCISCO—Oct. 28

Protection of Investors in mining properties is apparently one of the purposes of the State Corporation Commission which is operated under the blue-sky law. Recently a permit was issued to the Forest Hill Mining Co. to issue 50,000 shares of stock in payment for 2 placer claims and to issue 300 shares for services, upon condition that the shares are accepted at a valuation not less than 25c. per share, the price at which the company is permitted to sell an additional 30,000 shares for development purposes. The commission for selling is limited to 20%, and the 50,000 shares payment for property must be deposited in escrow, pending the financing of the company. In issuing stock to the original incorporators they must enter into separate agreements with the company that they are not receiving their shares as fully paid, but on the same basis as other purchasers. Meantime a mine promoter of San Francisco was arrested at Liveoak on complaint of ranchers in the vicinity that he had collected from them several hundred dollars with which he was to secure rich mining claims in Siskiyou County. The promoter excused himself on the ground that before he had an opportunity to secure the mining property, he was held up and robbed. He may go to prison for obtaining money under false pretence, but the farmers of Liveoak will not get their money back, and are just as apt to bite at another sucker proposition in spite of the blue-sky law, which, of course, has nothing to do with this class of criminal promoters.

DENVER—Oct. 28

Cripple Creek Deep Drainage and Tunnel Company's Executive Committee met, Oct. 12, at Colorado Springs, and decided, among other matters, that, upon the completion of the bore on its present course to the Elkton shaft, its direction be thereafter carried on a line nearly due east to the Golden Cycle shaft a further distance of approximately 8,000 ft. The Elkton shaft should be reached about Jan. 1. Irving Howbert resigned from this committee and was succeeded by Frank G. Peck, another officer of the Portland company. Great credit was given Charles M. Fuller, superintendent of the tunnel, for his excellent work and he has been sent to the Michigan iron regions to investigate mechanical muckers there in use and to decide upon their adaptability in his Roosevelt tunnel work.

Washing and Concentration of Hillside Débris has been undertaken by a new concern known as the Omaha Concentration and Mining Co. At two localities in the Cripple Creek district, this company has installed equipment of its own devising to cull gold from the soil, sand and gravel covering the slopes of the mountains—in the Kitty Hollis claim near Windy Point and in the Isabella territory on Bull Hill. At the former plant, treatment consists of following simple steps. With ordinary horse plows and scrapers the dirt is loosened and delivered to a bin whence it travels by conveyor belt to a stationary half-inch screen that rejects coarse gravel, roots and other worthless material. This half-inch product passes to a trommel with 5-mesh screen through which the finer material is washed by water, the undersize being immediately given its final sizing through a 10-mesh trommel. A spectator judges, from this arrangement, that the proprietors do not expect any coarse gold particles in this "wash." The small quantity of fines finally retained below the screens goes to a Harrington table, a machine for which originality is claimed. This table is a modified gold sluice, with an oscillating, longitudinal motion. Its bed contains semi-round grooves 2 in. deep by 2 in. wide running crosswise, acting as riffles. In these grooves rods of iron with fingers are caused to slide back and forth keeping the sand in motion. Clean-ups are made intermittently by sweeping the concentrate from the grooves. At the Isabella plant, not yet in operation, the first screened product will pass through rolls to release particles of gold in the quartz fragments as it is proposed to treat here both wash and dump material.

SALT LAKE CITY—Oct. 29

A Miners' Strike, involving 370 men was inaugurated at the Silver King Coalition mine, Park City, Utah, following a proposal by the company of a compensation plan, which does not meet with the favor of the men. This is the first strike in the history of the company which has been operating 30 years. According to the plan, the Silver King Coalition Provident & Insurance Association is to be formed, each miner paying $1 a month to the association, and the company a like amount—the funds of the association to be subject to the direction of six trustees, three to be chosen by the miners, and three by the management; in cases of disagreement the general manager of the company to act as arbiter and cast the deciding vote. In case of the death of an employee occurring on the property it is proposed to pay not less than $2,000 to the heirs, this sum being liable to increase at the discretion of the board of trustees; for permanent total disability the payment of not less than $2,000 is proposed, and for partial permanent disability not less than $1,250; and in cases of temporary disability not less than $12 a week, unless the board of trustees shall otherwise direct. The miners also object to the proposal made by the company that all cases be taken to the Holy Cross hospital at Salt Lake for treatment. Up to the present time the men have been paying $1 a month to the miners hospital at Park City. The larger number of the employees went on strike the morning of Oct. 26, leaving engineers and pump men in their places until 6 p.m., Oct. 28, and demanded that they be given the privilege of assigning their $1 to any hospital and the abolition of the company's insurance plant. At 6 o'clock, receiving no reply from the company the engineers and pump men joined the strikers after the mules in the underground workings had been brought out by the miners, and at present the water is coming into the workings at the rate of 600 gal. a minute. Thomas Kearns, general manager of the company, who was away at the beginning of the trouble, has arrived in Salt Lake City, and is awaiting overtures from the miners. If the water rises to the 1,300 level, the new electrical equipment (described on page 747 of this issue) may be seriously injured, it is stated, entailing a considerable loss. About two-thirds of the miners are non-union men, and the greater number are Americans. The Western Federation of Miners has espoused the cause of the Coalition miners, and pledged its support. The men have been warned to act in an orderly manner, and so far there has been no disturbance.

SEATTLE—Oct. 28

Navigation in the Arctic Ocean has closed for the season, according to a dispatch from Nome.

Deals in Broad Pass Mines are falling through because of an apparent intention of the owners to make unreasonable demands of those with capital who are anxious to prospect the ground thoroughly with a view of purchasing. Representatives of capitalists have looked the ground over, but have been unable to make any arrangements with the present owners and it seems likely that little real development work will be done in the district at present.

Larger Output Is Certain in the Fairbanks District, according to the latest figures. Every month this year to date, the output has been larger than the corresponding months of last year and indications are that the same conditions will continue during the remainder of the fall. Last year the opencut operators were hurt considerably by heavy frosts and the cold nights during the early part of September and October, and it is not likely that conditions will be any worse this year. All opencut plants have done well this summer, having had plenty of rain for the greater part of the time and having got an early start in the spring. The dredge on Fairbanks Creek started late but is doing well and will continue to work right up to Nov. 1 if possible. Hiltys plant, on Cleary Creek, is working full time and has increased the output considerably. The Pedro Creek operators are taking out more money than last year. Ester Creek is producing more gold than in 1914. Cleary and Chatanika are fully as good as last year and some of the operators are taking out a great deal more dust than in 1914. Several thousand dollars of gold has come down from the Tolovana district but the district will not show up to its true worth until 1916 and everyone in the Fairbanks district believes that with the increased production of the Tolovana added to the increased production of the Fairbanks district will show the entire territory in the vicinity of Fairbanks a larger producer in 1916 than since 1911.

MORENCI, ARIZ.—Oct. 29

The Clifton-Morenci Strikers' Delegates and the mine managers concluded their deliberations Saturday, Oct. 23, without reaching agreement on a single point. The managers again restated the only conditions under which they will resume work: The federationists must get out and the men must return to work under the pre-walkout conditions. When these requirements are met and normal conditions are restored, the managers will meet the employees, as they have always heretofore been willing to do, and discuss any grievances the employees wish to take up. In order that the public might have a clear conception of the situation, the officials gave out a brief industrial history of the district and a resumé of the incidents leading up to the strike. Owing to the orebodies being small and scattered over a wide area, the district could never have been opened up in the early '80s but for the abundance of cheap Mexican labor. The constantly lowering of the grade of ore, the very small tonnage per man as compared to that in other places in the state (about 3 here to 8 elsewhere), make it impossible for the companies to pay the same wages as are paid at other camps, which the strikers demand. The sliding scale adopted with the improvement of market conditions early this year, although it gave the employees more money at corresponding copper prices than they had received prior to the 10% cut when the slump came one year ago last August, did not give the 10% back in a lump sum. Thus the field was particularly attractive to the federation organizers. Governor Hunt and Attorney-General Jones, told their brethren at the beginning that the strikers' cause was "the cause of Almighty God" and that if the managers didn't "quidado" they might find themselves in "the bull pen." The governor has sent another detachment of troops to the district to guard against the entrance of a few thousand imaginary strikebreakers being assembled at Duncan. Or perhaps he wants to pour oil on the waters on account of petitions being circulated throughout the state for his recall. Young J. Pentland and Willis E. Miller, of Edinburgh, Scotland, members of the Arizona company, who are now in El Paso, have not accepted the invitation tendered by the federation to come to Clifton and "learn just how bad and inefficient their executives are."

CLIFTON, ARIZ.—Oct. 30

Strikers in Clifton-Morenci District have assumed an attitude of "watchful waiting" with the definite understanding that a federal investigation of causes leading up to the strike and of conditions existing at present will be held soon by Commissioner Myers, under direction of Secretary Wilson of Department of Labor and Commerce. The union reports finances plentiful and more in sight. There is no indication that the strikers' committee is contemplating presenting a new proposition to mine managers.

HOUGHTON, MICH.—Oct. 30

Taxation of Mines is likely to become a prominent issue in the Lake Superior district next month. At the last meeting of the board of equalization of Houghton County, the assessed valuation of Adams, which includes the three mines of the Copper Range Consolidated and is represented on the county board of supervisors by F. W. Denton, the manager of the mines, was raised more than $2,000,000 above the figures of Mr. Denton. He immediately protested when the report was made to the county board of supervisors. Supervisor Seeber, representing the St. Mary's Mineral Land Co., also protested, claiming that if the additional figures were spread on the Adams township taxes they would have to be paid, in large measure, by St. Mary's company, as they would not be put back on the mines. The state board of tax commissioners set aside a date for hearing and review of Adams township mineral land and mining assessment. Supervisor Denton claimed that the assessment of $16,000,000 on Adams township was too high and that the assessments of $29,000,000 on Calumet mines and $6,000,000 on Osceola mines were too low. He also complained that the method of reaching taxation valuations was unreasonable.

ISHPEMING, MICH.—Oct. 9

The Outlook on the Michigan Iron Ranges is excellent. It has been a good many years since the operators have started opening mines on the Michigan iron ranges when the end of navigation for the season was in sight. However, such is the condition right now, and it looks as though the coming winter would witness considerable activity. Shipments are continuing at a steady rate, and more ore would be going forward if the railroads could supply the cars. The Chicago & Northwestern Ry. placed an order last week for 500 new steel cars, and the Lake Superior & Ishpeming road ordered 400 steel cars last spring that have not been delivered yet. The operators feel certain that they are going to receive an advance of 50c. a ton for their product next year, and several of the companies have already announced that they will not close any more contracts at the present selling prices. The Cleveland-Cliffs Iron Co. and Corrigan, McKinney & Co. have withdrawn from the market, although both concerns have ore in stock that they might sell and ship this season. The latter company resumed operations at the Tobin mine, in the Crystal Falls district, this week, placing a large number of men at work underground. This is one of the big mines of the Menominee range and employs between 400 and 500 hands when working to capacity. It was closed over two years. This same company has taken a lease on the Cole & McDonald property, near Crystal Falls, and will start development work shortly. Cole & McDonald secured possession of the tract and drilled it thoroughly, proving up a large deposit of ore of good grade. The Fortune Lake Mining Co., a subsidiary of Oglebay, Norton & Co., will sink two shafts on the property recently drilled near Fortune Lake, in the Crystal Falls district. It was only a few weeks ago that a contract was awarded to change the course of Briar Hill Creek, which flows over the orebody, and which would make mining difficult. The Cleveland-Cliffs Iron Co. has added 60 men to its force at the Cliffs shaft mine, at Ishpeming. The production of this property is to be increased several hundred tons a day by doing part of the tramming and hoisting at night. The Volunteer Ore Co. has resumed operations at its mine at Palmer, which has been idle over a year. The outlook is certainly encouraging in the Michigan field.

TORONTO—Oct. 26

A Hydro-Electric Plant to supply power to the new gold district of Boston Creek, a short distance from Swastika, is to be financed by a local syndicate. If there is any surplus of power it will probably find a market at Kirkland Lake.

Many Wide Dikes Have Been Uncovered in the Kowkash gold area. A number of prominent Porcupine mining men have been prospecting in the district. An important find of Tellurides about 35 mi. west of Kowkash is reported. A direct Pullman car service from Toronto to Kowkash is in operation.

The Zinc Deposits at Burbridge, about 72 mi. from Ottawa, in the Gatineau region, have been investigated by J. D. Macfarlane, who has returned with samples of ore and confirms reports as to the richness of the deposit. He states that every 750 tons of ore mined will yield 100 tons of zinc, and that in one spot 40x25 ft. in area there is 40% zinc. The outcrop, which is 2½ mi. from Burbridge station, is of highly crystalline limestone at the base of a limestone ridge. The deposits were found some years ago, but as the locality was difficult of access, and zinc not so much in demand as now, the claims were simply staked and no effort made to develop them.

VICTORIA, B. C.—Oct. 26

Two Finds of Copper have been made recently that promise to be of more than usual interest. One is on Owl Creek in the Lillooet, where chalcopyrite and native copper occur in a silicious schist. The body appears to be of considerable extent and samplings made by J. A. Beaudette for Foley, Welch & Stewart show about 5% copper. The other discovery is near Jones Lake in the Hope district. It was covered by a glacier, but the extremely long warm season melted the ice and exposed it. The vein has a width of from 28 to 50 ft. and has unusually high mineral content.

CALCUTTA—Sept. 8

New Indian System of Weights—The Indian Government in October, 1913, appointed a committee to consider the question of uniform weights and measures within the Indian Empire. The recently published report of this committee is of considerable importance, affecting as it does, the commercial transactions of one-fifth of the world's population. The adoption of the metric system and alternatively of the British, was considered and rejected. The former, principally upon the ground that the use of decimals was alien to the customs of the Indian people. The latter, because it would have compelled an alteration in the weight of the tola, the most important standard of weight in use. Moreover, the weight of the tola and of the rupee being identical, the weight of the coin would also have had to be altered. The committee recommended that the Bengal, or Indian railway, weights should be adopted for universal use throughout the Indian Empire, with the exception of Burma, where a uniform system suitable for that province already obtains. The proposed weights are as follows, for India: Eight khaskhas make 1 chawal; 8 chawals, 1 ratti; 8 rattis, 1 masha; 12 mashas or 4 tanks, 1 tola; 5 tolas, 1 chatak; 16 chataks, 1 seer; 40 seers, 1 maund. A tola, the weight most used with reference to silver, is equal to 180 grains troy.

The Mining News

ALASKA

INDEPENDENCE (Seward)—Two hundred ounces of gold in five days with only 10 men and a miserably small plant is record of this property on Willow Creek. L. S. Robe is superintendent.

NEVADA CREEK (Douglas Island)—Mike Hudson, of Douglas is in charge of gang of 20 men that has started work at Nevada Creek mine which was recently sold after much financial distress following its operation by English capital. Development will be pushed rapidly.

ALASKA COPPER CORPORATION (Strelna)—Consulting Engineer Du Bois has finished his work for the year and has left for East. Compressors and drills will be installed in near future. Property is situated off Copper River & Northwestern Ry., in Copper River Valley about 25 mi. from famous Kennecott locations.

CACHE CREEK DISTRICT (Seward)—J. H. Rice, an operator on Willow Creek, in Cache Creek district, has just arrived in Seward from his placer claims. Owing to shortage of water he was able to work only about 45 days, but took out, in this time, $4,000 in dust. He describes property as having three distinct paystreaks of varying width and richness. Richer gravel on bedrock occasionally ran as high as $7 to the pan. Dust is high-grade, running nearly $18 per oz. after melting. Mr. Rice will shortly make the return trip of about 300 mi. with intention of remaining upon claims through winter.

CALIFORNIA

Amador County

ERNEST (Jackson)—Reported good body of ore disclosed at this mine near Doyle place.

BOITANO (Jackson)—Property reported to have been bonded; definite information not available. Situation adjoining Hardenberg makes it attractive, though Hardenberg is still idle.

FELLOWCRAFT (San Andreas)—Mine has been unwatered and well mineralized ledge exposed on 200 level. Thorough test of both 200 and 100 levels will be made before development is begun.

Butte County

BUTTE COUNTY R.R. reported to have been negotiated for by Southern Pacific and that latter company will extend line from Stirling to Westwood in Lassen County to connect with Fernley & Lassen branch. Butte County R.R. is operated by Diamond Match Co., between Chico and Stirling, under lease which will soon expire. Extended line will place Chico on transcontinental line and open up new mining regions.

Colusa County

MANZANITA (Williams)—This quicksilver mine at Sulphur Creek leased to H. B. Bradford, of San Jose. Reported that rich pockets of ore have been disclosed. Mine closed down two or three years ago by men who purchased of George V. Northey, who introduced concentration into metallurgy of cinnabar. Northey made successful concentration by use of Gilpin County bumpers and canvas tables. Though method was crude, attention of quicksilver miners was attracted to economic feature of practice. Some improved methods have been experimented with but most of larger operators still continue old process of direct roasting of coarse ores and retorting fines.

Eldorado County

CHEROKEE FLAT (Georgetown)—Davis and Federwitz, of Placerville, are developing this property on middle fork of American River, situated on Mother Lode. Vein is large and of good milling value and will be tapped by crosscut tunnel at depth of 100 ft.

STEAM-SHOVEL and locomotive equipment is being installed on Webber Creek, 6 mi. from Placerville, for operation of gravel mines. Gravel dug by steam shovel will be dumped into 4-cu.yd. side-dump cars and hauled by locomotive to sluices. This is first time that combination of steam shovel and locomotive has been adapted to gravel mining in California. George W. Kirkley is manager.

NEWTOWN RIDGE gravel mines at the head of Missouri Cañon will be opened by a 500-ft. crosscut tunnel to be driven at depth 200 ft. below old river channels believed to contain cemented gold-bearing gravel in quantity to make undertaking profitable. At intersection of tunnel and channel raises will be driven. L. A. Bender and Charles Wright have taken bond on 160 acres of land for this purpose.

Kern County

OLD MILLS ANTIMONY MINES are being operated in a small way. Carload of ore is reported ready for shipment. Property is situated in Devils Cañon about 7 mi. from Caliente.

CALIENTE CAÑON mines owned by J. B. Ferris, of Bakersfield, reported sold to Western mining men at large figure. Said to be large amount of low-grade ore disclosed by small amount of development.

Nevada County

HIGH-GRADING at Empire mine resulted in sentence of Andrew H. Coggins to 4 years in state prison. Coggins pleaded guilty in Superior Court. Archibald Boone, an accessory, escaped punishment, as ore had been recovered. Coggins had stolen about $50,000 worth of high-grade and specimen ore; but he had not disposed of any of it to his own profit. Boone assisted him in removing stolen ore from Nevada City to San José; but neither of them profited by the theft.

ENGLISH MOUNTAIN (Nevada City)—High-grade ore reported by Henry C. Schroeder who is operating under lease.

NORTH STAR (Grass Valley)—New hoist installed complete and in operation. Ore is being dumped into steel bins which are part of this new equipment at Central shaft.

Tulare County

TULARE COUNTY POWER CO. (Tulare)—Property sold to Mount Whitney Power & Electric Co., and corporation dissolved by court.

Tuolumne County

FLOODING OF MINING CLAIMS by Goodwin dam will be taken into court in suit for $10,000 damages by H. A. Preston, postmaster of Jamestown, against Oakdale and San Joaquin irrigation districts.

COLORADO

Boulder County

BOULDER TUNGSTEN PRODUCTION CO. (Nederland)—Has let contract to Colorado Iron Works, Denver, for erection, within 90 days, of complete concentration mill to have crushing capacity of 60 tons, and concentrating capacity of 35 tons per day. Flowsheet is as follows: Bins; conveyor belt to grizzly; Blake crusher; belt conveyor to 27x14 rolls crushing to $\frac{3}{4}$ in.; 20x5½ rolls crushing to 12 mesh; elevator to impact screens; jigs; classifiers; Wilfleys; Deisters; tails and oversize from screens elevated to 3x4 ball mill; cone thickeners; slime tables.

Clear Creek County

PRIMOS CHEMICAL CO. (Empire)—On Oct. 16, closed down operations in molybdenite mine in Daily district until cloud on title to property has been cleared by litigation now being waged between original owners who sold to this company years ago.

SANTIAGO (Georgetown)—Recent development operations in this mine in East Argentine district have opened vein of ore 2 to 4 ft. wide which ranges in value from $20 to $45 a ton in gold, silver and lead. During the past month about $4,000 worth of ore has been produced from development. The product is hauled in wagons to Georgetown whence it is shipped to smeltery at Salida. Systematic development is being pushed under direction of Frank Ricci.

Dolores County

EMMA (Rico)—Arrangements are being made to install flotation apparatus in the mill to handle complex sulphides.

RICO-WELLINGTON (Rico)—This and Rico-Consolidated, both owned by Knight Investment Co. of Salt Lake City, shipped 62 carloads during September.

Eagle County

TWILIGHT (Fulford)—John Weiskopf and John Storey have emerged from their mysterious camp in mountains south of here, bringing wonderful specimens of free-gold ore. They declare they cannot do further prospecting until spring, since their discoveries are very high. There promises to be a stir among prospectors in this region next spring.

Lake County

GRANITE TUNNEL (Granite)—Julius Hoffman, stockholder and creditor in this defunct company, has purchased all its properties at sheriff sale.

GARBUTT (Leadville)—Large double-drum hoist has been installed. Hereafter hoisting will be done in both compartments of shaft. Ore reserves are said to be very large. Building of proposed mill has been postponed until next spring owing to climatic conditions.

Ouray County

NATIONAL BELL (Ouray)—Davey Leasing Co. shipped 2 carloads to Durango smeltery, part of the material coming from mine dump.

WANAKAH (Ouray)—Large body of 5% copper ore carrying small amounts of gold and silver, making average grade of material about $15 per ton, found in old workings. Stuff was not marketable during former operations, but is excellent for company's smeltery now.

Pitkin County

CHARLES HARRIS AND KEMPER DUNLAP, prospectors, claim to have made important finds of ores carrying tin, antimony, copper, lead and zinc in the country about the heads of Avalanche, Capitol and Snowmass creeks in the Elk Mts., about 12 mi. west of Aspen.

San Juan County

SILVER LEDGE (Chattanooga)—Leaser Bonavida is mining and milling a fine grade of galena-sphalerite carrying gold and silver. Mill makes two clean products.

ALL O. K. (Silverton)—This property in Minnie Gulch is being reopened and developed by James O'Kelly. Main crosscut tunnel is being advanced toward Kittimac property. Recent metallurgical tests on All O. K. ore indicate that it can be treated satisfactorily by cyanide process

COLUMBUS (Animas Forks)—Manager Arthur Johnson estimates that tunnel will reach Columbus oreshoot during early part of January. Drifts will be driven both ways on vein. Shipments of ore are being made from upper workings and will continue as long as railroad is open.

GOLD KING (Gladstone)—Has been decided to convert entire plant to flotation process. Production of ore will necessarily cease during changes in mill, but underground development will proceed in anticipation of greater mill demands. Plans contemplate largest flotation mill in state.

TOMBOY (Telluride)—During September, mill treated 13,000 tons, recovering $45,000 in bullion and $40,500 in concentrate. Monthly expenses were $56,700. Despite low average value of this ore (=$6.58 per ton) the cost of $4.36 per ton is low for the conditions prevailing in this rugged region.

Teller County

CRESSON (Cripple Creek)—Mining and hoisting suspended few days last week while repairs were made in shaft.

GOLD DOLLAR (Cripple Creek)—Dell Brothers, leasing 500 level, shipped 30 tons from new shoot, receiving returns at rate of 2.21 oz. gold per ton.

GOLD SOVEREIGN (Victor)—Stockholders have voted to extend life of incorporation for another 20-year period. Mine is leased to Gold Sovereign Mining and Tunnel Co.

VINDICATOR CONSOLIDATED (Independence) — Net earnings from operations for third quarter of 1915 were little over $225,000, out of which five additional notes, of series issued in purchase of Golden Cycle mine, were paid, making 19 in all, together with six months' interest on balance of series remaining unpaid. This was accomplished with but small reduction in cash balances from those of previous quarters. Developments on 18th level of Golden Cycle disclose two different oreshoots in main veins amounting together to ovef double length and volume of orebody on 17th level, but of lower average grade. Further development on 17th and 16th levels has opened additional ore. About four-fifths of shaft sinking for two additional levels has been accomplished, including cutting of station for 19th level.

IDAHO

Shoshone County

GOLDEN WINNIE (Murray)—Erastus Smith, owner of this tungsten property, has given 30-day option to Bennett Bates on basis of about $50,000. Has small mill run by water power. Several small shipments have recently been made.

REINDEER-QUEEN (Mullan)—E. B. Crawford has been elected president. Car of high-grade copper ore will be shipped soon. Driving on vein is under way and tunnel has just entered Queen ground for first time; face of drift shows 4 ft. of shipping ore, according to reports.

MINNESOTA (Wallace)—Under management of O. B. Wallace, who organized Interstate and managed it until its consolidation with Callahan, Minnesota Mining Co. is developing group of claims adjoining California, on Nine Mile, about 2½ mi. from Wallace.

GERTIE (Wallace)—Long Gertie crosscut adit has been driven 3,720 ft. in 12 months, average of 311 ft. per month under system whereby miners receive bonus of $25 to $40 per month. Adit is 6 by 8-ft. section and has cost $67,000, which includes cost of machinery and other equipment.

MARK COONEY (Burke)—M. W. Neary, of Spokane, has made payment of $25,000 on option on Mark Cooney group, near Burke. Second payment of $75,000 is due in one year and final payment of $75,000 six months later. Property consists of 4 claims, patented in 1901 and idle since.

AMERICAN-COMMANDER (Mullan)—Preliminary work was started on American-Commander this week, preparatory to extending lower tunnel to vein. Will secure power from Independence Lead Mines Co. American-Commander is supposed to be on Hunter vein and good ore showing is reported in upper tunnel.

CONSTITUTION (Pine Creek)—Ex-Senator George Turner and Frank G. Graves, of Spokane, have taken option on large block of stock of Constitution M. and M. Co. Mine has shipped 3 cars of crude zinc ore, which has been penalized by smelters on account of 10% lead content. Compressor and hoist will be installed at once and if developments justify mill of 150 tons capacity will be built.

MONITOR (Adair)—Has recently started 6,000-ft. tunnel near railroad at Adair which will explore its ground at depth of 1,100 ft. Tunnel is designed to form outlet for adjoining properties also. Tunnel is now in 500 ft. New boarding and bunkhouse just completed to accommodate 16 men, also new compressor building. Old workings on Idaho-Montana divide consist of shaft 700 ft. deep, from which copper ore amounting to $70,000 has been shipped to Saltese, Mont. Buildings at upper works burned in forest fire several years ago. Ore returned 20% copper and considerable gold.

MICHIGAN

Copper

MOHAWK (Kearsarge)—Copper content risen remarkably in six months, now showing 21 lb per ton

WHITE PINE (Ontonagon)—Railway connection, by way of St. Paul and Calumet & Hecla spur will be completed.

TAMARACK (Calumet)—Lake Superior shareholders are convinced that there will be no consolidation with Calumet & Hecla.

MASS CONS (Mass)—This property has increased actual recovery to 20 lb. per ton. Closer selection of rock necessary because of limited mill capacity explains situation. October output will be half million pounds. One Quincy furnace operates on Mass mineral full time

CENTENNIAL (Calumet)—Meeting of shareholders held this week decided to select committee to make proposal of outright sale to Osceola Consolidated, regardless of outcome of Tamarack-Calumet & Hecla deal Names of committee withheld until acceptances are certain

CALUMET & HECLA (Calumet)—Estimated output for this company and subsidiaries for 1915 is 155,000,000 lb. Costs will average for all properties about 9½c. per lb. Within two weeks another of the big furnaces at the Dollar Bay plant will go into operation. This will mean employment of 25 more men at this plant where smelter force is already 25% above normal.

Iron

LAKE ANGELINE (Ishpeming)—Shaft being repaired. Some exploratory work is to be carried on underground. Mine closed for months was recently sold to Cleveland-Cliffs Iron Co. If mining is started again new hoist will be put in. Air will be procured from Lake mine. Only rock drifts are open for passage now.

MINNESOTA

Cuyuna Range

HILLCREST (Ironton)—Viaduct and approaches now being installed for Northern Pacific spur to enter property.

Mesabi Range

ALEXANDRIA (Chisholm)—Shaft now down to orebody, drifting begun.

LAMBERT (Hibbing)—Preparations being rushed for opening this new property.

UTICA (Hibbing)—New shaft now being put down, and old shaft being repaired.

HAROLD (Hibbing)—New engine and dry house being built by Arthur Iron Mining Co.

LAMBERT (Hibbing)—Butler Bros. will start stripping this property within few days. Contract was let this week.

GRANT (Buhl)—Butler Bros. will strip 1,500,000 cu.yd. of overburden here this winter. Mine was heavy shipper this year.

GLEN (Chisholm)—Electric-haulage system new being installed. Upon its completion mine will immediately begin stockpiling.

LEONARD-BURT (Chisholm)—Large amount of test pitting now being done preparatory to greatly increasing production next season.

GRANT (Buhl)—Inter-State Mining Co., has let contract to Butler Bros. for 1,500,000 yd. additional stripping. Will require two years to complete job.

MISSOURI

EASY EIGHT (Joplin)—Has fine prospect on lease on Nelson land south of city. Operation under way for some time with little success, within the last week or two has been rewarded.

HUNTER & CO. (Joplin)—Has recently opened unusually good lead and zinc mine on Tim Malloy land, west of Joplin. Shaft is down about 85 ft. Struck first run at 75 ft.; still sinking in good ore.

MONTANA

Hill County

HAVRE NATURAL GAS (Havre)—Ditching for natural-gas pipe from well east of Havre to city, started Oct. 21. Main artery will traverse county road; laterals will be cut so as to supply every point of city.

Jefferson County

PICNIC GULCH DEVELOPMENT (Wickes)—Company, consisting of Butte mining men recently organized to develop group of four claims near Wickes. Claims show copper and are part of holdings of Wickes-Corbin Copper Co. New management expects to be taking out ore within month.

Silver Bow County

DAVIS-DALY (Butte)—Development work on the 2,500-ft. level of Colorado mine continues to prove satisfactory and orebodies opened up so far show indications of continuing. Total tonnage for October between 2,500 and 3,000 tons, average 7 to 8% copper. Planned to change shaft between 1,700 and 1,900-ft. levels, where it has but one compartment, by constructing two additional compartments, making entire shaft a three-compartment shaft from top to 2,500-ft. level.

ANACONDA (Butte)—Extensive preparations made for development of 70 acres of unexplored ground recently acquired, lying south of its Belmont mine and of Davis-Daly property. It is understood crosscut will be run from Belmont shaft into new territory and under property taken over by company on 40 years' lease. It lies in a part of Butte district that has attracted a great deal of attention following Davis-Daly opening of its 2,500-ft. level. Rumors that company is to take over Butte-Duluth getting more persistent.

BUTTE & GREAT FALLS (Butte) — With arrival of big transformer Oct. 14 that is to complete power installation, it is expected unwatering 350-ft. shaft will begin at once and as soon as that is finished development work will be started. Mine is most northerly in Butte district, located about 3 mi. north of Anaconda mine. As soon as shaft is unwatered, it will be sunk to 500-ft. level and crosscut will be started from there to Genevieve vein. Crosscut on 300-ft. level which already cuts Genevieve vein will be continued to determine extent of orebody.

PLACER LITIGATION IN U. S. SUPREME COURT—On Oct. 19 U. S. Supreme Court in case of Olivia H. Hopkins, Washington-Butte Mining Co. and Anaconda Copper Mining Co. against Frank Walker and 20 others, granted the latter 20 days in which to file brief in answer to appellant's brief asking supreme court to review action of U. S. district court of Montana in this litigation. Suit involves title to portions of Butte and Boston placer mining claim in the Butte district, lands in controversy having been held by aforesaid mining companies for more than 20 years, but are now claimed by Walker and others under lode filings. Lower court held it

had no jurisdiction and supreme court is asked to take jurisdiction and to sustain title of mining companies.

BUTTE & SUPERIOR (Butte)—In answer to inquiries as to probable effect of pending litigation between Elm Orlu and Butte & Superior, Hayden, Stone & Co., closely connected with management of company, has issued statement to effect that ground under dispute comprises not more than 25% of Butte & Superior's holdings on main Rainbow lode; this ground has not been touched by either company for mining purposes since present management came into control, nearly 4 years ago. Should Butte & Superior be defeated in suit, this would entail no loss as regards present earning capacity. Should it win its claim to disputed ground, this would add just so much to workable area of property.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—During September total production was 32,500 tons, from which resulted net realization of $112,847. There were 2,204 ft. of development work performed during month at cost of $4.60 per foot.

NEW GOLDFIELD SIMMERONE (Goldfield)—In a short raise above 100-ft. level 4 ft. of $300 ore has been opened. Drifts on the 100-ft. and 250-ft. levels are being extended to catch extension of shoot.

REORGANIZED KEWANAS (Goldfield)—On 838-ft. level about 300 ft. northerly from main winze an east crosscut passed through 45 ft. of vein matter showing stringers assaying from $10 to $50 per ton and exposed about 12 in. of $20 ore on hanging wall. Another east crosscut is being started 75 ft. farther north from same drift.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 23, totaled 9,704 tons valued at $200,632. The producers were: Tonopah Belmont, 2,919 tons; Tonopah Mining, 2,850; Tonopah Extension, 1,850; Jim Butler, 1,050; West End, 760; miscellaneous leasers, 275 tons. Bullion shipments amounted to about $177,000.

MONTANA TONOPAH (Tonopah)—About 45 men are engaged operating various leases. Several hundred tons of ore shipped first half of October varied from $25 to $50 per ton.

PIONEER CON. MINES CO. (Pioneer)—Scale of operations to be increased on Nov. 1 and mill to be operated continuously. Present production is from above depth of 250 ft. and from stopes varying from 5 ft. to 20 ft. in width.

MANHATTAN DEXTER (Manhattan)—Milling of 37 tons of ore extracted by Glavinich-Choklat lease on extension of Shea vein in Union Nine Claim gave amalgam return of $1,150; average of $31 per ton from plates; milling made in War Eagle mill under the supervision of J. J. Griffith.

SUNSET MINING AND DEVELOPMENT (Rhyolite)—Mill now treating 50 tons per day of $4 to $10 ore. Installing additional equipment to raise capacity of plant to 100 tons per day. Main tunnel now in 2,200 ft. with 800 ft. farther to go to cut Denver vein. Present output is from Hobo and Eclipse veins.

MANHATTAN M. AND O. (Manhattan)—Plan for consolidation of main producing properties on Litigation Hill, with Manhattan Milling and Ore Co.'s plant to be included in merger, so that as soon as operation is started new company will be able to treat its ores in its own mill, and thus do away with high custom-mill rates, is well under way.

Storey County

ANDES (Virginia)—Explored old stopes above 175 level and put in chutes; ore will be taken through Central tunnel.

MEXICAN (Virginia)—Face of southwest drift 2,500 level shows 2 to 3 ft. of quartz of low assay value. East crosscut No. 2-A started on 2,700 level. Mill crushed 286 tons of ore averaging $13.38 per ton.

CROWN POINT-BELCHER (Gold Hill)—Water now 60 ft. below 1,600 station; 37 cars mill rock saved from No. 1 raise on Belcher 1,300 level and 9 cars of fill on 1,400 level. Jacket mill received 880 tons dump rock and 91 tons mine rock and shipped 1 bar bullion.

SIERRA NEVADA (Virginia)—Jointly with Union opening southwest drift on 2,500 level to Union shaft station and raising to 2,450 level. Sierra Nevada west crosscut on 2,500 level advanced 15 ft.; ore from $11 to $130 per ton; face in ore averaging $130, with no indication of passing through the vein.

CON. VIRGINIA AND OPHIR (Virginia)—West crosscut on 2,700 level to pick up east vein was continued. Ophir 2-compartment winze 2,500 level sunk 5 ft. on vein; saved 10 cars of ore averaging $7.80 per ton. Central tunnel vein 250 ft. level now 2 sets wide.

UNION CON. (Virginia)—Raise in No. 1 stope 2,500 level extended 5 ft.; north end in ore averaging $79 per ton; Central averaging $12; south end in good milling ore. Face of north drift from 42-ft. point in raise samples $898 per ton. Saved from this stope 108 cars of ore averaging $26.90 per ton; from No. 3 stope extracted 17 cars averaging $10.26 per ton.

NEW MEXICO

Grant County

WALDO (Lordsburg)—Operation of lead mill has ceased. Company will do mining on small scale and later resume milling operations.

CARLISLE MINE (Steeplerock)—Operations suspended pending purchase and arrival of larger mining equipment. Work on Jim Crow will be resumed.

ECLIPSE MINING AND MILLING CO. (Steeplerock)—Company has been organized by Messrs Kalar, Waite, Watson and Allen to operate property owned by G. A. Kalar in Steeplerock district.

AZURE MINING (Tyrone)—Contention mine in Tres Hermanas Mountains of Luna County, has been taken over by Azure Mining Co., from Dr. S. D. Swope. Azure interests busy in Tres Hermanas. M. L. and J. Doby are sinking shaft on contract for company.

JOHNNIE BULL EXTENSION (Steins)—Mine being operated by Moffitt and Creswell. Shipments being made to smeltery. Excellent grade of copper ore has been developed. Consolidation of copper properties in Steins section pending. May be purchased by Globe, Ariz., capitalists who have been over ground.

Lincoln County

MEHRMANN (Jicarilla)—Strike of sulphide ore carrying gold made by Wm. Mehrmann on Prince Albert claims.

WRIGHTMAN MINES (White Oaks)—Sale is reported to be completed whereby Richard Wrightman takes over practically all producing property in White Oaks region including North and South Homestake, Old Abe, C. A. Stevens and others. Reports state option alone has been granted.

NEW YORK

Niagara County

E. I. DU PONT DE NEMOURS POWDER CO. (Wilmington, Del.)—Will build $500,000 electro-chemical plant at Niagara Falls.

UTAH

Juab County

TINTIC ORE PRODUCTION for week ended Oct. 23 amounted to 121 carloads, estimated at 6,050 tons valued at $150,000, compared with 124 carloads week previous.

Summit County

PARK CITY ORE PRODUCTION for week ended Oct. 23 amounted to 1,921 tons valued at $76,000, compared with 1,614 tons week previous.

SILVER KING COALITION (Park City)—Because of strike, Oct. 26, mines have been closed. An open shop has been in vogue at Park City and this is first labor trouble here in many years.

VIRGINIA

Norfolk County

NORFOLK SMELTING CO. (West Norfolk)—Is smelting low-grade copper, silver and gold ores obtained from Cuba, Venezuela, west coast of South America, Missouri, Central West and Atlantic seaboard as far north as Canada. In connection with this plant, company is completing and putting into operation byproduct sulphuric-acid plant.

CANADA

British Columbia

RETURNS OF PLACER GOLD for province will be higher this year than last. Increase is shown in output of Atlin and Cariboo and considerable gold is being received from points tributary to Grand Trunk Pacific Ry.

NOONDAY (Sandon)—New tunnel is to be commenced and 6-drill compressor installed. New buildings have been constructed on property and surveys made for pipe line.

ENGINEER GROUP (Atlin)—Mill operated by Capt. Alexander yielding from $10,000 to $15,000 a month. Ore is free milling. On Gleaner group, adjoining Engineer, development is being carried on, and a shipment of gold ore is being made to smeltery.

GLOSSY GROUP (Highland Valley)—S. P. Dunlevy, interested in bond on this property given by J. W. Burr and others of Ashcroft, states that 22 men are employed doing development work. Shaft is down 26 ft. and shows 5 ft. of ore assaying $28 per ton mainly in copper. Car of ore being shipped to Tacoma smeltery this month.

Ontario

SCHUMACHER (Porcupine)—October production approximately $20,000.

SENECA-SUPERIOR (Cobalt)—Reported silver is being produced for 6.3c. an ounce.

McINTYRE (Porcupine)—Is increasing capacity of mill to provide for new ore that will shortly come from Jupiter.

BRUCE COPPER MINE (Bruce)—Mond Nickel Co. has taken over this property and is now shipping to its smeltery at Coniston, Sudbury District.

TOUGH OAKES (Kirkland Lake)—Made net profit of $58,000 in September. Ore being developed on 400-ft. level is richest ever discovered in mine.

PEARL LAKE (Porcupine)—Suit brought against Burr Cartwright by Louis Streuther for financial irregularities has been dismissed. This leaves property clear for McIntyre, which has bought control.

LA BELLE (Kirkland Lake)—Is name of new company with capital of $2,000,000 which has been organized to handle Loring property. Underground work has been stopped pending installation of plant. Reported vein is about 10 ft. of $15 ore.

CANADIAN COPPER (Sudbury)—Has placed all smeltery and surface men on 8-hr. basis, with same pay they formerly received for 10 and 12 hr. For small number of men whom company is unable to put on 8-hr. basis, pay will be increased. Miners who are now receiving $3.50 for 8 hr. will receive an increased wage.

DOME LAKE (Porcupine)—Has produced $86,082 since beginning of year from 9,318 tons of ore; average recovery $8.20 per ton. Mining and milling costs for period, $6.14 per ton; extraction about 80%. Subscriptions have been asked for 500,000 shares of new stock to provide money to build cyanide plant.

Quebec

TIMMINS-McMARTIN SYNDICATE (Montreal)—Has taken option on Cheney copper property near Thessalon. Taking over of this property indicates revival in district long known for its copper deposits, but abandoned for many years.

The Market Report

Metal Markets

NEW YORK—Nov. 3

All of the principal markets were distinctly stronger during the last week, a good volume of business being transacted in each case, although there was less activity in spelter than in the other metals.

Copper, Tin, Lead and Zinc

Copper—A large business was done during the week both with European and domestic consumers. With certain producers the foreign business predominated, while other producers reported the larger proportion of domestic sales. Several large contracts were entered into, covering lots of one million to four million pounds. Business in wire bars was pretty good, domestic wire drawers exhibiting considerable interest in the market. Orders for cakes also were placed freely, indicating that the rollers of copper sheets are doing a better business. It is the common belief that domestic manufacturers, generally speaking, have entered into large contracts for their goods for which they have not yet bought the raw material, while they have let their stocks run down pretty low. On the other hand, electrolytic refiners report no increase in the stock at refineries.

In the early part of the week sales were made chiefly at 17⅞@18c., delivered, regular terms. Some of the producers who had sold all they wanted to at 18c. raised their asking price to 18⅛ or 18¼c., in the latter part of the week, but up to the close of the week the market had not reached such figures. At the close, a considerable quantity of copper was still offered at 18c., regular terms. In England electrolytic copper was sold at £89@89½, this being the general price of the producers. What this would net to producers here depended largely upon the freight rate, the deduction on that account being pretty large if no room previously engaged were available. The freight rate has now risen to 60s.. per ton for November-December shipments.

Tin—The price of this metal rose under the influence of rather heavy buying, which is attributed chiefly to the improvement of business in those lines wherein tin is required.

Lead—The continued large business in the early part of the week led the A. S. & R. Co. to advance its price to 4.90c., New York on Friday afternoon. Since then business has been lighter and there has been more competition for what was in sight. The market in St. Louis failed to advance in the same proportion as in New York and now stands at the usual differential. In the New York market certain producers began to shade the generally named price.

There was a good deal of discussion of the conditions which caused the price for lead in London to decline, while it advanced in New York. At one time the London price was £2 below our parity. The weakness in the London market was explained by heavy arrivals in England of lead intended for Archangel which could not be delivered at that port either for lack of freight room or the expected freezing of the harbor. This lead had to be resold in the English market. The subsequent rally in that market indicated that these supplies had been absorbed.

Spelter—The domestic business was practically nil. The foreign business was very much less in volume than in the previous week. That which was done was chiefly for delivery during the ensuing quarter, although some contracts running well into the second quarter of 1916 were made. Certain producers appeared to be willing to sell for delivery at any time in 1916 at prices far below the present market, and some transactions of that sort were made, but they were sporadic rather than general. The way that the price for prime western has maintained itself has caused much surprise. One explanation is that the supply of common spelter has not yet increased as much as was expected, owing to the conversion of so large a proportion of it into superior grades. The accumulation of unsold spelter up to the present time has been chiefly in superior grades. Brass special is quoted at 16@16½c.; high-grade intermediate, 20@22; strictly high-grade is 35c. asked, but it appears to be difficulty salable at any such price. It is impossible to quote the superior grades of spelter with any accuracy, for the official classification no longer rules, these grades of spelter fetching all kinds of prices according to their analysis in each case.

Zinc Sheets—Business has been active, sales good but with no material change in quotations. The base price for carload lots is $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—Conditions have not changed. Stocks of foreign material are small, and the chief domestic producer declines to quote for early delivery. Prices are high, 55@57c. per lb. being asked for No. 1 ingots, New York, spot. No quotations on futures.

It is reported that negotiations are forward for the sale of the property of the Southern Aluminum Co. to parties who are said to represent the Aluminum Co. of America.

Antimony—Business continues rather active and prices are firm. Chinese and other ordinary brands are 35@36c. per lb.; while 45@46c. is asked for Cookson's.

DAILY PRICES OF METALS IN NEW YORK

Oct Nov	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Spot, Cts. per Lb.	Lead New York, Cts. per Lb.	Lead St. Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
28	4 6250	49¼	17 70 @ 17 80	34⅜	4 75	4 65 @4 70	12.50 @14.00
29	4 6538	49¼	17 70 @ 17 80	35	4.80 @4 90	4 65 @4 75	12.50 @14.50
30	4 6425	49¼	17 70 @ 17.80	35	4 90	4 70 @4 75	13.00 @14.50
1	4 6200	49¼	17.70 @ 17 90	36	4.90	4.72½ @4 77½	13.50 @14.50
2							
3	4 6350	49⅝	17.80 @ 17.90	35¼	4 87½ @4.90	4 72½ @4.77½	13.50 @14.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Oct.-Nov	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos.	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts. per Lb.
28	24⅛	72⅛	72⅛	88	18 16	156¼	156	24⅛	4 98	70½	14.55
29	24 1/16	73	73⅛	88½	18.12	158¼	158¼	23⅞	4 96	71½	14.89
30	24 1/16	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
1	24⅛	75⅛	75⅛	88½	18.26	163½	162¾	23⅝	4.87	73	15.07
2	24 3/16	74⅛	74⅛	89	18.36	161	159¾	24	4 95	75	15.48
3	24¼	74½	75	89	18 41	162½	161½	24½	5.06	76	15.69

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

Nickel—Quotations for ordinary forms are nominally 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—An almost total lack of supplies early in the week carried the price of small lots of spot up to $105 and $110 per flask. The arrival of a large lot from California by rail eased off the market and today the New York quotation is $100 per flask of 75 lb. for large lots and $100 also for smaller orders. San Francisco reports by telegraph a firm market at $92@94 per flask. London price is £16 10s. per flask, with 2s. 6d. less quoted by jobbers.

Gold, Silver and Platinum

NEW YORK—Nov. 3

Gold—Exports from Yokohama, Japan, in the eight months ended Aug. 31 were $15,998,250; of silver, $138,144. The gold shipments were chiefly to the United States; they compare with $1,060,640 last year.

Platinum—With supplies still very scarce and no present prospect of an increase the market continues very firm, although little business is doing. Dealers quote $50@55 per oz. for refined platinum and $55@60 for hard metal. All sales are a matter of more or less negotiation.

Silver—During the last few days the demand for silver has been more active and price has advanced to 24¼d. It has not developed whether this advance has been occasioned by the Indian inquiries in conjunction with home mint orders in England, but is fair to infer there has been some outside buying.

Zinc and Lead Ore Markets

PLATTSVILLE, WIS.—Oct. 30

The base price paid this week for zinc ore was $75@80 per ton for 60% grades. The base price paid for 80% lead ore was $54@55 per ton.

SHIPMENTS, WEEK ENDED OCT. 30

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	6,489,290	201,130	485,960
Year	169,316,050	5,884,340	22,724,750

Shipped during week to separating plants, 5,584,440 lb. zinc ore.

JOPLIN, MO.—Oct. 30

Blende, high price $93; base per ton 60% zinc, premium ore $90; medium grades $85@85; lower grades $84@80; calamine base per ton of 40% zinc, carlots, $58@62.50; average selling price, all grades of zinc, $82.67. Lead, high price $55.60; base per ton of 80% metal content $50@55; average, all grades of lead, $51.84 per ton.

SHIPMENTS WEEK ENDED OCT. 30

	Blende	Calamine	Lead	Values
Totals this week	9,750,830	815,740	1,560,710	$477,680
Totals 10 mos..	479,281,020	33,984,170	74,595,970	$21,178,570

Blende value, the week.....$412,720; 10 months, $18,388,410
Calamine value, the week..... 24,520; 10 months, $36,860
Lead value, the week..... 40,440; 10 months, 1,953,300

Iron Trade Review

NEW YORK—Nov. 3

The iron and steel markets are extremely active and new business is coming forward rapidly. The domestic business is increasing fast, consumers becoming anxious about getting in their contracts for 1916 business so that their deliveries will not be delayed by the rush of foreign trade.

The Pennsylvania R.R. order for rails is 175,000 tons and is divided among the Cambria, Pennsylvania, Bethlehem and Lackawanna steel companies and the Steel Corporation.

The Attorney General has taken the first steps for an appeal to the Supreme Court from the decree of the Circuit Court setting aside the suit of the Government to dissolve the United States Steel Corporation.

The stockholders of the Thomas Iron Co. at a special meeting held Oct. 28 voted to accept an offer of $3,500,000 for their property. The offer was originally $3,000,000, but a higher bid was made the day before the meeting and the purchasers raised their bid by $500,000. This will net the stockholders about $56 per share of $50 par value, after all debts are paid. The purchaser is N. C. Kachelmacher, of Hocking, Ohio, but it is not known whom he represents.

The latest statement is that W. H. Donner has exercised the option which he held on both the Pennsylvania Steel and the Cambria Steel stock owned by the Pennsylvania R.R. Co., and will therefore control both those companies.

PITTSBURGH—Nov. 3
(By Telegraph)

The position of the steel mills has not changed since the last writing, except that the demand seems to be more intensive and the pressure for finished steel greater than it was.

Buyers are still more eager to purchase finished steel products, while mills are still more reserved about making commitments. Current bookings of the mills in specifications against contracts are running much heavier than was anticipated, recent sharp advances having caused buyers to specify to the limit. The majority of large contracts for bars, plates and shapes, for instance, are at 1.25c., while the present market is firm at 1.50c., and the contracts will yield the mills' business, up to the expiration of contracts at the end of the year, that will probably require three or four months of the new year to work off.

Finished steel prices are now at an average level slightly above the highest prices reached in the last movement, which culminated in the winter of 1912-3 and prices seem to be advancing more sharply than ever. The trade is entirely at sea as to what to expect, for precedents no longer count and the demand seems to be almost unlimited.

The sensation of the week is found in the very large orders for pig iron which have been placed with the merchant furnaces, indicating that the steel companies cannot provide themselves with pig iron equal to the current demand. The Youngstown Sheet & Tube Co. is today closing for 10,000 tons of basic pig and as this finishes its purchases for the present, announcement is made of the buying which began several days ago, the total being 75,000 tons of basic and 25,000 tons of bessemer for delivery up to April 1, 1916, at $15.50 Valley furnace for the basic and $16 Valley for the bessemer. The Jones & Laughlin Steel Co. is understood to have bought 30,000 tons of basic iron, the Allegheny Steel Co. 12,000 tons of basic, the Republic Iron and Steel Co. 8,000 tons of bessemer, making the total purchases of bessemer and basic iron now reported for Pittsburgh and Valley steel mills 150,000 tons. There have also been purchases of about 75,000 tons by Ohio River steel interests, including the Wheeling Steel & Iron, the Portsmouth Steel, the Newport Steel and the American Rolling Mill Co. The market today is very strong at $15.50 Valley for basic and $16 Valley for bessemer pig. With the prospect that should any considerable demand in addition come forward, it will advance the market to $16 for basic and $16.50 or $17 for bessemer iron. The buying movement so often predicted seems to have fully set in.

IRON ORE

Rather active inquiries have been made in the East for low phosphorus ore, which is just now in demand. It is said that one lot of 10,000 tons Spanish ore has been sold to a Pennsylvania furnace at about 10c. per unit, delivered.

COKE

Coke production for the past week in the Connellsville region is reported by the "Courier" at 428,319 short tons; shipments, 437,548 tons. Shipments of Greensburg and Upper Connellsville districts, 43,995 tons.

On appeal from the Court of Common Pleas the Supreme Court of Pennsylvania has decided that the law of 1913, taxing anthracite coal produced, is unconstitutional. The money collected under this act must be returned. The legislature passed a new law in 1915, and it is said that this also will be contested.

In Philadelphia Oct. 29 the final decree in the anthracite trust cases was filed in the United States Circuit Court in Philadelphia. While dismissing most of the original complaint the court maintains that the union of the Philadelphia & Reading Coal and Iron Co. and the Lehigh & Wilkes-Barre Coal Co., through the instrumentality of the Reading Co., the holding corporation, is a combination in restraint of trade and violates the anti-trust act of 1890.

Within 90 days the defendants are ordered by the decree to submit to the court a plan for the disposal by the Central Railroad Co. of New Jersey of all the stocks, bonds or other securities of the Lehigh & Wilkes-Barre Coal Co., now owned or in any manner controlled by it.

Chemicals

NEW YORK—Nov. 3

The general market is not especially active and is rather irregular in spots.

Arsenic—Business is quiet and without material change. Quotations are $3.50 per 100 lb. for large lots and $3.75@4 per 100 lb. for smaller orders.

Copper Sulphate—Business continues on a fair scale and no considerable change is noted. Quotations are $6.50 per 100 lb. for carload lots and $6.75 for smaller parcels.

Nitrate of Soda—The market is quiet and substantially unchanged. The current quotations are 2.45c. per lb. for spot and early deliveries.

Assessments

Company	Delinq	Sale	Amt.
Aetna, Ida	Oct. 16	Nov 15	0 001
Argenta, Ida	Oct. 11	Nov 13	0 001
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0 01
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0 002
Comstock, Ida	Sept. 30	Oct. 30	0 001
Copper Mt. M & D., Ida	Oct. 28	Dec. 1	0 002
Dailey-Lloyd, Utah	Nov. 14	Nov. 30	0 0025
Diamfield Black Butte, Nev	Oct. 4	Nov. 4	0 01
Eagle Mt., Ida	Oct. 15	Nov 15	0 0005
Eastern Star, Ida	Oct. 29	Nov 29	0 002
E. Hercules Ext., Ida (post)		Nov 11	0 0015
Enterprise, Ida	Oct. 15	Nov. 15	0 002
Four Timbers, Wash	Oct. 4	Nov 4	0 001
Friend, Wash	Oct. 18	Nov. 10	0 002
Giant M. & M., Ida	Oct. 7	Nov. 8	0 003
Great Western, Nev	Nov. 15	Dec. 7	0 001
Hancock Cons., Mich	Jan. 3		1 00
Idaho-Nevada Exp., Ida	Nov. 1	Dec. 1	0 002
Idora, Ida	Oct. 11	Nov. 11	0 05
Lewis & Clark, Ida	Oct. 15	Nov. 15	0 001
Lucky Swede, Ida	Nov. 11	Dec. 11	0 002
Military M. & M., Ida	Oct. 28	Nov. 29	0 0065
Montana Standard	Nov. 15	Dec. 15	0 005
Nahob, Ida	Oct. 25	Nov. 15	0 005
Naildriver, Utah	Oct. 9	Nov. 8	0 02
New Arcadian, Mich	Dec. 1		0 50
New Baltic, Mich	Jan. 15		0 50
Northern Light, Ida	Nov. 2	Dec. 2	0 004
O. K. Ex. M & R., Utah	Nov. 20	Dec 15	0 005
Old Veteran, Ida	Nov. 1	Nov. 27	0 002
Ophir, Nev	Oct. 12	Nov. 2	0 05
Oriental, Nev	Nov. 6	Dec. 7	0 003
Original, Nev	Nov. 6	Dec. 7	0 003
Pacific M. & M., Ida	Nov. 10	Nov. 30	0 0005
Phoenix, Mich	Jan. 1		1 00
Pioche Metals, Nev	Oct. 20	Nov. 20	0 001
Rainbow, Ida	Oct. 15	Nov. 20	0 002
Royal, Ida	Oct. 12	Nov. 9	0 0015
Silver Cliff, Ida	Nov. 8	Dec. 6	0 0025
Silver Mood, Ida	Oct. 15	Nov. 18	0 005
Silver Pick Cons., Nev	Oct. 16	Nov. 23	0 01
Sunset M. & D., Nev	Oct. 18	Nov. 22	0 02
Sunshine, Ida	Oct. 15	Nov. 15	0 0006
Ton. Gipsy Queen, Nev	Oct. 29	Dec. 6	0 01
Umatilla Ton., Nev	Nov. 8	Dec. 13	0 005
Union Cons., Nev	Oct. 25	Nov. 15	0 05
Wisconsin, Ida	Oct. 19	Nov 19	0 003
Wolf Mountain, Utah	Nov. 12	Dec 14	0 0025

Stock Quotations

Comstock Tunnel shares have been dropped from listing by the New York Stock Exchange, as the new commission rates make no provision for shares having a par value of $2 and selling for less than $1 per share. Alaska Juneau has been listed by the Exchange.

COLO SPRINGS	Nov. 1	SALT LAKE	Nov. 1
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.02‡	Beck Tunnel	.05
Cripple Crk Con.	.006	Black Jack	.06‡
C. K & N	‡ 02	Colorado Mining	.06
Doctor Jack Pot	.09‡	Crown Point	.01
Elkton Con	.25‡	Daly-Judge	6 90
El Paso	.78	Emma Cop	.26‡
Findlay	.03‡	Gold Chain	.10
Gold Dollar	.02‡	Grand Central	.54
Gold Sovereign	.06	Iron Blossom	.78
Goldea Cycle	1 77	Lower Mammoth	.04‡
Isabella	.16	May Day	.19‡
Jack Pot	.06‡	Opohongo	.00‡
Jerry Johnson	.06	Prince Con	.74
Lexington	‡ .005	Seven Troughs	.01‡
Mary McKinney	.45	Silver King Coal	3 15
Pharmacist	.008	Silver King Coa	2 02‡
Portland	1 67‡	Sioux Con	.02
Raven B. H	.03	Uncle Sam	.07
Vindicator	1 60	Yankee	.35

TORONTO	Nov. 1		
Bailey	.04‡	Dome Exten	.27
Chambers Ferland	.13	Dome Mines	25 50
Coniagas	3 50	Foley O'Brien	.48
Peterson Lake	.23	Hollinger	25 00
Right of Way	.01	Imperial	.05‡
Seneca Superior	‡ .78	Jupiter	.11‡
Silver Queen	‡ .01	McIntyre	.53‡
T. & Hudson Bay	20 00	Pearl Lake	.00‡
Timiskaming	.41‡	Porcu. Crowo	.80
Trethewey	.14	Preston E. D	.06
Wettlaufer-Lor	.08	Rea	‡ .09

SAN FRANCISCO	Nov. 1		
Comstock Stocks.		Misc. Nev. & Cal	
Alta	.04	Belmont	3.50
Andes	11	Jim Butler	.75
Best & Belcher	.08	Lone Star	.04
Caledonia	.68	MacNamara	.02
Challenge Con	.08	Midway	.12
Chollar	.03	Mont-Tonopah	.30
Confidence	.21	North Star	11.00
Con. Virginia	.22	Rescue Eula	.67
Gould & Curry	.04	West End Con	.65
Hale & Norcross	.05	Atlanta	.24
Jacket-Cr. Pt	.20	Booth	.36
Julia	.02	C.O.D. Con	.04
Mexican	.36	Comb Frac	.07
Occidental	.78	D'field Dalsy	.03
Ophir	.55	Jumbo Extension	1 27‡
Overman	11	Pitts.-Silver Peak	.07
Potosi	.03	Round Mountain	.40
Savage	.08	Sandstorm Kendall	.09‡
Sierra Nevada	.08	Silver Pick	.09
Union Con	.74	Central Eureka	11

N. Y. EXCH.	Nov. 1
Name of Comp.	Clg.
Alask a Juneau	12‡
Am.Sm.&Ref.,com	92
Am. Sm. & Ref., pf.	109‡
Am. Sm. Sec., pf. A	86
Am. Sm. Sec., pf. B	83
Anaconda	82‡
Batopilas Min	1‡
Bethlehem Steel	461
Bethlehem Steel, pf.	166
Chino	53‡
Colo. Fuel & Iron	57
Crucible Steel	82
Federal M. & S., pf.	52
Great Nor., ore, ctf.	51
Greene Cananea	39‡
Guggen. Exp	72
Homestake	119‡
Inspiration Con	46
International Nickel	198
Miami Copper	34‡
Nat'l Lead, com	67‡
National Lead, pf	110‡
Nev. Consol	15‡
Ontario Mlo	3
Quicksilver	5‡
Ray Con	26‡
Republic I&S, com	54
Republic I&S, pf	104
Slosse-Shef'd, com	61
Tennessee Copper	63‡
Utah Copper	73‡
U. S. Steel, com	87
U. S. Steel, pf	115‡

N. Y. CURB	Nov. 1
Alta Con	.18
Beaver Con	.30
Big Four	.05
Blue Bell	.02
Braden Copper	11‡
Buffalo Mines	.50
Can. Cop. Corpo	2‡
Cashboy	.07‡
Chile Cop	26‡
Con. Ariz. Sm	1‡
Con. Coppermines	2‡
Con. Nev.-Utah	1
Dia Black B	.05
Florence	‡ .44
Goldfield Con	1‡
Goldfield Merger	19
Howe Sound	4‡
Kennecott Cop	53
Kerr Lake	3‡
La Rose	.45
Magma	14‡
McKinley-Dar-Sa	.30
Mines of Am	2‡
Mother Lode	.34
Nevada Hills	‡ 21
New Utah Binghan	2‡
Nipissing Mines	6‡
Ono	.01
St. Joseph Lead	14‡
South Utah	.30
Stand'd Oil of N.J.	488
Standard S. L	1‡
Stewart	1
Success	.64
Tonopah	5‡
Tonopah Ex	2‡
Tonopah Merger	.36
Tribullion	‡
Yukon Gold	2‡

LONDON	Oct. 17
Alaska Treadwell	£6 5s 0d
Burma Corp.	1 8 9
Cam & Motor	0 1 3
Camp Bird	0 5 0
I-I Oro	0 7 0
Esperanza	‡0 7 6
Mexico Mines	‡3 11 3
Nechi, pfd	‡0 12 6
Oroville	0 11 6
Santa Gert'dis	‡0 7 6
Tombov	1 0 0
Tough Oakes	‡0 6 9

BOSTON EXCH	Nov. 1
Name of Comp.	Clg.
Adventure	2
Ahmeek	397
Alaska Gold M	32
Algomah	2
Allouez	56
Am. Zinc	69
Ariz. Com., ctfs.	7‡
Bonanza	30
Butte-Ballaklava	3‡
Butte & Superior	67‡
Calumet & Ariz.	66‡
Calumet & Hecla	556
Centennial	17‡
Copper Range	58‡
Daly West	2‡
East Butte	13‡
Franklin	9‡
Granby	86‡
Hancock	16
Hedley	28
Helvetia	.50
Indiana	5
Island Cr'k, com	42‡
Island Cr'k, pfd	86‡
Isle Royale	28‡
Keweenaw	2‡
Lake	13‡
La Salle	5‡
Mason Valley	2
Mass	14
Mayflower	4‡
Michigan	2‡
Mohawk	84
New Arcadian	11
North Butte	31‡
North Lake	1‡
Ojibway	1‡
Old Colony	3‡
Old Dominion	53‡
Osceola	87
Quincy	85‡
Santa Fe	4
Shannon	7‡
Shattuck-Ariz	32‡
Superior	28‡
Superior & Bost	2‡
Tamarack	52‡
Trinity	10
Tuolumne	35
U. S. Smelting	43
U. S. Smelt'g, pf	47‡
Utah Apex	3
Utah Con	13
Victoria	3
Winona	3
Wolverine	60
Wyandot	1‡

BOSTON CURB	Nov. 1
Bingham Mines	.7‡
Boston Ely	.21
Butte & Lon'n Dev.	.32
Calaveras	1‡
Calumet-Corbin	.02
Chief Con	.90
Cortez	.55
Crown Reserve	.50
Davis-Daly	1‡
Eagle & Blue Bell	1‡
First Nat. Cop	5
Houghton Copper	2‡
Iron Cap Cop., pf	7
Majestic	63
Mexican Metals	22
Nevada-Douglas	65
New Baltic	2‡
New Cornelia	8‡
Ohio Copper	.13
Oneco	1
Ray Con Copper	10
Rex Cons	.51
Smokey Dev.	.15
So. Lake	5‡
Tonopah Victor	.30
Trip'oli Verde Ext	5‡
Utah Metal	8‡

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.855	28 983	26 553	22.731
February	64 642	57.506	48.477	28.357	26 573	22 753
March	57 870	58 067	50.241	26 669	26 788	23.708
April	59 493	58.519	50.256	27 416	26 958	23 709
May	60 361	58.175	49.915	27 825	26 704	23.570
June	58 980	56.471	49.034	27 199	25 948	23.267
July	58 721	54 678	47.519	27 074	25.219	22.597
August	59 293	54 344	47.163	27 335	25 979	22.780
September	60 640	53.296	48.680	27 986	24 200	23 591
October	60 793	50 654	49.385	28 083	23.199	23.925
November	58 995	49 082	.....	27.293	22 703	....
December	57 760	49 375	.....	26.720	22 900	....
Year	59.791	51 811	.....	27 576	25 314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14 223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69 170	*
April	14.211	16.811	64.747	75 096	69.313	*
May	13 996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82 574	66 274	95.333
July	13.223	18.796	60.540	76.011	64 955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68 915	‡	85 250
October	*	17.686	‡	72 601	‡	88.000
November	11.739		53 227		*	
December	12 801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 779	34 260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47 884	163.966	166.225
May	33 360	38.790	150.702	162.675
June	30 577	40.288	138.321	167.636
July	31 707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33 125	‡	152.625
October	30.284	33 0 0	‡	151 554
November	33.304	47 884	1 0.391	
December	33.601		147.102	
Av. year	34 301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4 111	3.729	4.011	3.548	19.665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3 970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.224	3.688	4.142	18.225	21.694
May	3 900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3 738	5.531	19 051	24.611
August	3.875	4.656	3 715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.52	4 600	3.384	4.499	‡	23.994
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3 862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.206	21.469	44.141
April	5 113	10.012	4.963	9.837	21.569	49.888
May	5 074	14.781	4 924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	19.026	4.770	18 856	21.568	97.250
August	5 568	12.781	5 418	12.611	‡	67.786
September	5 580	13.440	5.230	13.270	‡	67.841
October	4 900	12.800	5.250	12.596	‡	66.536
November	5 112		4 962		25 016	
December	5 592		5 430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15 06	14.55	14.42	13.45	14 08	13.90
March	15 07	14.55	13 91	13.45	14 10	13.95
April	14.90	14.55	13 90	13.45	14 13	13.95
May	14 90	14.61	13 90	13.60	14 27	13.83
June	14 90	14.70	13.90	13.67	13 96	13.77
July	14 90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14 08	14.75
September	14 90	16.86	13 90	15.95	14 03	15.70
October	14 81	16.95	13 75	15 96	13.97	15.80
November	14.59	.....	13.43	....	13.83	....
December	14.70	.....	13.45	....	13 83	....
Year	$14 88	....	$13 78	...	$14 01	...

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

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GOLD AND SILVER—GEOLOGY

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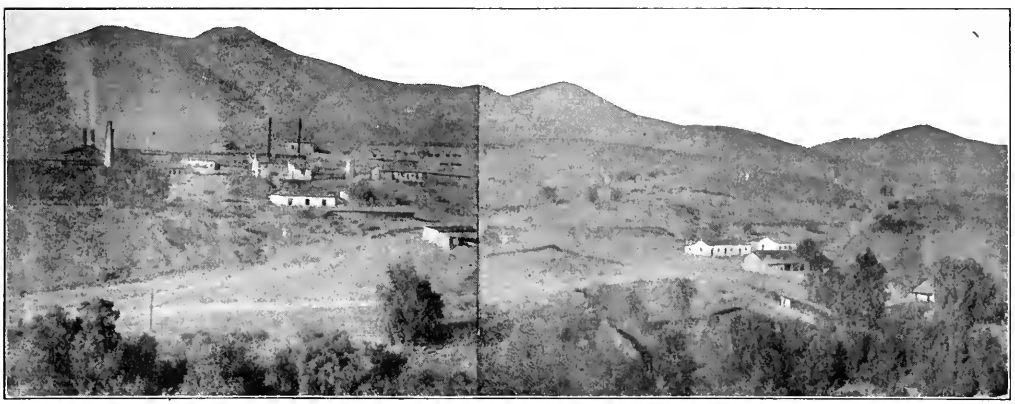
Smelting at Panulcillo, Chile

SPECIAL CORRESPONDENCE

SYNOPSIS—An account of the smelting operations of the Central Chili Copper Co. at Panulcillo in the province of Coquimbo. Besides the ore of its Panulcillo mine, the company smelts custom ores, for which a bedding system is provided. An unusual charge-track arrangement is employed.

The Central Chili Copper Co. was the outcome of the reorganization of the Panulcillo Copper Co., which began operations about 50 years ago at Panulcillo, in the province of Coquimbo, Chile. The company is owned by French and English capital and is under the management of Berthold Schiff, a native of France, who has had a wide experience in Mexico and Latin-American countries. The mining operations are in charge of Charles Gibbons, and the smelting plant is under the direction of Thomas F. Higgins, formerly with the United States Smelting Co., at Midvale, Utah, assisted by R. L. Lee, formerly with Mason Valley Mines Co., of Thompson, Nev.



GENERAL VIEW OF CENTRAL CHILI COPPER CO. AT PANULCILLO

WORKS IN CENTER OF COQUIMBO ORE DISTRICT

The smelting plant of the Central Chili Copper Co. is situated in the center of the Coquimbo ore district, being 78 km. from the port of Coquimbo and 42 km. from Ovalle. On account of its central location, the plant is able to secure ores from all the surrounding districts without incurring a heavy freight rate. There are two other smelting plants in the district, but they do little or no custom smelting.

The Central Chili Copper Co.'s plant is at an elevation of 1,200 ft. above the sea, out of the zone of heavy rains, and below that of snow or freezing weather. Consequently, little housing of the plant is necessary. The present furnace of the Herreshoff type has a capacity of about 250 tons a day and was installed by H. K. Masters in 1905, replacing three old-style furnaces.

CUSTOM ORES ARE BEDDED

The company operates the famous Panulcillo mine, situated about 2 km. from the smelting plant. A little more than 50% of the ore smelted is from this mine. The remainder of the charge is made up of purchased ores, carbonates and oxides, from various parts of the district, and as they are of a wide variety, a bedding system is necessary. The *Journal* of May 15, 1915, published an illustration of the beds made at the Central Chili Copper Co.'s plant by dumping the ore sacks brought in by burro troop. As this system was modernized some time ago, a description of the bedding system now in use may be of interest.

The Panulcillo mine is connected with the smelting plant by a gravity incline, and the ore is brought down in 3-ton bottom-dump cars. While about 2% of the custom ores still arrives on burros and is dumped to the pile direct, the other 98% arrives in railroad cars, mostly of 20 tons' capacity, having flat bottoms. In one of the accompanying illustrations the bedding system is shown with two trestles, 125 ft. long. These are 12 ft. higher than the feed-floor level and have a track for the charge cars which run along either side.

When the custom ores arrive at the plant, they are shoveled over the side of the car, commencing at one end of the trestle and moving forward as the unloading proceeds, so as to give an even layer from the contents of each car. As the ore falls on the apex of the bed and rolls to either side, a fair mixture is obtained. From the two trestles four beds of 900 tons each can be made. This storage capacity, about 3,600 tons, is ample for this plant.

The sampling of the ores is done in a primitive way, but it is the method used in most parts of Chile and seems to give satisfaction both to buyer and to seller. As the ore is unloaded from the cars, every 20th shovelful is taken for a sample. This is passed through a Sturtevant jaw crusher and then over a divider, after which it is quartered and bucked in the usual manner. Owing to the great number of different ores arriving each day, it is almost impossible to get an analysis of all the ore placed on a bed before it is smelted. In making up the furnace charge, the percentage of iron and sulphur in the bed is taken into consideration, since by knowing these two factors the metallurgist accustomed to the ores of the district is able to judge of the proportions of the furnace mixture. Any alteration that may be required can be made as soon as the slag has been examined. Once the bed or mixture is adjusted to produce the right slag, there is seldom any need to change the charge until the next bed is opened.

Coke is bought in England and shipped in sailing vessels, the voyage from England to Coquimbo taking about one hundred days. Before the war German coke was used. Arriving in Coquimbo, the coke is unloaded on stockpiles. Because of the uncertain arrival of the ships it is necessary to carry a large stock of coke at all times. Shipment from stockpile at Coquimbo is made in 7-ton railroad cars as needed for the furnace. The coke is unloaded at the smelting plant in a manner similar to that for ore, the space provided for coke having a capacity of 300 to 400 tons, thus compensating for any irregularity in the arrival of the coke trains.

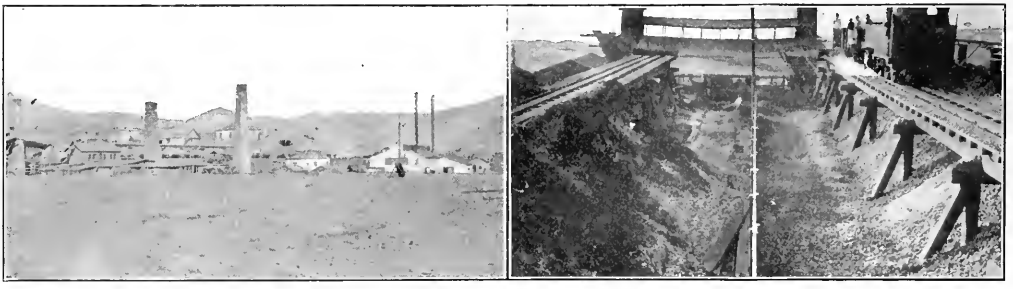
Transfer Car and "Change Track" Permit Use of Charge-Car Tracks Without Curves

In handling the furnace-charge cars an unusual method is used. By installing a "change track" and a transfer car, all curves in the charge tracks were eliminated. The ore beds, the sulphide ores and the coke piles are all made parallel to the axis of the furnace. The so-called change track, 200 ft. long, runs at right angles and is 2 ft. lower than the charge track. On the change track runs a flat car, the top of which is on a level with the rails of the charge-car tracks.

Side-dump charge cars of 2½ tons' capacity are used for the ores and smaller cars of the same type for the coke. The coke and ores are shoveled into the cars from the floor of their respective beds. After filling, the cars are pushed out to the change track, run on the flat, or transfer, car and then to charge tracks on either side of the furnace. The charge cars pass over scales on the way to the furnace, are weighed and run to the charge doors. At first thought, this appears to be an expensive method of handling charges, but when the cheapness of labor is taken into consideration, it is not found to be expensive. The cost of taking ore from the beds to the furnace is less than 4c. per ton.

Sow Difficulties in the Blast Furnace

The blast furnace at the Central Chili Copper Co.'s plant measures 46x144 in. at the tuyeres and has a height of 9 ft. There are four jackets on each side and one jacket at the ends. The side jackets have three tuyeres each. A copper breast jacket is used, and a water-jacketed steel spout, with water-cooled copper nose-piece,



TWO VIEWS OF THE SMELTING PLANT AT PANULCILLO, PROVINCE OF COQUIMBO, CHILE

traps the blast 5 in. All jackets, as well as the spouts, are made at the plant. The copper breast jackets and nose-pieces were formerly purchased in New York. Lately, however, a small reverberatory furnace, 2 ft. wide and 4 ft. long, has been constructed, and in this the old breast jackets and scrap copper are melted and the copper poured into the molds for the new breast jackets and nose-pieces.

The bottom of the blast furnace is lined with silica brick, but on account of difficulties with iron "sows," the problem is to prevent the bottom from becoming too high rather than from burning out. In the two years' run on the present bottom there has not been one break-out in the bottom of the furnace.

The forehearth is 8 ft. in width and 15 ft. in length and is made of ¼-in. steel, lined with crushed siliceous ore, the bottom being of slag brick. When necessary the settler is cooled by a water spray, but the latter is sometimes not used for several days. Owing to accumulations of iron sow, the bottom of the settler gradually builds up and it becomes necessary to raise the tap hole from time to time. After a run of 30 to 40 days it is usually necessary to change settlers. This is done by breaking the joints on each side, where the sheets are put together with bolts instead of rivets. The frame is then taken

away in pieces and the sow raised with jacks in order to permit it to be taken out on rollers. Changing the settler necessitates shutting down the furnace for two days, during which time any necessary repairs are made. Small forehearths of the type formerly used at Trail, B. C., were tried, but it was found that sow difficulties were greater with the small settler than with the large one. The settler sow, when cooled, is blasted, broken into pieces small enough to enter the furnace doors and resmelted at times when the furnace is in good condition. The smelting of the sow in small quantities does not seem to make any increase of sow in the settler. The sow usually contains about 40% Fe and 40% Cu.

The Slag Is High in Alumina

About 7,000 tons of ore are smelted per month, and an average slag analysis is as follows: SiO_2 40.9%; Fe 15.6; CaO 12.3; Al_2O_3 22.8; MgO 1.1; Cu 0.43%. The slag is hauled to the dump in small hand-tilted pots drawn by mules or horses. It is under consideration, however, to replace the animals with mechanical traction. The matte is tapped from the settler into cast-steel molds, each mold holding about 300 lb. of matte. When cooled it is passed through a Blake crusher and put into sacks containing about 220 lb. each and shipped to New York. The grade of the matte is maintained as near 50% as possible, as this grade has been found most economical.

Flue dust was previously wet and fed back to the furnace while running under low blast. Recently an Empress briquetting machine has been installed, and in the future the flue dust will be briquetted with some of the finer ores which contain sufficient talcose material to act as a binder.

The power-house equipment comprises two Garrett compound engines of 225 hp. each, running at a speed of 187 r.p.m., direct-connected to three-phase generators. Only one engine is run at a time, the other being kept in reserve in case of breakdown, or to give time for cleaning the boilers. The power is distributed through different motors about the plant, there being a 60-hp. motor for the matte crusher, a 15-hp. motor for each of two pumps and another of the same size for the sampling mill, an 80-hp. motor for the briquetting plant, and a 100-hp. motor for the furnace blower. The blower is a No. 7 Connersville and delivers air to the furnace at a pressure of 20 oz.

The smelting plant is operated in 12-hr. shifts and, including the mechanical department, employs about 200 men. The men are paid from 2½ to 4½ pesos per day, except the mechanics, who receive from 4½ to 8 pesos. As the Chilean peso has a value of about 18c., U. S. Cy., according to the present rate of exchange, hand labor is in most cases cheaper than mechanical operations. Therefore much of the work is done by hand.

When labor is cheap one is usually inclined to think that it is inefficient. On the contrary, some of the men at this plant are excellent workers, and as a whole one might compare them to the Greek laborers used in some of the plants in the western part of the United States. As an example of the efficiency of these workers, it may be mentioned that a gang at Panulcillo unloads 20 tons of ore per man for a day's work, and the charge wheelers will load and put to the furnace 20 tons per man per day. Yard men working by task will do as much as the average workman of this class in the United States. As for mechanics, one may encounter much worse in the States.

In closing, it may be of interest to mention that the Central Chili Copper Co. was one of the few mining or smelting establishments of Chile that withstood the general crisis in 1914 and worked without interruption after the outbreak of the European war.

TRANSPORTING MOLTEN SLAG AND "CLEANUP" AT THE PANULCILLO PLANT

Slag is hauled from the blast furnace by animals at present. The substitution of mechanical traction has been under consideration for some time, but up to date no installation has been made.

Method of elevating "cleanup" to the furnace-feed floor. The "angarillas" hold about 250 lb. each. Because of the cheap labor and the small quantity of material to be handled, an elevator is not installed.

Asphalt in the United States

Since 1907 the output of manufactured asphalt from domestic sources has dominated the asphalt industry of the United States, says the United States Geological Survey. The quantity of manufactured asphalt from domestic petroleum reached 360,383 tons in 1914, with another 313,787 tons produced from Mexican petroleum, as against a total production of natural asphalt of 77,588 tons. This latter was subdivided as follows: Bituminous rock, 48,771 tons; wurtzilite (elaterite) and gilsonite, 19,148; and grahamite, 9,669 tons. This was produced by the states of California, Kentucky, Oklahoma and Utah. Although ozokerite occurs in Utah, the United States has for years imported practically all its supply from Galicia.

Production of Precious Stones in the United States in 1914 amounted to $124,651, according to the Geological Survey. Of this, $60,932 was in sapphires; $13,370 in turquoise and matrix; $8,312 in agate, chalcedony, onyx, etc.; $7,980 in tourmaline; and the remainder of the production scattering.

The Second Pan-American Scientific Congress

On Oct. 23 the preliminary arrangements were completed for the most comprehensive international conference that has ever been held in the United States. From Dec. 27, 1915, to Jan. 8, 1916, there will meet in Washington, D. C., the Second Pan-American Scientific Congress, in which all of the American republics will participate and for which preparations have been going on for nearly two years.

According to the official reports, each of the 21 American republics will appoint delegations composed of its leading educators, economists, engineers, international lawyers, and experts on mining, agriculture, health, transportation and finance. From present indications it is estimated that there will be in attendance over 150 of the most representative men of Central and South America.

The first congress was held in Santiago, the capital of Chile, in 1908. That was attended by hundreds of the leading scientists of the Americas, including a large delegation from the United States. When it adjourned, it unanimously agreed to hold the second in Washington. The United States Government has therefore appropriated $50,000 for the expenses of the conference, and the President of the United States was authorized by Congress to invite all the other American governments to participate. The authority for the preliminary arrangements was placed in the hands of the Secretary of State, who in turn appointed an executive committee to make all preparations for the congress. This committee consists of:

William Phillips, Third Assistant Secretary of State and chairman ex-officio.

James Brown Scott, secretary of the Carnegie Endowment for International Peace, vice-chairman.

William H. Welch, president of National Academy of Sciences, honorary vice-chairman

John Barrett, director-general of the Pan-American Union and secretary-general of the committee.

W. H. Bixby, brigadier-general, U. S. A., retired.

Philander P. Claxton, Commissioner of Education.

William C. Gorgas, surgeon-general, U. S. A.

William H. Holmes, head curator of Smithsonian Institution.

Hennen Jennings, former president of London Institution of Mining and Metallurgy.

George M. Rommel, chief, Animal Husbandry Division, Bureau of Animal Industry, Department of Agriculture.

L. S. Rowe, president of American Academy of Political and Social Science.

Robert S. Woodward, president of Carnegie Institution, of Washington.

The president of the congress will be Eduardo Suárez-Mujica, Ambassador of Chile.

Motor-Truck Ore Hauling in California

Motor-truck freighting in competition with the railroad in southern California is reported as failing to be as successful as was anticipated. The men who engaged in motor-truck freighting in direct competition with the railroad are said to have created the impression that the steam and the electric railways would in a short time be supplanted as freight carriers by motor trucks. This is one of the wild dreams indulged by automobile manufacturers and drivers; but it is one of the most painful ones from which to awaken.

The motor truck has a place in southern California and especially on the desert and in the mining districts, not so much in competition as in connection with railroad freight transportation. The actual competition of the motor-truck freighter is with the mule and the horse. There are places, of course, where the automobile has difficulty in climbing the hills, but these places are few and good road construction would reduce them to an inconsiderable minimum. Automobiles are being used very extensively for carrying express and parcel post, not only in southern but in northern California as well; but comparatively little of this is in competition with the steam and the electric railway lines. In the heavy freighting by motor trucks there is practically no competition with railways, but in the suburbs and between the smaller towns, the automobile has made heavy inroads on the passenger traffic of the railroads, more particularly the steam railroad. So far as the motor stage is concerned, whose chief competition is with the horses and mules, the advancement or failure of this method of heavy transportation in the mining districts will depend upon the improvement of the automobile to meet the requirements of the desert and mountain roads. Large amounts of parcel-post and express matter, and in some instances articles of weight and bulk, are hauled in the small cars built for passenger purposes and not in any respect adapted to the carrying of even light freight.

The automobile manufacturers seem to have given more attention to the carrying of passengers in the mining districts than to the hauling of freight. There is a demand for light freight automobiles in various districts, in addition to practical passenger cars.

The Drills

By Berton Braley

Hear the clamor of the drills
As they bark,
As they batter the foundations
Of the everlasting hills
In the dimly lighted dark,
And the loud reverberations
Fill the murky stopes with sound,
Waking echoes underground!

Oh, there's music to the drills,
And it thrills,
For the clamor as they hammer
And they batter on the rock
Is a song of brave endeavor
And of hope and progress too.
For the drills are drilling ever,
Making dreams come true!

Hear the ringing, swinging measure
Of the drills
As they dig for buried treasure
Underneath the mighty hills;
How they shout in joyous mirth
In the caverns of the earth!

How they clatter as they shatter
All the locks that guard the ore,
And their song grows ever louder
As they bore, bore, bore,
Making ready for the powder [der
Which shall wrench the rocks asun-
With a sound of muffled thunder,
With a deep and mighty roar

In the deepest nooks and niches
Go the drills,
Reaching for the hidden riches
And the buried wealth that fills
Nature's treasure houses deep.
So the gold that misers heap,
And the silver and the lead
And the copper rich and red—
They are all the fruit of toiling
Of the drills;
They are plunder from the spoiling
Of the hills;

So the heart of man beats faster
And his every fiber thrills
To the song that makes him master
Of the treasure of the hills,
To the yammer and the hammer
And the wild barbaric clamor
And the unrelenting war song
Of the drills.

Cost of Mine Openings*

SYNOPSIS—The cost of opening ground for mining development has never been standardized, and there is a wide difference of opinion as to the real value of work intended to serve as assessment on claims. Facts and figures are given in this article, and standardizations made which may serve as a guide to similar work.

A large part of the early development work on most mining properties consists of surface excavations such as opencuts, trenches, shallow shafts and short tunnels. Of this work the greater portion may be classed as the annual labor performed on unpatented claims. This assessment work entails the expenditure of large sums each year throughout the mining regions of the West. Its unit cost of course varies greatly under the peculiar conditions applicable to particular localities. There is, however, a much greater difference in the cost of mining work in separated regions as depth is reached.

Costs for Excavations by Hand

During the last four years in the Northwest, in inspecting about $500,000 worth of surface prospect work, I have taken advantage of many opportunities to collect authentic cost data along this line. The figures given here are all for handwork. In the specific cases to which references are made an average efficiency of the labor was obtained. With a higher efficiency, undoubtedly much lower costs could be shown in some cases.

The performance of assessment work is not taken seriously by a great many people, particularly when the owner does the work himself, not with a view to the real development of the ground, but merely to hold it. In such cases it is only natural to expect that the amount of work will be stinted. Men usually apportion to themselves higher wages than they could obtain elsewhere, and in addition work short hours. Where owners hire the work done, no matter for what purpose the ground is held, they aim to get full value for the money expended.

There is a sort of tradition among many miners and claim owners that all assessment work is worth $10 per foot and that the United States Government will allow that valuation for the work when passing on claims for patent. This is not the case, however, as the law pertaining to the statutory expenditure on a claim is very specific as to the value of the work required, and no mention is made of feet or yardage. When a full $100 has not been expended as annual labor on an unpatented claim, it is subject to adverse location, no matter how many feet of work have been done. Accordingly, it behooves every owner of unpatented mining property to acquaint himself with the reasonable value of work performed upon his claims, so that he may be in a position to protect himself from a charge of abandonment for failure to do the requisite amount of assessment work.

Quite often among non-mining-claim owners, and even among some mining men, there is a misconception of the actual cost of surface mining work. A miner, on completing work on a mining claim, will generally report so many feet of tunnel run, or of shaft sunk, for a certain amount of money expended. To a man who has no way of knowing the cost of surface work, this reported cost may sound reasonable, but not to a man of experience in this line. As an instance: A miner, who had been hired by a claim owner to do the annual labor, reported a 10-ft. shaft sunk for the $100. The owner, who remembered reading mining companies' reports of shafts that cost from $40 to $150 per foot, considered he was receiving his money's worth; while, as a matter of fact, the miner should in this case have sunk four 10-ft. shafts for the $100.

Throughout the country great numbers of unpatented mining claims which show promise, and in which the owners have faith, are held by business and professional men who, in having the annual assessment work performed, want every dollar to count in the way of developing the ground. Usually, men are employed on a daily-wage basis to do this work, nearly always unsupervised. It is difficult to get full returns for the money thus paid for unsupervised labor, but a great many claim owners insist on getting fair returns and take steps to insure good results by making it clear to the miners that they are not going on a picnic, and by checking up the work as often as possible.

There is no doubt that, ordinarily, greater efficiency can be obtained from men working under direct supervision, as in a city trench, than working without it in some remote place. This does not, however, necessarily mean that the unit of a large operation carried on by fully supervised labor can be conducted more cheaply than can the small job performed by unsupervised workmen. This is attributable to the absence of all overhead and depreciation charges such as large contractors have to carry. Quite often, where only a few men are working, there is no overhead expense whatever to charge against the cost of the work.

Another thing to keep in mind is the correct number of men to be put on a job to get the best results. In this respect there are other things to consider besides the placing of the men with a view of working to the best advantage. A case has been brought to my attention where two men were sent out to a camp in the hills to do the annual labor on two lode claims. After the completion of the work on the first claim, a third man was sent out to help finish the job. In checking up the results, it was found that more work was done for the $100 on the first claim than on the second, under identical working conditions. The mystery was finally solved when it occurred to the owner that "slough" is a three-hand game.

Relation Between Wage Scale and Total Cost

Increased cost of work naturally results where higher wages are paid and the working day is shorter, but the resulting increase is seldom as much as the price per hour per man would appear to indicate. Men working an 8-hr. day will generally do a greater amount of work per hour than those working a 10-hr. day. It was noticed in places underground that when an 8-hr., instead of a 10-hr., schedule was put into effect practically the same amount of work was accomplished in the shorter shift.

*Read by E. D. Gardner before the Montana Society of Engineers, Butte, Mont., Apr. 10, 1913.

Better work may be expected, other conditions being equal, from miners in a $4 camp than from those in a $3 one. The mines paying the higher wages naturally have a larger number of men from which to choose their workers. As a rule, high-priced men are more efficient than those receiving smaller wages. As an example: On a rush job miners at $3.25 per 8-hr. day were put to work to help finish an excavation on which a Greek section crew were working at $1.75 per 10-hr. day. The cost per cubic yard of the work done by the miners was a little less than that done by the section crew. This is of course an exceptional case, and allowance must be made for cost per hour of labor.

Places where surface excavations are made are generally in the outskirts of the main districts or in places remote from centers of population, where it is necessary for the men either to go some distance to work or live at a camp. Generally, the more efficient men are not obtainable to do this work at the standard scale of wages for the locality. Such jobs are usually relatively short and have other obvious disadvantages, to offset which it is often customary to pay $0.25 or $0.50 per shift more than the standard scale.

It sometimes occurs, though seldom, that a shaft or tunnel is started at the surface where the rock is unaltered and may be as difficult to excavate as at depth. Ordinarily the work is in rock affected by weathering and decomposition. In most mining districts the sedimentary rocks are shattered and softer at the surface. The igneous rocks also have the same tendency toward disintegration, particularly in the vicinity of veins. Exposed rock is seldom as hard as that found at depth.

The Cubic-Yard Basis for Openwork

The simplest forms of development work are opencuts and trenches. Later, when the location of the lead is determined, shafts may be sunk or, if the contour of the ground is favorable, adits opened.

In computing costs, opencuts and trenches are calculated on a cubic-yard basis and shafts and tunnels by the linear foot, due allowance being made for the size of the cross-sections. A good method of arriving at the cost of shaft is to figure the first 7 ft. as an opencut on a cubic-yard basis, and from there down as a shaft at so much per foot in depth. Material can be readily thrown with a shovel from a depth of 7 ft. To do so from a greater depth increases the cost per cubic yard, and where a windlass is to be installed in any event, it is not economy. It is common practice in city trenches, and to some extent in shafts where no greater depth is desired, to throw material from a depth of 8 or 9 ft. to the surface. Shafts are often sunk to a depth of 15 ft. or more without installing a windlass, the material excavated being thrown to the surface by means of benches. The broken rock is thrown from the bottom to a bench and from there to the surface.

The cost per cubic yard of opencuts varies from $0.50 to several dollars; prospect tunnels, from $2.50 to $30 per ft.; and prospect shafts, from $4 to $40 per ft. depending upon the conditions. The cross-sections of such tunnels and shafts are generally 4x6 ft.

At Butte, with miners' wages $3.50 per 8-hr. shift, the cost of opencut work averages about $1 per cu.yd. The formation is a quartz monzonite, locally known as the Butte granite. This rock, with the exception of unaltered boulders and an occasional ledge of solid granite which outcrops, decomposes at the surface and to quite a depth in the proximity of veins. The boulders are mainly at the surface, but are frequently found below and in veins at depth. There is almost an entire absence of any angular slide overburden. At points where the granite is well disintegrated, the cost of opencut work will be less than $1 per cu.yd. On the other hand, where boulders are encountered and in ledges of solid granite the cost will be considerably higher. Excavations in this district are nearly always started in the decomposed granite. There is not much object in starting them in hard rock as no vein outcrops are found in the unaltered portions. The altered granite near the surface is mostly picking ground, and little blasting is required in openwork.

The cost of short tunnels from the surface at Butte runs from $3 to $8 per ft., except some work on the main range in hard aplite, which costs over $10 per ft. In the majority of cases involving decomposed granite, the cost is between $4 and $5 per ft. This includes cutting the timber standing on the claim or near-by and placing it in the tunnel, but not its purchase price or the expense of bringing it from a distance. Generally, where the rock is soft enough to require timbering, the greater ease with which it is broken will compensate for the extra labor of cutting timber and putting in sets. Where the tunnels run into spiling ground and into hard boulders, the cost will of course be increased. These figures do not refer to tunnels of large cross-section in the solid granite in the deep mines.

The cost per ft. of sinking prospect shafts in the Butte granite depends on the amount of decomposition of the rock and on the depth of the shaft. Prospect shafts are generally about 4 ft. wide and 6 ft. long, as this makes a convenient-sized excavation in which one man may work. The average cost of a 4x6 shaft 15 ft. deep is about $5 per foot below a depth of 7 ft., the upper 7 ft being figured on a yardage basis. The cost increases with depth. A 4x6-ft. shaft 10 ft. deep is generally considered by the United States mineral surveyors and others at Butte as costing $25. This is generally a fair valuation, but in some cases it is a little high.

Patent Work Done on Mining Claims

Patent work amounting to $25,000, done under the supervision of two men on about 50 scattered lode claims ranging from four to six miles from Butte, showed a cost of $0.80 to $1.25 per cu.yd. for opencut work and an average of $5 per ft. for tunnels. The work done on a single claim of this number for an expenditure of $500 aggregated 113 cu.yd. of opencuts and a partly timbered tunnel 3x6x84 ft. long. The cost of the tunnel, by allowing $1 per cu.yd. for the openwork, was $4.60 per linear foot. The work on all of the claims consisted of opencuts and tunnels with a few shafts. The deepest shaft was 55 ft., and the others were comparatively shallow. The cost of the deepest shaft to a depth of 47 ft. was $370, or nearly $8 per ft., and to the depth of 55 ft., $470, making the last 8 ft. cost $12.50 per ft. This shaft was sunk on a vein on a 45° incline, and was cribbed with an inside measurement of 3x5 ft. The broken rock was hoisted by a hand windlass in a bucket sliding up on guides. In this case the construction of the windlass and frame and other extra work made up for

the smaller cost of the first 7 ft. The formation was more or less decomposed Butte granite, and required blasting. From the last part of the shaft some water had to be bailed. It is considered that 55 ft. is just about the limit for economical sinking with a hand windlass.

Another shaft 4x6x15 ft. cost $48. This amounted to $1 per cubic yard for the first 7 ft., and a little over $5 per ft. for the remainder. The cost to the City of Butte of excavating the material in sewer trenches within the granite area amounted to $2.16 per cu.yd. The trenches were 2 ft. wide and averaged 9 ft. deep. All the work was done by contractors. Wages for ditch diggers are $4 per 8 hr. this being the minimum price for all laborers on city work, and is $0.50 per day more than is now paid to miners. This rate of wage has been fixed by ordinance of the city government. City contractors in Butte have to contend with numerous labor-union regulations. The higher cost per yard of this work than for opencut mining is due to the labor situation, the great depth and small width of the trenches, and the larger proportion of solid granite, consisting of boulders and ledges included in the softer material that has to be moved.

A 300-ft. tunnel run from the surface in a hard, compact granite cliff at the head of Rattlesnake Creek in Beaverhead County, cost $28 per ft. Several hundred feet of prospect tunnels on the porphyry dike in the Remini district, Montana, were run by contract for $3 per ft. Prospect tunnels in the soft porphyry in the lowlands district, Montana, cost from $2 to $5 per ft.

Tunnels in the soft schist in the Crevasse mining district, Montana, cost from $4 to $5 per ft.

Cost of Work in the Cœur d'Alenes

In the Cœur d'Alene mining district there are few outcrops and the surface on the mountainsides is generally covered with soil and angular wash to a depth of 2 to 8 or 10 ft. Under the overburden the formation in place nearly always is broken and shattered to an appreciable depth, but very seldom over 15 ft. or 20 ft. The formation is a series of sedimentary rocks which are, on the whole, easily eroded and weathered. There are a few hard strata, such as the copper beds in the Revette quartzite, which resist weathering and are as hard at the surface as at depth, but these comprise only a very small part of the whole series. Miners' wages are $3.50 for 8 hr. The cost of surface cuts here is found to be a little higher than at Butte, averaging about $1.20 per cu.yd. for the material removed. Individual cuts cost from $0.75 per cu.yd. when in wash, to $2 per cu.yd. when in the harder rock. The average cost of a series of cuts up to 7 ft. in depth on flat surfaces and with 12-ft. faces on side-hills, was $1.20 per cu.yd. In classifying the material most of the rock in place in opencut work would come under the head of loose rock.

The average rock in the Cœur d'Alenes is much softer than the solid granite at Butte, but harder than the altered granite. The cost of prospect tunnels in the Cœur d'Alenes ranges from $3.50 to $10 per ft., according to the hardness of the rock, with an average of about $6. The contract price of a tunnel in the shale above Pottsville, Ida., from 400 to 500 ft. from the portal, was $4.50 per ft. The total cost to the contractor, however, was $3.50 per ft. Surface prospect tunnels run by one of the mining companies in hard quartzite at Burke, Ida., cost $10 per ft.

Annual assessment work on five lime placer claims 12 mi. from the railroad on Pend d'Oreille River, in Washington, showed an average cost of $3.23 per cu.yd. of rock removed. Wages were $3.50 for 9 hr. The formation was tough, compact limestone and dolomite, with an entire absence of all surface weathering and overburden. The cuts were made in the bluffs above the river.

Development Expense in Washington

Development work in opencuts on lime placer claims at Metaline Falls, Wash., in solid limestone, cost from $2.50 to $4.10 per cu.yd. The cost per cubic yard of opencuts on a vein in disintegrated andesite on the north half of the Colville Indian Reservation, Washington, was $0.94 per cu.yd. The cuts averaged 34 ft. long, with 15-ft. faces. Wages $3.50 for 9 hr. The contract price for excavating solid rock in trenches 3x9 ft. deep in the City of Spokane, Wash., was $4.75 per cu.yd. This rock is a basalt of extreme toughness and requires an excessive amount of drilling and blasting. The contract price for the same work in opencuts in street work was from $0.90 to $1.25 per cu.yd. The cost to the city for removing gravel in the same-sized trenches was $0.90 to $1 per cu.yd. Wages are $3 for 8 hr. for city work. The contractors figure that 20% of the cost consists of overhead charges, interest and depreciation and 6% tax for workmen's compensation.

Opencuts made at Bingham, Utah, in weathered limestone and quartzite and slide rock, under my direction, cost $0.80 per cu.yd. Prospect tunnels in the same formation cost $4 to $6 per ft. Miners' wages were $3.25 for 8 hr. Hand placer work is cheaper, on the whole, than the same kind of work on the lode claims, which is to be expected from the nature of the material handled in each case. The formation of placers consists of stream gravel, sand or clay, with an occasional boulder, and in some cases cemented strata. Hand placer excavating is straight pick-and-shovel work except where boulders are encountered. In hand sinking on many placer properties the amount of water that has to be bailed or pumped out is the greatest factor in determining the cost, and often the quantity of water entirely prevents sinking. In many places cemented strata are entirely absent and what boulders are found are near bedrock and need not be moved in prospect work.

By considering how much gravel a man can handle per shift and his daily wage, it would be possible theoretically to arrive at the cost of most placer excavations. Byrne, on page 202 of his Inspector's Hand Book, gives the average amount of material a man can loosen per hour with a pick as, in clay or cemented gravel, 1 yd.; loam or loose gravel, 2 to 3 yd.; sand, 4 to 6 yd. On the same page he gives the average quantity a man can shovel per hour with a limit to the cast of 6 ft. vertically and 12 ft. horizontally as in rock, 1 yd.; clay or heavy soils, 1.5 yd.; loose earth or sand, 2 yd.

By taking Byrne's figures of 2½ yd. per hr. for loosening gravel and of 1.5 yd. per hr. for shoveling, a man in an 8-hr. shift could excavate a trifle over 8 cu.yd. of material. By allowing for miners $3.50 per 8 hr., the cost per yard would be $0.44. This agrees fairly well with other authorities, such as Gillette and Trautwine.

On placers, the cost of openwork or trenches up to 7 ft. deep with little or no water varies from $0.40 to $1 per cu.yd., depending on the nature of the material and the price of labor. Timbered prospect tunnels in gravel cost generally from $4 to $6 per linear foot. The cost of a 10 ft. shaft with little or no water is generally taken as being $10. Frozen gravel is not taken into consideration.

Trenches in city streets, particularly in a mountainous country, are quite often in material similar to that found on placers. Costs are generally kept fairly close on this work and can be used as a basis of comparison for placer work in similar ground.

At Missoula, Mont., it costs the Missoula Light and Water Co. an average of $0.36 per cubic yard to do the excavating for city water trenches 2x6 ft. The work is done by day labor, with wages at $3 for 8 hr. The material moved is almost entirely wash gravel, with an occasional hardpan.

The Great Falls Water Co., at Great Falls, Mont., in excavating for city water pipes moved 89% earth, 5% solid rock and 6% loose rock at an average cost of $0.34 per cu.yd. Wages were $2.25 for 10 hr. S. Lefevre, in his article in the February "Bulletin" of the American Institute of Mining Engineers gives the cost of surface excavations at Mineville, N. Y., in hardpan and boulders, as $0.80 to $1 per cu.yd. Wages for this kind of work are about $2 per 10 hr. Well diggers sink 5x5-ft. wells up to 30 ft. in depth on the Missoula Flat, at Missoula, Mont., on contract, at $1.50 per ft. including placing but not supplying the timber. Below 30 ft. the cost increases. The Flat is an old river bottom, and consists mostly of river gravel.

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The Boulder Batholith

BUTTE CORRESPONDENCE

The Boulder batholith and its bearing upon the future of mining in the entire district was the subject of consideration and discussion at a meeting and banquet of the Montana section of the Institute of Mining Engineers in Butte, Oct. 8. The subject was presented by J. A. Grimes and was a continuation of the discussion on a paper prepared jointly by Mr. Grimes and Paul Billingsley and read at a previous meeting of the Montana section.

The Boulder batholith includes the granite formations that compose the mining district that centers around Butte. It extends from the Bannack mining district in southwestern Montana north to the Marysville district north of Helena and from the mining districts around Phillipsburg in Granite County on the west to and including the Radersburg district on the east.

This district ranks today, he said, as one of the greatest metal-producing sections, if not the greatest, in the world. From a special study, which took in 70 distinct mining districts in which are located over 700 mines that are either producing at present or have been producers at some period of their history, it is shown that the granite formation of the Boulder batholith bears a regularly defined mineral enrichment. The gold is found in the strata just above the granite formation in some districts, like that of Marysville in particular. The silver ores are found generally just on the upper edge of the granite. The silver-lead ores are found just below the upper edge, while the zinc ores are found at a somewhat deeper level. Below the zinc comes the copper formation, although this, outside of certain exceptional districts such as Butte, is of such low grade as not to be commercial ore. Going lower, they run into the iron-bearing quartz, and the indication is that the mineralized section does not run deeper than that.

Mr. Grimes noted four exceptions in particular to the rules that apply in the rest of the district covered by the Boulder batholith. These exceptions are the Hecla mine, the Granite-Bimetallic, the Elkhorn and the Butte districts. In the last, a depth of 3,400 ft. has not yet taken the explorations to the bottom of the copper-bearing ores, and in the Elkhorn district the end has not been reached at a depth of 2,100 ft.

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The Gennamari Mill, Sardinia

BY C. W. WRIGHT*

The problem of remodeling the Gennamari mill, to be described, was a simple one because of the character of the ores treated. The object of the change was to increase the metal recovery and to reduce milling costs and thus permit the treating of lower-grade ores at a profit.

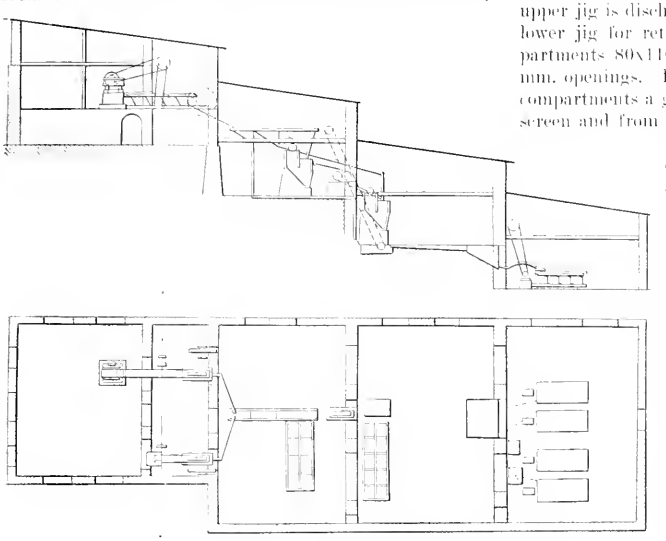
A series of careful tests at this mill in 1910, extending over several months, showed a metal recovery of only 60%, two-thirds of the loss being in the fines under 1½ mm. in size, all of which material was treated in a few small jigs. These tests showed the immediate need of tables for the treatment of the fine ore, which was being carried down the river and lost. Tables were designed and built at the mine, and eight were installed along with necessary classifiers and dewatering boxes. The metal recovery was gradually increased to 75%, which was largely due to the tables, though the costs were still high. The next change was to replace the small-sized Harz jigs, treating ½ ton per hr., with large jigs similar in type but of 6 tons or more capacity per hr., and to eliminate the system of close sizing. By these alterations, which are described in detail, the lead recovery was further increased to 80% and the costs of milling were reduced. Finally, last year, a plant for the retreatment of the slimes was built, using large spitzkasten, 3 slime tables and 2 corrugated rubber-belt vanners. This last improvement has increased the lead recovery to 86%.

DESCRIPTION OF THE GENNAMARI ORES

At the Gennamari mine the ore is galena, which occurs in fissure veins traversing both the granite and schist country rock. The veins in the granite contain quartz and siderite in about equal proportions as gangue minerals, while those in the schist have siderite, blende, pyrite, some calcite and quartz as gangue minerals. The veins average about 6% lead; the galena is in compact veinlets and pieces and not minutely disseminated, so that its separation is fairly simple. The coarse lumps of lead ore are sorted by hand in the stopes and on the *piazzales*, while the rest of the ore which averages from 3 to 4% in lead is transported to the mill. The material from the stopes, which yield a low-grade ore, is sent direct to the mill after a sorting out of the larger waste rock, which is left as filling.

*Mining engineer, Ingurtosu, Sardinia, Italy.

At the mill are bins of 250 tons' capacity equipped with grizzlies having 30-mm. openings to separate the coarse ore, which is delivered in cars along the side of the crushers and fed into them by shovel. The fine ore, which passes through the grizzly, is delivered into a small bin equipped with an automatic feeder. Both the ore from the crusher and the fine ore are fed to shaking



SECTION OF PART OF THE GENNAMARI MILL, SARDINIA

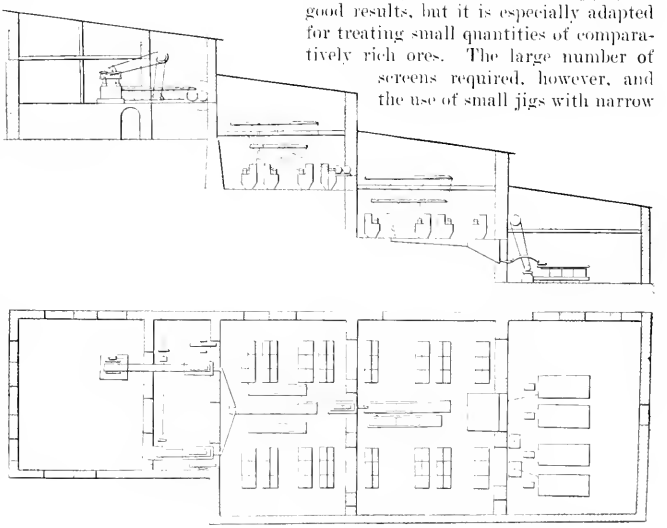
screens with 15-mm. openings. The oversize goes to a set of rolls at the end of the screen, and the undersize goes direct to the screen below the rolls for further sizing. The opening between the rolls is set at about 10 mm., and they are kept in constant adjustment so that there is practically no oversize from the screens.

The main modifications in the mill begin at this point. They consist of a reduction in the sizing of the ores, thus requiring fewer screens and the use of larger jigs. Four of the shaking jigs have been abolished, and 14 small jigs have been replaced with two large ones. One section of the mill was first modified, and after six months of comparative tests the second mill section was also changed. A plan and elevation of both the old and new sections have been added and these show clearly the changes that have been made in the treatment methods.

The amount of ore treated is from 9 to 10 tons per hr. in each section. After the ore has been crushed, it is graded into 3 sizes, 0 to 1, 1 to 4, and 4 to 15 mm. The fine size, which amounts to about 15% of the feed, goes to the spitzkasten and on to tables for treatment. The size from 1 to 4 mm. goes to a lower jig, and the size 4 to 15 mm. is sent to the upper jig. The upper jig has four compartments 90 by 120 cm. in size. From the first compartment a galena product is made on the jig screen, having 5-mm. openings, and in the hutch. From the other three compartments a middling is drawn off above the jig screens through the pipe discharges and sent to a set of rolls to be reground, after which it goes to the lower jig. The hutch product from the last three compartments of the upper jig is discharged into a canal and sent direct to the lower jig for retreatment. The lower jig has five compartments 80X110 cm. in size, the jig screens having 3-mm. openings. From the first and sometimes the second compartments a galena product is obtained both from the screen and from the hutch. The middling product from the jig screen and the hutch of the other compartments is delivered to an elevator and is either sent to a set of regrinding rolls and returned to the lower jig for treatment or sent to a ball mill and treated separately.

The upper jig receives about 45 tons per shift and makes 24 tons of tailings containing traces of lead, 20 tons of middlings with 5% lead, and about 1,000 kg. of galena containing 55% lead. The lower jig receives 20 tons of direct feed from 1 to 4 mm. in size and 20 tons of recrushed middlings from the upper jig. This jig makes 35 tons of tailings with traces of lead, 14 tons of middlings with 5% lead and 1 ton of product containing 65% lead. The mill is only operated one shift of ten hours a day.

The old system of using small jigs gave good results, but it is especially adapted for treating small quantities of comparatively rich ores. The large number of screens required, however, and the use of small jigs with narrow



ANOTHER PART OF THE GENNAMARI MILL, SARDINIA

compartments and screen areas naturally increase the cost of attendance, repairs and water consumption and make this method impractical for the treatment of a large tonnage of low-grade ore.

The following tables are added to show some of the advantages of the new method over the old one. As the

difference in the two systems is confined to the modifications in the screening and jig treatment, only these changes will be considered.

Comparison of Machines in Operation

Old Section		New Section	
Shaking screens, upper floor	3	Shaking screens	1
Jigs for coarse ore	6	Jig for coarse ore	1
Shaking screens, lower floor	2	Jig for fine ore	1
Jigs for fine ore	8	Elevator	1
Total number of machines	19	Total number of machines	4
Cost of machinery, lire	20,000	Cost of machinery, lire	10,000

Reduction in Power Consumption (Although Amount not Determined)

Water consumption per min., liters	1,080	Water consumption per min., liters	380
Area of jig screens, sq. m	175	Area of jig screens, sq. m	85
Labor		Labor	
Screens	1	Upper jig	1
Upper jigs	3	Lower jig	1
Lower jigs	4	Screen, etc.	1
Total	8	Total	3

Cost of Supplies and Repairs (Oil, Belting, New Screens, Etc)

Screening, lire	224 53	Screening, lire	96 65
Jigging, lire	169 68	Jigging, lire	76 30
Transmission, lire	124.45	Transmission, lire	79 30
Total, lire	518 66	Total, lire	252.94

Besides the advantages mentioned, the new system permits a more accurate supervision of the jigs, with the result that more uniform products are obtained.

Antimony Mining in Bolivia

Antimony mining in Bolivia has recently been active, according to a correspondent of the London *Mining Journal*, who writes as follows:

As regards antimony, 1,315 tons were exported during the first five months of this year, as compared with 120 tons during the same period of last year. The high prices had already stimulated production, and since then there has been great activity. Antimony is quite widely distributed throughout the metamorphic slates of the Bolivian plateaus. The veins are not usually constant, but frequently form quite large pockets. So far there is practically no development work, and the ore being mined is superficial; still it is almost entirely sulphide of good quality, with little or no lead. No capital has been invested in antimony mining; work is from hand to mouth, and there are no reserves blocked out which might give an idea of the permanency of the deposits, but these are so numerous that with good prices there is no doubt that the output will be considerable. I have not any sure data to go on, but I think that at least 1,000 tons of antimony ore of over 60% is leaving the country monthly at the present time. Of course local conditions of scarcity of labor and means of transport soon limit output, and it is to a large extent at the expense of the tin mines that antimony is being produced; although, on account of the antimony deposits being at a lower altitude, part of the workmen employed on them are of a class that does not go up to the large mines.

The ore is spalled by hand, and naturally a good deal of lower-grade stuff remains in the dumps, as well as a considerable proportion of zinc, which by concentration would yield a good marketable product.

The high transport costs practically prohibit antimony mining in Bolivia except when prices are abnormally inflated, and therefore a stable industry cannot be counted on, the natural consequence being that no money is forthcoming for the development of the antimony industry.

Many commercial houses have been buying and exporting antimony, among them Gibbs & Co., which, I am told, has been doing so for the English Government.

Employees' Liens in California

By A. L. H. Street*

An owner of a California mine will not be subjected to a lien for compensation due an employee employed by one known by the latter to be operating the mine under an option to purchase the property, according to the holding of the California District Court of Appeal in the late case of Street vs. Hazzard, 149 *Pacific Reporter*, 770.

*Attorney at law, Minneapolis, Minn.

Another point decided in the same case is that the failure of the owner of mining property to file for record, as required by the California statutes, a notice disclaiming liability for work done on the property, does not give a lien to a workman who had actual notice of the fact that the owner was not his employer.

Volunteer Engineer Officers

In view of the program, which has been made public, of the Administration's plans for preparedness with particular reference to increases in the army, the following from General Orders No. 54, 1914, and General Orders No. 50, 1915, War Department, Washington, D. C., will be of interest.

For the purpose of securing a list of persons specially qualified to hold commissions in any volunteer force which may be called for and organized under the authority of Congress, other than a force composed of the organized militia, the Secretary of War is authorized from time to time to convene boards of officers at suitable and convenient army posts in different parts of the United States, who shall examine, as to their qualifications for the command of troops or for the performance of staff duties, all applicants who, being citizens of the United States, come within the prescribed limitations.

For engineers these requirements are, besides passing a satisfactory physical and moral examination and the presenting to the board of evidence of their technical qualifications together with a full statement of their professional experience,

3. For the grades of lieutenant—(a) The candidate must be an engineer in the active practice of his profession or in some business immediately connected with or concerned in engineering matters.

(b) He must either hold the grade of junior engineer, civil, electrical or mechanical, or higher grade in the civil service, or he must be a graduate from an approved engineering college, or belong to one of the following national engineering societies in a grade not lower than that shown opposite to each: The American Society of Civil Engineers—junior member; the American Institute of Mining Engineers—member; the American Society of Mechanical Engineers—junior; the American Institute of Electrical Engineers—associate. Or he must be or have been a noncommissioned officer of the grade of sergeant or above from one of the regular battalions of engineers.

4. For the grade of captain—(a) Same as 3 (a).

(b) He must either hold the grade of assistant engineer in the Engineer Department at Large or a corresponding engineer grade in the civil service in another department of the Government service, or be an associate member, or member of one of the national engineering societies enumerated under 3 (b), or have held a commission in the Corps of Engineers of the regular army.

(c) Sufficient knowledge of Field Service Regulations, Army Regulations, and Tables of Organization to understand the type of information of which these regulations are the source.

5. For the grade of field officer—(a) Same as 3 (a).

(b) He must either hold the grade of assistant engineer in the Engineer Department at Large or a corresponding engineer grade under the civil service in another department of the Government service, or be a member of one of the first three national engineering societies enumerated in 3 (b), or be a fellow of the American Institute of Electrical Engineers, or have held a commission in the Corps of Engineers of the regular army not more than two grades below that for which he desires to be listed.

(c) In addition to fulfilling the qualifications given in 5 (a) and (b), the candidate will be required to pass the examination prescribed herein for a field officer of infantry and an examination on the duties of engineer officers and troops in war, what they are and how they are performed.

Applications for examination, accompanied by recommendations and other documents of a commendatory character (as prescribed in General Orders 54), should

be made to the adjutant-general of the state, according to the legal residence of the applicant, in the month of May or November, to the end that the governor of the state may forward the accumulated applications with his recommendations in each case, to the adjutant-general of the army about Jan. 1 and July 1 of each year.

Mining in Boulder County, Colo.

Special Correspondence

Boulder County, Colo., measuring 24 mi. north-south and approximately 32 mi. east-west, has unusually varied industries, due to the remarkable diversity in altitude, climate, geology and mineralization. Beginning at the eastern border there is a beautiful agricultural country with abundant irrigation and sustaining a thriving population. This area is underlain by splendid beds of lignite that have for years been extensively worked. The principal coal-mining towns are Lafayette, Mitchell, Superior, Louisville and Marshall. The surface of this coal-mining and farming area is a gently rolling prairie with an average altitude of about 5,000 ft.

Boulder, the county seat, lies immediately west of this farming and coal-mining area, where the plains and the foothills of the Rocky Mountains meet at an altitude of about 5,400 ft. Adjacent to the city—in fact, within it—the sedimentaries in the region to the east (where they lie practically flat) are tilted on edge, flanking great hills of metamorphic rock. In these steep beds may be found sandstones, limestones, shales and all sorts of clays. These rocks have been quarried for commercial uses, and the clays have been extensively used in the manufacture of bricks and refractory goods.

Metal Mines Situated in the Hilly Country

It is in the hilly country to the west of the city that we find the metal mines. Gold mining began here in 1859—almost contemporaneously with its beginning in the contiguous little county of Gilpin—and records show that the first location document ever filed in this state (then territory) was for a quartz vein not far from the city. Westwardly the hills rise back of one another to the crest of the continent, the county line, along which the average altitude is about 13,000 ft. Long's Peak, with an altitude of 14,271 ft., is in the very northwest corner of the county, while Arapahoe Peak, 13,176 ft. high, is about 22 mi. due west of Boulder. The station of Corona, remembered by all travelers over the Denver & Salt Lake (Moffat) Railroad, is in the southwest corner of this county.

The prevailing rocks of the mountainous country are granite, gneiss and schist, inclosing many strong dikes and sheets of siliceous porphyries. This is a region of typical vein fissuring. The veins vary in thickness up to 30 ft. or more and are inclosed by all the country rocks. They carry shoots or bodies valuable for their content of gold, silver, tungsten, lead and copper, all of which metals have been sought and mined commercially. Up to the present time little attention has been given to zinc, bismuth, vanadium and molybdenum, although these metals are known to occur here. They will unquestionably come in for recognition before long.

The veins that bear gold and silver are usually of complex character carrying sulphides of lead, iron, and copper in addition to the precious metals. The gangue is usually quartz. The ores of the two precious metals generally contain both silver and gold, but the variations in the relative amounts of these metals are such that some mines are classed as gold mines while others (sometimes contiguous properties) are considered silver mines. For instance, near the town of Crisman, the Yellow Pine mine has made a large production of silver that was accompanied by but a trace of gold; while the Logan mine, next to it, has a production record of about $150,000 in gold. The White Raven mine, near Ward, ships high-grade silver ore containing little or no gold. In the '70s the Caribou mine was said to be the greatest silver mine in Colorado, but it lies in proximity to other mines in which the chief metal is gold. As a general statement, however, it may be said that the majority of the metal mines in this county produce ores in which the principal value is the gold content.

Gold occurs free in the upper zones of the veins, and amalgamation was the common treatment during pioneer times. Below the zone of oxidation, the gold often exists in the telluride form, sylvanite, and cannot be saved by amalgamation. Formerly the stream beds were washed by primitive placer methods and unrecorded quantities of coarse gold recovered. Silver occurs in the native state and as the sulphide, argentite. Very often its presence in ore is not discernible because it is so fine and in such intimate association with lead and copper sulphides.

Tungsten Mining Becoming an Important Industry

Tungsten occurs in a narrow belt crossing the mountains in a northeasterly direction. The veins are found where granite and schist are crossed by pegmatite dikes that appear to possess a direct relationship to the mineralization. These tungsten veins are usually richer when they have walls of granite. The gangue most closely associated with these occurrences of tungsten is hornstone or cherty quartz. The tungsten, itself, occurs as ferberite, the tungstate of iron, and as hübnerite, the tungstate of manganese. The main production has been of the former, a black, heavy mineral that predominates in the southern portion of the field, where most of the development has taken place.

Tungsten mining in this county has been contemporaneous with tungsten mining throughout the United States. It began in 1900, when shipments amounted to about 40 tons of equivalent 60% WO_3 concentrates. The largest production was in 1910, when it was equivalent to 1,221 tons of this material. Altogether, up to the present time, statistics show that the county has furnished about 60% of the nation's production. With the recent remarkable strength in the tungsten-metal market there has been a pronounced increase in mining and prospecting for the metal, and the 1915 production will reach record figures for both tonnage and value. The Conger mine is the greatest tungsten mine in the world, its production having a gross value of nearly $1,500,000.

Practically all the tungsten production to date has been in a small territory at the southwesterly end of the belt, near the town of Nederland. The metal was known to occur in other parts of the county, but it has been only within the past few weeks that miners have given serious effort to developing it outside of the limited area. Now tungsten has been proved in paying quantities

several miles northeast of Nederland, at the camps of Magnolia, Sunshine, Salina and Wall Street.

The metal-mining part of the county—containing, along its westerly rim, glaciers and perpetual banks of snow—is well supplied with streams that provide water for milling purposes. These mountains, below timber line, were formerly heavily wooded, and even yet in places there are fine stands of pine. The Colorado Power Co.'s 20,000-hp. hydro-electric plant at Magnolia is in this mining country, and its transmission lines traverse the various districts. Water for this power generation is impounded by a great dam in Middle Boulder Creek, is conducted 12 mi. through a 35-in. reinforced-concrete pipe line under gravity flow to a small reservoir at the top of a steep mountain, down whose slope a steel 48-in. pipe line carries the water 9,400 ft. to turbines, where it enters under a head of 1,830 ft. Moderate rates for current consumption have been established. The county is crossed by the Colorado & Southern, Union Pacific, Burlington, Denver & Interurban, Denver, Boulder & Western and the Moffat railroads. Of these, only the last two penetrate the metal-mining parts. The Denver, Boulder & Western, frequently spoken of as the "Switzerland Trail," is narrow-gage and reaches most of the metal-mining camps.

Pioneer miners divided the metal-mining part of the county into eight so-called mining districts, known as Gold Hill, Central, Ward, Grand Island, Sugar Loaf, Magnolia, Boulder and Snowy Range. Necessarily, these districts are comparatively small, since the entire metal mining area is not over 15 mi. square. The Gold Hill district was the first organized in Colorado, and it also contained the first stamp mill, machinery for which was hauled by ox teams from St. Joseph, Mo.

Manifest Advantages Led to Unscrupulous Speculation

Because of its easy accessibility, its splendid climate and its actual mineral production, this county years ago fell a victim to practices of unscrupulous or inexperienced mine promoters who, securing options to attractively situated claims, incorporated companies and sold stock broadcast, little or no actual mining resulting from such financiering. Often, the capital raised by sales of stock was foolishly expended in the premature erection of showy milling plants. Perhaps some of these defunct concerns never had any sound bases for mining operations, but probably the majority of them might have succeeded had they been managed by mining men instead of sharpers.

Some Boulder County mining enterprises met their doom when, after legitimately and successfully operating for a long time on their oxidized ores, they encountered the sulphide and telluride ores that were distinctly refractory to the simple milling methods of a decade ago. Such companies were obliged to discontinue operations or to entirely reconstruct their plants and revise operations. Such crises occurred about the time of general national financial depression and the propagation, by magazines of large circulation, of the theory of the unsoundness of mining investments; with the result that the metal-mining industry of Boulder County has languished, or at least stood still, for years.

There is now, however, a decided revival of interest. Old mines are being reopened, new prospects are being exploited, and milling plants are being installed to treat ores by modern methods. A few operators are giving attention to the mining and treatment of low-grade ores, such as were avoided in the past. Because Boulder County projects have failed in numerous instances, the region is, by some, accused of being "pockety" in the sense that oreshoots are of trifling extent and that profits derived in mining some rich bodies are absorbed in developing new ones. This is not a wholly just charge. It is no more applicable to veins in this county than to those of any other typical vein district. Reference to a map will show that Boulder County is really part of the general mining area covering also Gilpin and Clear Creek Counties to the south. The veins of western Boulder County are, in fact, identical in their characteristics with those of Gilpin County. Nor is the latter county active, but nobody that knows this famous little district will say that its veins are defective or worked out, or that the ore occurs in small and widely spaced pockets. Analysis of the depression in mining activity in this region will show that it can be explained by reasons that are quite apart from natural deficiencies. Among such reasons are the lack of local plants for treating the sulphide ores, failure to accept and adopt new methods, erection of mills with capital that should have been used in development, unsystematic and illogical systems followed in mining, almost complete nonemployment of trained engineers or metallurgists, management of enterprises by wholly inexperienced persons, and the failure on the part of Boulder County residents in the past to oppose illegitimate schemes.

But a new order of things will hereafter prevail, and mining activities will be guided by men of experience. An encouraging thing is the experimentation or research that is being carried on by experienced millmen and metallurgists. Cyanidation and flotation are being adopted in some instances. It is hoped that future mining operations will not be managed by needy relatives of Eastern investors or by men whose only mining experiences have been in small districts like this one, in which economics has never been a serious study.

Social Improvement at Lead

Special Correspondence

A survey of conditions in a Western metal-mining camp from the viewpoint of a sociologist is always interesting to many classes of people. There is no denying that many employers have rather derided efforts toward social betterment and regarded them as a weakness on the part of their fellows who indulged in them, and failed to consider the increased efficiency obtained through better moral and social conditions. Our great industrial leaders have now changed their attitude and are giving serious consideration to the results of the work done in the field of social welfare.

Among the places under scrutiny is the little city of Lead, S. D. This municipality of 9,000 people is the abode of the Homestake property, classed as one of the world's greatest gold mines. Lead was one of the places visited by the Congressional Commission on Industrial Relations which investigated its first and only labor difficulty in 35 years of operation. Professor Commons, who displayed much interest in Lead, pronounced it the most remarkable and interesting community he had observed. From the fact that only one clash had occurred between the owners and their employees and the additional fact

that at least half of the men sided with the company in that trouble, one would correctly infer that much effort had been made to keep the miners satisfied with the working conditions and to maintain harmonious relations and comfortable living conditions.

Both the late superintendent, Thomas J. Grier, and the present incumbent, Richard Blackstone, entered the service of the Homestake Mining Co. shortly after its organization and consequently were closely identified with every movement inaugurated to preserve harmonious relations with the workmen. Both displayed interest in the social life of the men and may be properly classed among the men of business who first saw practical benefit through better social and living conditions.

One of the results of this interest is what is known as the recreation building. This was erected at a cost of $350,000 by the Homestake Mining Co. for the free use of its employees and the people of Lead. It contains the finest theater in the state, a magnificent swimming pool and rooms equipped for all forms of indoor recreation. Here is installed the famous Hearst Free Library, equipped and maintained by Mrs. Phoebe Hearst. The building forms an important part of the social life of the community and is a strong link in the chain of common interest between employer and workman.

The free medical and hospital service for all employees and their families; the Aid Association, which provides insurance at a minimum cost against sickness, accident and death; the auxiliary, a woman's organization to care for any cases of temporary destitution or need; and the liberal financial assistance to churches—these are among the measures that were inaugurated and fostered under the direction of the former and present managers. These things could not, of course, come in any other way than by gradual growth. During the reign, so-called, of the Western Federation of Miners many of the men took a position in opposition to everything proposed by the company and preferred to provide their own relief measures through their own organizations. Likewise the amusements and forms of social recreation were those supplied by people who collected a profit from them.

During the transition period following the fall of the Federation, the influence of the employers was predominant and there were suggested and placed in operation many measures which at other times might have been difficult to explain, both to directors and to employees. The pressing needs of the hour in caring for perhaps fifteen hundred new employees and their families permitted the easy introduction of better forms of entertainment as well as better sanitation and advanced safety methods. Once inaugurated, the ideas grew and developed with little notice or adverse comment. Measures to secure a home for each family desiring to own one were provided.

"Safety-First" methods, which would have been derided in the old days, were taken up with enthusiasm, and the eager desire for increased efficiency enabled a first-aid team of but a single year's existence to win the first prize at the Panama-Pacific Exposition in competition with the oldest and best teams in the country.

Figures showing a comparison between the number of accidents to employees under the old and the new methods and those showing the improvement in the number of hospital cases and serious cases of sickness are startling and offer in themselves a sufficient excuse for every advanced measure inaugurated.

Chronology of Mining for October, 1915

Oct. 3—Arizona militia ordered to Clifton on account of strike disorders.—Crushing begun in mill of United States Gold Co., Boulder, Colo.

Oct. 6—Operations resumed at Butte-Alex Scott.

Oct. 9—Derry Ranch dredge near Leadville, Colo., went into commission.

Oct. 10—Shafthouse and equipment of Matchless mine, Leadville, destroyed by fire.

Oct. 11—Commencement of suit of Elm Orlu vs. Butte & Superior.

Oct. 13—Pilares mine of Moctezuma Copper Co. and the concentrator at Nacozari, Sonora, closed down.

Oct. 14—Production of electrolytic zinc begun at Anaconda, Mont.

Oct. 16—New stamp mill of Brunswick Consolidated started.

Oct. 18—Stockholders of Tennessee Copper Co. approved the issue of $3,000,000 first-mortgage 10-year convertible 6% bonds.

Oct. 19—Carranza government in Mexico recognized by the United States.—Explosion of dynamite at Granite Mountain mine, Butte, Mont., 14 men killed.—Viloro dredge No. 2, Oroville, Calif., burned and sank.—Plant of Mineral Products Co., Marysvale, Utah, started operation.

Oct. 21—First spelter made at Donora, Penn.

Oct. 23—Stockholders of Southern Aluminium Co. voted to dissolve the corporation.

Oct. 25—Operations suspended at Cananea owing to cutting of railway by Yaquis.

Oct. 26—Beginning of strike at Silver King Coalition mine, Park City, Utah.

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Japanese Phosphate Trade

Owing to the European war, Japanese imports of phosphate rock have been greatly interfered with. Florida phosphate is generally used by the fertilizer manufacturers of Japan, and in ordinary times costs about $7.25 per ton, while at present the freight rate alone is about $13.75, which, being added to the original cost of the phosphate, comes to about $20 per ton. Under these circumstances, efforts are being made to supply the Japanese companies with domestic products.

The Japan Phosphate Co. of Tokyo contemplates working its mine on a large scale, while the Rassa Island Phosphate Co., which has the biggest phosphate mines in Japan and which produces ordinarily about 50,000 tons per year, is said to be making preparations for a greatly enlarged production. The Japanese phosphate is said to contain a large percentage of iron, alumina, etc., and consequently is reputed to be a poor material for the manufacture of superphosphate, but under present conditions the Japanese enterprises may prove profitable.

⁂

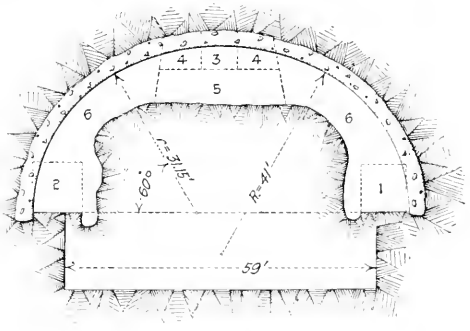
The Production of Nitrogen Compounds in Germany, particularly sulphate of ammonia and cyanamide, has been considerably increased during the course of the war, and the sale price of nitrate is said to have been lower than the cheapest price of the last 10 years, according to the "Journal of the Society of Chemical Industry," Sept. 30, 1915. In order that on the conclusion of peace the newly developed German industry may not be confronted with destructive foreign competition a national monopoly is now being considered.

Details of Practical Mining

The World's Largest Tunnel

The largest tunnel ever undertaken is that which has been partly driven at Marseilles, France, for the Marseilles-Rhône Canal for use as a barge-canal tunnel. The work was suspended at the outbreak of the war and the date of resumption is of course problematical. The tunnel, lined throughout, is nearly 4½ mi. (7.2 km.), is 22 m. (72.2 ft.) wide inside the lining, and the crown of the arch (nearly semicircular) is 9.90 m. (32½ ft.) high. The depth of water is to be 3 m. (10 ft.).

Excavation was begun by driving at the right a heading with a cross-section of 75 sq.ft., with its base at the elevation of the towpath. A second heading, of 96-sq.ft. section, was driven at the same elevation on the left side, parallel to the right heading; and for the purpose of checking the alignment and for ventilation, this was connected with the first heading by cross-drifts every 328 ft. A third small heading was then driven at the summit of the arch, and openings of 43-sq.ft. cross-section were driven to this heading from the two side headings every 60 ft. This third heading was then widened, and the excavated material was dropped through the cross-drifts



HEADINGS IN THE MARSEILLES-RHONE CANAL

into cars operating in the side headings. The top heading was then lowered, and finally the connection with headings 1 and 2 was accomplished as shown in the accompanying sketch.

In the meantime the footings for the masonry arch were laid and the arch centering was erected, being supported on the unexcavated core of the tunnel. The masonry of the arch ring was laid in sections 19 ft. long. Every third one of these sections was built, and then the intervening rings were undertaken. After the completion of the arch masonry, the remaining core was removed.

Before the tunnel proper was begun, two shafts 11.48 ft. in diameter, distant 8,200 and 17,800 ft. respectively from the south portal, were constructed, the former having a depth of 460 ft., the latter of 230 ft. These will serve for the ventilation of the tunnel.—*Engineering News.*

How The Repair Man Sees It

By Harry E. Scott*

How many mine superintendents would stand for an engineer taking a double-jack and pounding the piston of an engine or compressor, should it fail to do its work properly from overloading, or, in fact, from any cause? Without a doubt that engineer would next be seen headed toward the timekeeper's office with a nice large can on him. This holds good on everything in the mechanical line with one exception—that is, the misused and neglected air drill of all kinds and makes.

The management is always kicking about the cost of repairs; the foreman, about the footage and tonnage; the shift boss, about too much time being lost setting-up, getting steel, water, etc. The machine man kicks all of the time—the ground is too hard or too soft, the drift too high or too low, the air poor, the drill no good, the steel poor, and many other things too numerous to mention. They do not stop to consider that on the modern drills they are making machine runners much faster than they did years ago, when a man had to know more than the difference between the chuck and the crank before he could draw a machineman's check.

At the present time a young fellow who knows nothing about mining, and has never broken any ground except by the acre or in digging trenches for some of the warring nations comes into a mining camp. He rustles the proper official and gets a "job" mucking. In about a week the shift boss goes down the hole in the morning and is short a machine runner. The young fellow is not much force on the muck-stick as yet, possibly the poorest mucker in that stope, and as the shift boss does not care to spoil a good mucker, he puts the new man on a drill of the unmounted type. The latter knows nothing about it and is told practically nothing except that he must get "rock in the box" and lots of it.

The young fellow wants to make good, as there is more money and more glory in being a machine man than in being a mucker. He is shown where to drill, makes a few trips to the level for drill, hose, and steel, and at last everything is ready. He has no oil, but that makes no difference; it will run, so needs no oil. He has no trouble until the hole is two or three feet deep; then the steel sticks from one of many causes and refuses to rotate. He makes it turn by twisting on the handles, and about the second twist the machine stops.

When the shift boss arrives, making his rounds, the drill is sent to the shop, the rotation on the bum. Of course the machine man did not break it—it just stopped, so he says.

In from one to two hours it comes back. He is in a hurry now to make up for lost time, so he grabs a steel and rams it into the chuck. The hole is not large enough for the water tube and when the steel is taken out of the machine the tube comes with it; then back to the shop.

*Morenci, Ariz.

This performance continues for about three days if someone does not take pity on him and put him wise; then he wonders why they handed him his time. It would have been much better from the efficiency standpoint, to have taken time, possibly 30 min., and explained enough about the drill to get him started right, provided there was not an experienced man on the job.

The older men on this type of drill are nearly as bad as the green ones. Their troubles consist chiefly in running without oil, using the air and water connections for handles and breaking them off, dropping machines down ladderways instead of letting them down with a rope, taking drills apart underground and putting them together incorrectly or losing some of the small parts, and many other things that do not increase the efficiency or life of the machine. In a large percentage of breaks on air drills it is not the fault of the drill, but of the man behind it.

In the running of air drills of the mounted type we see some foolish things, which at times are amusing, such as throwing wrenches, hammers, steel, pounding the chuck, piston, drill or anything that happens to get in the way, because the machine will not run. It would be much easier to line up to the hole or change the bent steel for a straight one and let the machine do the work than to pound it in with a hammer or chuck wrench.

In drills of this type there are many things for the efficiency man to consider, of which the following are a few: The setting-up of the machine in the proper place and distance from the face, having it close enough to get the cuts at the proper angle to break well in hard rock and far enough away to make changes in steel without too much trouble and delay. The machine should be oiled at least twice a shift with good oil—not too light, as it will blow through the drill and do very little good. The heavier oil may gum somewhat, but it is better than the light oil, which goes on through and leaves the machine dry after the first hole.

The following tests, made in a repair shop, of three different classes of air drills show the wisdom of sending drills to the shop to be overhauled and cleaned at proper intervals: A piston machine was tested in the shop and consumed 195 ft. of free air per min. It was overhauled and a new front-head leather used, then tested again, taking 117 ft. at the same pressure. A stoper consumed 101.5 ft.; after cleaning and oiling, 75.6 ft. A jackhamer took 79 ft. on arrival and 63.4 when overhauled. In the two latter drills absolutely no new parts were used.

If the air drill was given a small percentage of the care and attention that other machinery receives, the efficiency would be greatly increased.

Handling a Long Heavy Cable Underground

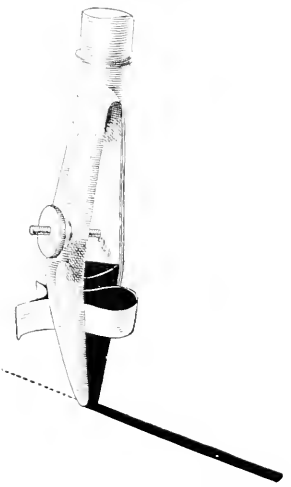
By James Humes*

At the Silver King Coalition mines in Park City, Utah, a cable, capable of carrying 800 hp. at 2,300 volts, and weighing about 6 lb. per ft., was taken into the tunnel in sections 1,200 ft. long. The reels that held these sections were too large to go in the tunnel. The cable was therefore fastened to the electric locomotive and strung out on mine cars spaced about 30 ft. apart. This scheme worked all right on the straight track, although some trouble was experienced on the curve to keep the small cars from tipping over. Despite this slight trouble, the scheme proved a very satisfactory one.

*Superintendent, Silver King Coalition Mines Co., Park City, Utah.

A Pen Kink for Draftsmen*

It is often necessary to draw heavy lines in the drawing office. By putting a piece of bent drawing paper between the blades of a tracing pen as shown in the illustration,



A DRAWING PEN FOR HEAVY LINES

thus increasing the capillarity and flowing friction of the ink, very heavy lines can be drawn and blots at the end of the lines avoided. The pen can also be filled with more ink.

*A. O. Alexay, in "American Machinist," Oct. 28, 1915.

Paint Required for Structural Work

In a pamphlet entitled "Engineer's Handbook on Protective Coating," published by the Goheen Manufacturing Co., paint engineers, Canton, Ohio, are given tables which show that for highway bridges the amount of paint required varies from 0.014 to 0.028 gal. per 100 lb. of bridge, for lengths of span varying respectively from 300 to 20 ft. For single-track railway bridges the paint required is 0.008 gal. per 100 lb. of bridge, regardless of the length of span.

For I-beams the amount required varies from 0.46 gal. per ton of 3-in. I-beams to 0.16 gal. per ton for 24-in. beams. For channels the amount varies from 0.48 gal. per ton for 3-in. beams to 0.22 gal. per ton for 15-in. beams. For buildings in general, 12 lb. of iron will average 1 sq.ft. of surface requiring painting, to which is to be added 10% for corrugations where corrugated iron is used.

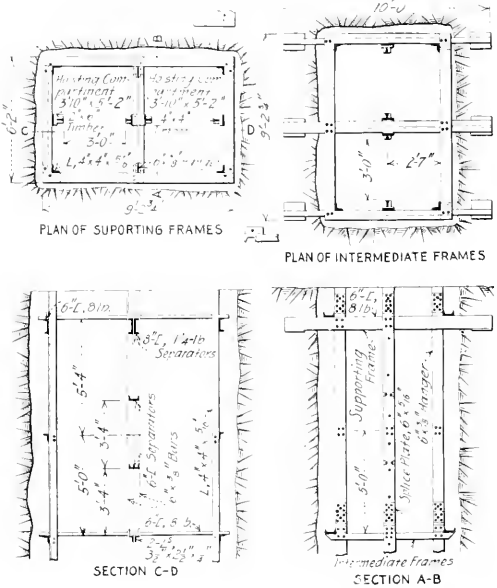
The approximate cost for labor per ton for applying the paint, working on the ground, is equal to the cost of paint per ton of steel. For elevated work anywhere

from 10 to 50% should be added to the cost of labor on the ground, depending on the amount of scaffolding and climbing necessary in the work.

For steel-riveted pipe the number of gallons required per lineal foot of pipe equals the sum of the inside and outside diameters in inches, multiplied by 0.000362 for first coats and by 0.000174 for second and succeeding coats, adding 3% for laps. All figures are for one single coat, except as noted, and are for paint manufactured by the Goheen company.

Steel Shaft Timbering*

At the Los Ocotes copper mine in the State of Oaxaca, Mexico, an 800-ft. shaft was timbered with steel, the details of the shaft-set being shown in the accompanying sketch. Supporting, or bearer, sets made up of 8-in. steel channels were cemented into hitches cut in the side of the wall. These supporting sets were installed just below



DETAILS OF STEEL SHAFT TIMBERING, LOS OCOTES MINE

the collar and at 240-ft. intervals in the shaft. All the steel, before being installed, was painted with a mixture of coal-tar and turpentine. From the surface to the 600-ft. level, sets were put in 10 ft. apart. From the 600- to 800-ft. level, because the ground showed a tendency to cave, the sets were put in every 5 ft. The lagging of 2-in. planks was laid lengthwise between the sets.

For timbering this shaft about 73 tons of steel was required, costing approximately $100. United States currency, per ton laid down at the mine. A steel gallows frame was erected containing 15 tons of steel, which cost about $140, United States currency, per ton laid down at the mine. This is at the rate of 5c. and 7c. per lb. and does not include the cost of erection.

*Abstract from article by R. H. Cromwell in "School of Mines Quarterly."

Telling Time with a Compass

It is commonly known that points of the compass can be determined by the use of a watch. By pointing the hour hand toward the sun, a bearing half way between the hour hand and 12 o'clock on the watch, is true south.

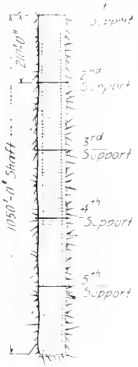
It is not generally known that time can be told by the compass with equal facility. Take the true azimuth or bearing of the sun and subtract from it 180°; multiply the remainder by the fraction $^1/_{15}$, and the result will be the hours before or after 12 o'clock noon.

How Electric Blasting Saves*

In blasting of all kinds, the most modern method is firing by electricity. The apparatus necessary to use depends on the kind of blasting, but from the following list one can easily select the proper ones for his work: Blasting machines, electric blasting caps, waterproof electric blasting caps, delay electric blasting caps, delay electric igniters and electric squibs.

Where electric power is used this can be substituted for blasting machines with better and more satisfactory results, provided the proper voltage and amperage are used.

In coal mining, ore mining, tunneling, shaft sinking, etc., where it is necessary that all charges do not detonate at the same time, it is economical to use either the delay electric blasting caps or the delay electric igniters. These can be used in the same circuit with the electric blasting caps. By their use the various charges can be detonated at different intervals as desired.



Advantages of electric firing are:

1. Charges of explosives can be detonated at the time and in order desired.

2. There will be no hang-fires, which often happen when using fuse and blasting caps.

3. In shaft sinking, should the hoist refuse to work after a round of holes with fuse is lighted, the shot-firers' lives are in great danger. This is entirely eliminated, as the charges of explosives can be detonated from the surface.

4. The inconvenience and danger from misfires because the fuse has failed to burn through or because it has been damaged from storage are eliminated.

5. Because the electrical-blasting method is economical, safe and sure, and therefore cheapest in the end.

Explosives for Sheet-Ground Mining in Joplin

In a paper prepared for the Gogebic Range meeting of the Lake Superior Mining Institute in September, Edwin Higgins, mining engineer of the Bureau of Mines, Ironwood, Mich., states that in the sheet-ground mines explosives count one of the chief items of mining expense, varying from 20% to as high as 30% of the total cost. A box of powder breaks from 30 to 45 tons of dirt, according to the nature of the ground.

*Du Pont Magazine, September, 1915

Details of Milling and Smelting

Truax Zinc-Slag Treatment

Sewall Truax, of Cañon City, Colo., has patented (U. S. Pat. No. 1,155,628, assigned to the Granadena Mining Co., an Arizona corporation) a method of treating zinc-bearing material, especially zinc slags, by passing them in a fluid condition over finely divided reducing material, such as coke or carbon, the particles of which are prevented from passing into the fluid by being mixed with a binder such as clay.

The lining or bottom of the furnace is made of such a mixture of fine coke and clay rammed into place. A good mixture consists of coke of graduated sizes, from a maximum of 1-in. pieces down to fine dust, and 25% or more of a plastic clay. The furnace is heated by means of oil, pulverized coal or other suitable means, and as the slag or other zinc-bearing material comes in contact with the coke in the furnace bottom, the carbon monoxide formed by the action of carbon on zinc oxide or zinc silicate, rises in small bubbles through the melted mass and comes into intimate contact with a further portion of zinc oxide or silicate, liberating metallic zinc and producing carbon dioxide, which rises and passes off with the vapors of zinc, and at a lower temperature oxidizes the zinc again to oxide in case no free oxygen is present. Usually oxygen is present in the atmosphere of the furnace, and so zinc oxide and carbon dioxide are given off in the vapors. The zinc oxide may be collected in a baghouse in the usual manner.

The consumption of coke is stated to be about 20% of the zinc driven off, or in the case of slag containing 10% zinc the consumption of coke is about 2% of the weight of the slag treated. Experiments indicated that zinc above 0.5 or 0.6% of the weight of the slag is readily removed. The carbon and clay are replaced by "claying" the sides and bottom of the furnace with the brasque.

*

Preparing Pulverized Coal for Reverberatory Furnaces

E. P. Mathewson states that in many places reverberatory copper-matting furnaces using pulverized coal as fuel can be operated more cheaply than blast furnaces, even where the coke consumption in the blast furnaces is as low as 8% of the charge. He summarizes[1] some of the main considerations in the successful use of pulverized coal in reverberatories, as follows:

Coals varying in ash from 5% to 23% have been used successfully in pulverized form. Two points are essential for success: The coal must be dried below 1% moisture before pulverization; and the pulverization must be carried to a very fine point. Preferably, not over 5% of the pulverized coal should rest on a 100-mesh screen, while 95% should pass through 100-mesh screen; not over 20% should rest on 200-mesh screen, while 75% should pass through 200-mesh screen. The flame is as easy to handle as gas; the ash is caught to the extent of 50% in the flue connection between the furnace and the waste-heat boiler, the balance being absorbed by the charge.

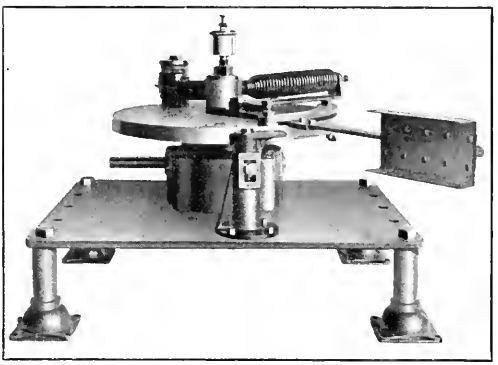
[1]"Symposium on the Utilization of Fuels in Metallurgy," International Engineering Congress, 1915, San Francisco, Calif.

Bardill Sampling Machine

By J. O. Bardill*

This machine was designed for sampling wet and sticky mill concentrates and similar materials. The photograph shows the construction. The principal elements are a turret and its worm-gear drive, incased in an oil-tight housing. A cutter arm is pivotally mounted on the turret and revolves in unison with it, except through about 40° in each revolution, while it is being held stationary by a vertical detent bolt.

The relative motion between the turret and the cutter arm effected during this 40° period of inactivity of the cutter arm produces tension in the coil spring shown, which is exerted between the turret and pivoted cutter arm. A cam underneath the rim of the turret releases the



THE BARDILL AUTOMATIC SAMPLER

detent bolt at the proper time, causing the cutter to pass rapidly through the stream owing to the spring action independently of the motion of the turret.

The action of the cutter arm is extremely rapid, and it is suddenly stopped by its opposite end coming in contact with a rubber buffer post. This absolutely clears the cutter of any material that might adhere. The material is deposited in a receiving box properly placed, and the cutting action and delivery are done so neatly that there is no spilling. The power required is so slight that the turret may be operated through its entire revolution, and against the spring action, by turning the wormshaft by hand.

Reference to the diagram shows that the machine may be placed in close quarters, only about 12 in. being required vertically in the stream between discharge of hopper and top of conveyor belt.

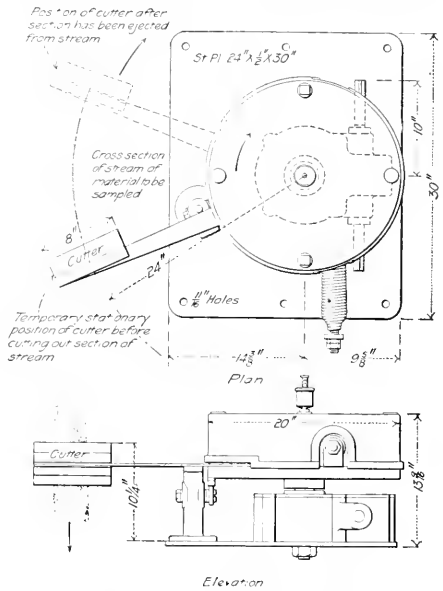
The machine may easily be made into a self-contained, portable affair by mounting a small driving motor on the base plate.

A sample removed from two carloads containing wet lead concentrates weighing 136,940 lb. and delivered

*150 Lafayette Ave., Palmerton, Penn

from the storage hopper to a conveyor belt by means of a 6-in. screw feeder weighed 495 lb. The stream was cut six times per minute and the dimensions of the cutter were 4 in. wide and 8 in. long. The length of cutter has no bearing, of course, so long as it is sufficient to take in the entire stream. This sample was produced by 840 cuts, 0.59 lb. per cut, percentage of total weight 0.39. Expressing this in terms of volume, each 0.83 cu.ft. had removed from it 5.6 cu.in. in one cut.

Since 140 min. were consumed in handling this material by the conveyor running at a speed of 275 ft. per



THE BARDILL AUTOMATIC SAMPLER

min., these concentrates were distributed in the form of a band approximately 38,500 ft. long, from which 840 cuts were removed at intervals of 46 ft. The analysis of this sample checked absolutely with a "one-in-ten" shovel sample taken from this lot.

Smelting at Anyox, B. C.

Smelting operations at the Granby Consolidated Mining, Smelting and Power Co.'s plant at Anyox, B. C., are gradually rounding into shape as the peculiarities of the ores are becoming better understood and necessary changes in equipment made to conform to the conditions now being established as best suited to economical work. The usual difficulties of starting a new works were augmented by the large amount of fines on the charge, the increasing content of silica and the aluminous character of the ores.

The reports for the year ended June 30, 1915, of W. A. Williams, superintendent of smelters, and of A. J. Bone, superintendent of the Anyox plant, give an interesting résumé of the progress that has been made in working out the metallurgy at this plant. The works was started in March, 1914, and the problem was not merely to smelt the Anyox ores, but to determine conditions of maximum tonnage and minimum expense for a new property. Commenting on the progress that has been made, Superintendent Williams says:

> We commenced operations as a pyritic plant, using low coke and very little flux, No. 1 ore being used as a base to smelt No. 2 ore. The ores have not come to us as free from inert materials, such as dike and schist, as we could wish. They have been more or less erratic as to the silica content from day to day, and the tendency in both ores is to higher silica and alumina. This fact, coupled with the shipment of about 100 tons of foreign ore per day, has made it hard to operate the furnaces as originally intended, and the coke and flux percentages have risen to some extent. With the greater development of our own orebodies and with the better storage facilities at the mine and smelting plant, this should be materially helped. We have been trying to make a converter grade of matte in the first operation, but have found it to be the better practice to regrade our matte. The making of converter grade of matte in the first smelting, we believe, will eventually be accomplished.

Several changes and additions to equipment have been made with the purpose of improving operating conditions and lowering cost. These include new charge cars, matte machine, increased crane capacity, a skull grid, silica bins over converters and additional ore-storage bins, all of which have been charged to "Operation." A fourth blast furnace has been constructed and placed in operation, and an agglomerating plant for handling converter slag, flue dust and similar materials. Discussing the smelting operations in more detail, A. J. Bone says:

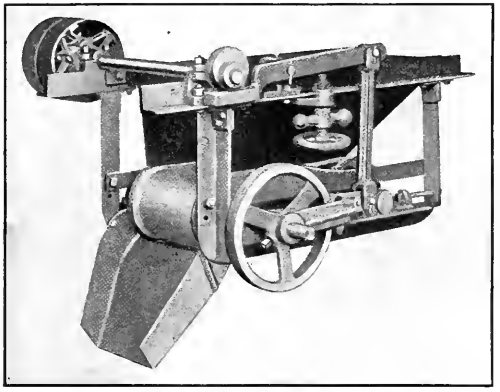
> The ores smelted covered a wide range in analysis, from low silica, low alumina, requiring quartz and little coke to smelt, to the other extreme of high silica, high alumina, taking a basic flux and higher coke. Of late the tendency has been toward higher silica content. We are also receiving about 100 tons daily of siliceous custom ore. The result of these conditions is to curtail the use of quartz in the blast furnaces and increase the consumption of limerock and basic "Mamie" ore, and consequently the percentage of coke.
>
> It may be suggested that our slag is comparatively low in silica. The obvious remedy for increased silica in the ore would be to make slags higher in silica. In this connection it should be remembered that the bulk of the iron that enters the slag is oxidized in the furnace and combines with silica in conformity with the principle underlying slag formation in pyritic smelting, namely, that the temperature prevailing in the focus determines the particular ferrous silicate which results. Working along natural lines, our endeavor would be to make more slag in the furnace—not to alter its character. In other words, by obtaining a greater degree of oxidation, more ferrous oxide will be furnished to slag silica and at the same time make less matte but of higher grade.
>
> During the last quarter of the year, the first matte, when too low grade, has been resmelted with siliceous ore and brought up to 20% or 25%. Even this grade can be considered low as converter mattes go, but with it the converter department can produce at the rate of 3,000,000 lb. per month with ease. One of our chief concerns is to make matte of suitable converter grade in the first smelting, and though no permanent success in doing this can yet be recorded, it is not improbable that efforts in this direction will be successful.
>
> Recently the system of feeding the furnaces was improved through the adoption of Anaconda-type charge cars. These permit a more favorable placing of the charge, the advantage of which was immediately reflected in a marked decrease in crust formation. Incrustation in the upper part of the furnace shaft has been responsible for terminating fully 90% of the campaigns. These for the year were very brief, averaging only 13.6 days, but with the new cars, longer campaigns are the rule. A saving of labor on the feed floor was also made possible by the new cars.
>
> The prolific fall of low-grade, corrosive matte imposes a duty on furnace connections and settlers probably without precedent in the practice of copper smelting. Means to cope with this condition have been devised, and the furnaces are no longer subject to the frequent interruptions by purely mechanical mishaps, which proved so embarrassing in the past. In the converter department, new steel silica bins were built and so placed as to permit feeding silica to the converters without resorting to the use of cranes.

Heat Losses in an Electric Steel Furnace were recently determined by W. H. Wills and A. H. Schuyler as being 12.5% through the door and tap hole and 7.3% through the electrodes (September meeting, American Electrochemical Society).

Mining & Metallurgical Machinery

Hamill Belt-Driven Ore Feeder

A new type of ore feeder is presented in the Hamill, the construction of which is shown in the accompanying illustration. Its moving parts consist of a short conveyor, or endless belt, intermittently propelled by a bell crank engaging a friction wheel on the headshaft. The bell crank is actuated either by a pulley and eccentric, on the belt-driven type, or by a fork-lever reaching under the tappet for the stamp-actuated type. As the bin gate can be left wide open and the ore flowing loosely to the



A VIEW OF THE HAMILL BELT-DRIVEN FEEDER

feeder belt, there is no bridging, blocking or crowding, irrespective of the size of the material. Coarse rock is fed as easily as fine material, and there are no idle strokes. By reason of this steady, regular delivery, the feeder is said to increase the capacity of stamps and other mills. It is adjustable while running, and can be set to longer or shorter stroke, or to nothing, independently of the speed of the driving pulley or rockshaft.

The machine is patented and is distributed by Edward Maag, 535 I. W. Hellman Building, Los Angeles, Calif.

Golden Glow Headlights

The Esterline Co., of Indianapolis, Ind., has been working to obtain a nonirritating light adapted to commercial uses and reflected in an intense but nondazzling beam, resulting in the Golden Glow mirror reflector. The ingredients used in making this glass are such as to give it a rich golden green, producing light as near the color of molten gold as it is possible to obtain.

There have been over 6,000 of these Golden Glow headlights in use in electric-railway and tunnel service, and in four years not a single accident has been recorded because of lack of light or inability to see the car approaching. A similar record should be obtained in mine properties, for the men ahead are not blinded or confused; miners can work in a seam at close range or at a considerable distance with equal ease, and in fog or dampness it provides protection not possible with any white light.

The "Simplate" Valve

To insure higher mechanical and volumetric efficiency and to simplify air-compressor cylinder design, the Chicago Pneumatic Tool Co., 1080 Fisher Building, Chicago, Ill., has recently placed on the market the "Simplate" valve, which is of the flat-plate design. The valve has several distinctive features and the chief advantages claimed for it are that it is simple; that its plates are independent in action, one of another; that each plate has

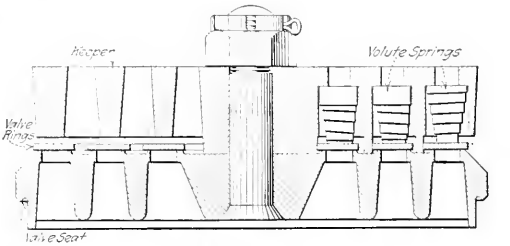


FIG. 1. "SIMPLATE" DISCHARGE VALVE

its individual springs; that the tensions of the springs on the inlet and discharge valves differ according to the density of the air handled; and finally, that it is applicable to all positions and conditions.

Fig. 1 shows a section through a discharge valve. The seat is cast from a special alloy steel, heat-treated, oil-tempered and ground true on one side. As shown in the

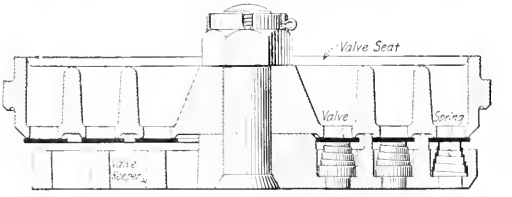


FIG. 2. "SIMPLATE" INLET VALVE

illustration, the seat has circular ports and it is machined so that the raised portion, or the point on which the plates rest forming the joints, is narrow, thus reducing the unbalanced area of the valve. The keeper is of the same material. It is provided with suitable ports for the free passage of the air through it and also furnishes guides for the valve plates and pockets for the valve springs. The latter are of the volute type and are made of high-grade crucible steel. The valves are simple concentric steel plates of uniform section, with a separate and independent plate over each port. Each plate is independently governed by its own spring, hence the action or opening

of each valve is entirely independent of the other. Should one of the plates open, the next one to it does not need to move unless the speed conditions should demand it. Ordinarily the outer plate opens when the compressor is running at slow speed, when running at intermediate speed two plates operate, and at full speed all valves are

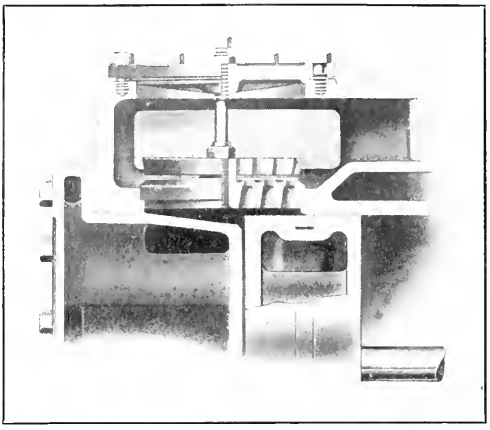


FIG. 3. POSITION OF VALVES IN AIR CYLINDER

open. The parts making up a complete valve are assembled and held together by a nickel-steel stud and castle nut, and when this nut is tightened in place it is held by the cotter pin.

As shown in Fig. 2, the construction of the inlet valve is similar to that of the discharge valve. It differs in that the keeper is thinner and the springs have lighter tension. On account of this difference in thickness, inlet and discharge valves cannot be reversed. The spring tension on the inlet valves is light in order to derive the full benefit of the various openings of the different plate, when the piston speed is changed. For example, with an inlet valve of the size shown herewith, the spring tension is so calibrated that the outer plate opens with a pressure of but ¼ oz. per sq.in., while 1 oz. will open the intermediate plate and 2½ oz. the inner plate. The valves are said to be noiseless in operation, and their

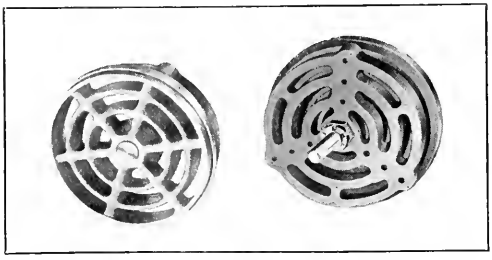


FIG. 4. THE "SIMPLATE" VALVE

location in the cylinder is convenient for examination or repair, as indicated in Fig. 3. Top and bottom views of the valve are shown in Fig. 4. It is equally suited to high- and low-pressure work and requires no lubrication. A feature worth noting is that all valve parts are interchangeable.

Gasoline Shovels Auxiliary to Steam Equipment

There are localities where smoke ordinances, the cost of coal and water or the demand for licenses for firemen and engineers prevent the use of steam shovels and make advisable the employment of those driven by gasoline power if certain handicaps of the latter can be overcome. The gasoline shovel therefore has been designed to satisfy a certain limited demand, rather than to produce a machine in competition with the steam shovel. Gasoline shovels will probably be restricted to medium and light excavation.

Several designs of gasoline-power shovels have been brought out recently, among which is that of the Marion Steam Shovel Co., of Marion, Ohio. The following notes on the equipment and operation of this type have been obtained from the company.

The Marion design has been developed only in the revolving type. All operations are performed by power from one engine and the operation is controlled by friction

FIG. 1. REVOLVING SHOVEL WITH GASOLINE-ENGINE DRIVE

clutches of the outside-band type. The engine is a constant-speed, four-cylinder, four-cycle vertical marine type with a throttling governor, jump-spark ignition and high-tension magneto. It is splash-lubricated and has a cooling-water pump. A flywheel is carried between the engine and the load to relieve the crankshaft of stresses due to sudden changes in torque. Any fuel can be used down to that of 39° Bé., provided the proper carburetor is employed.

On the end of the engine shaft is a bevel pinion which meshes with two bevel gears loose on a reversing shaft (*A* in accompanying view). One or the other of these is connected to the shaft by friction clutches. Placing the lever for operating these clutches on center will release both clutches. Geared to the reversing shaft is the hoisting drum *C*. This is of differential or stepped type, instead of the usual straight barrel seen on steam shovels. This scheme is employed to give greater pull and slower speed on starting the dipper out of the pit and an increased speed with lighter pull when the dipper clears the bank. In this way the difficulty of using a constant-speed drive is minimized. Forward of the hoisting-drum shaft and connected to it by an intermediate shaft *E*, with gears, is a pair of reversing gears with friction clutches—an arrangement similar to that on the main reversing shaft just mentioned. These control the crowd-

ing of the dipper handle, and are both governed by a single lever arranged so that when in central position both frictions are released and a brake *G* is set to hold the dipper handle in any position. Meshing with the reversing bevel gears on the intermediate crowding shaft is a bevel gear on a shaft *H*, running at right angles and having telescopic joints connecting to the crowding gear on the boom. This allows for variation in height of the boom.

The propelling of the shovel is done from a friction clutch and gear *J* mounted on the end of the hoisting-drum shaft. The gear meshes with another gear keyed to a horizontal shaft running directly over the rotating center. Here the shaft carries a bevel pinion, which engages with a bevel gear on the vertical propelling shaft, the lower end of which drives the shovel exactly as on the same manner. The gasoline shovel is a one-man machine—the elimination of the boiler makes a fireman unnecessary. It is not necessary for the operator to leave the shovel levers to look after the engine.

The gasoline type of shovel can be converted into a single-motor electric shovel by the substitution of an electric motor of the proper capacity in place of the gasoline engine. With the control gearing described a constant-speed alternating-current motor may be employed.—*Engineering News.*

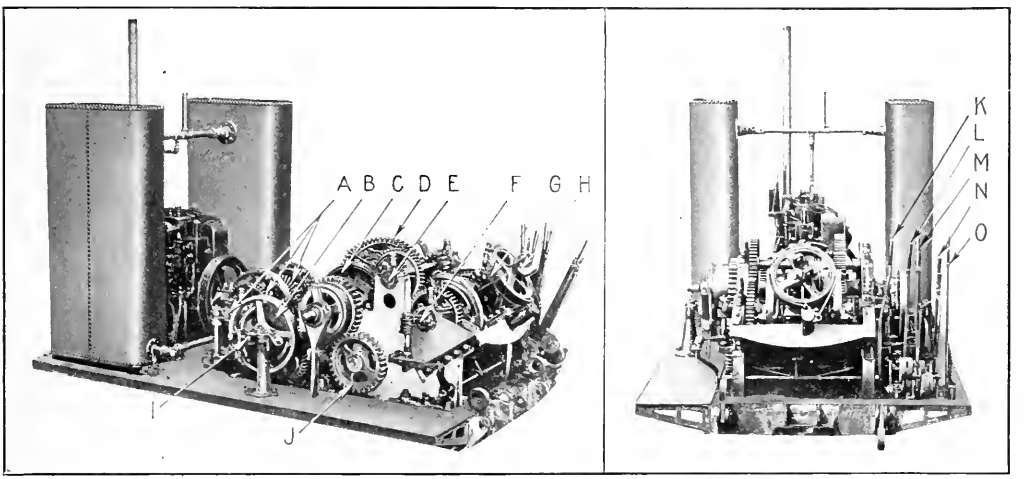


FIG. 2. TWO VIEWS OF POWER AND GEARING UNIT OF A MARION GASOLINE SHOVEL

the steam type. Reversing the drive is done at the main reversing gears already noted.

The shovel is swung by a spur gear carried on the main reversing shaft. This gear engages a corresponding spur gear fixed on a swinging shaft *I*, each end of which has a drive-wheel keyed to it and a corresponding friction housing *B*, which is keyed to a gear mounted loosely on the same shaft (with bronze bushings). Both of these gears on the swinging shaft are controlled by outside band frictions, duplicates of those on the reversing shaft; each gear engages another gear keyed to a short shaft below and forward. At the outer end of each short shaft is a bevel pinion meshing into a swinging crown gear on a vertical swinging shaft. The other end of each of these last shafts, exactly as on a steam shovel, carries a spur pinion meshing with a large rotating gear on the lower frame of the shovel. Since there are two swinging mechanisms between the bull wheel and the intermediate swinging shaft, the shovel can be turned in one direction or the other, according as one gear or the other on the intermediate shaft is engaged.

The operator's control of the gasoline shovel is kept identical with that of a corresponding steam shovel; the operating levers have the same position and work in

National Matheson Joint Pipe

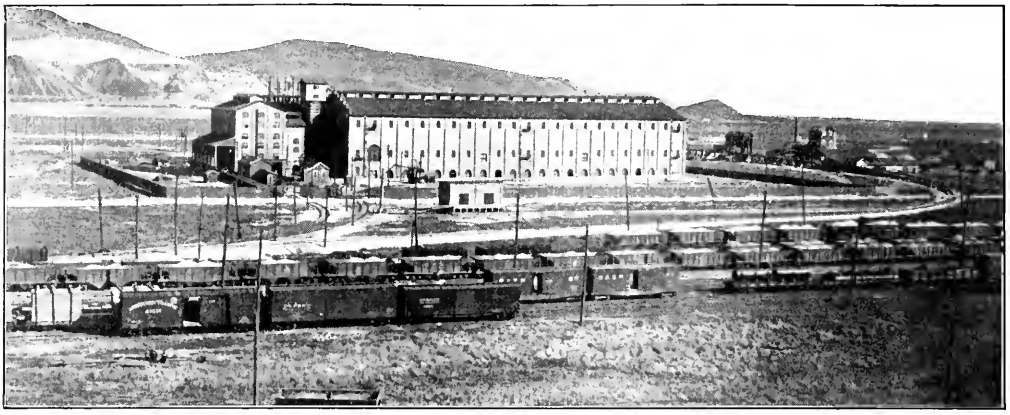
In a recent bulletin on Matheson Joint Pipe, the National Tube Co. calls attention to the following: "There is no economy in laying cheap pipe. Its life is too short. There is great inconvenience and disturbance in taking up a long flow line and replacing it with new pipe, and the first cost of the temporary system is practically thrown away."

It is claimed that National Matheson Joint Pipe has been in use from British Columbia to Mexico for periods as long as 30 years, in earth impregnated with alkali, sulphur and arsenic, and is still almost as smooth inside and out as when first laid.

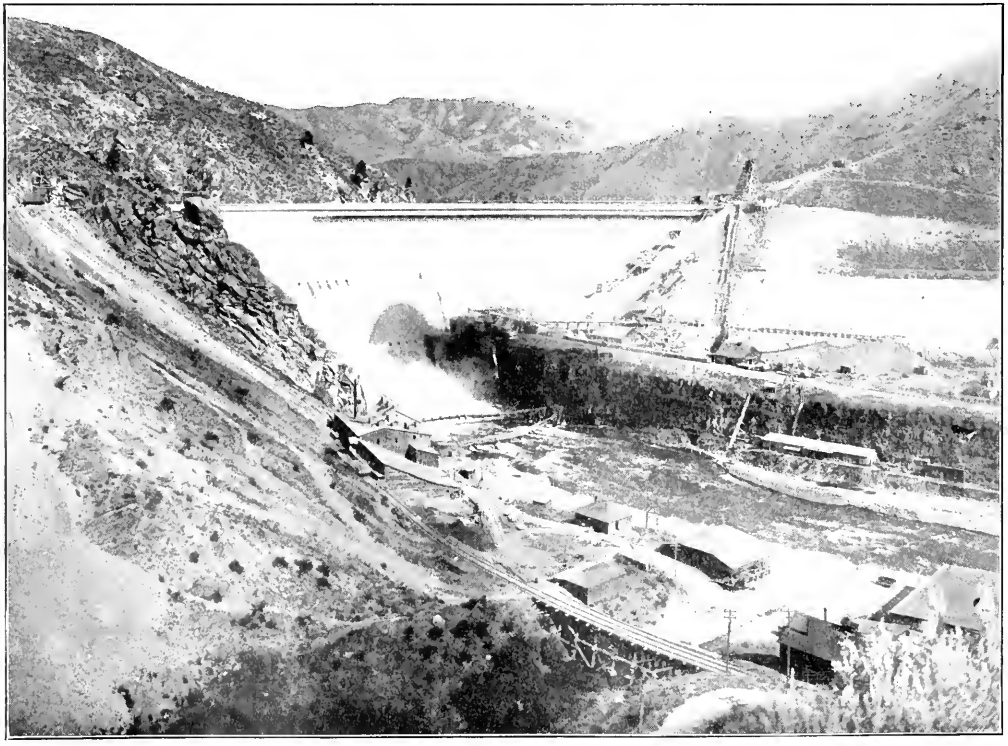
Asbestos-Protected Metal Skylight Construction

A form of puttyless skylight construction is being introduced by the Asbestos Protected Metal Co., of Pittsburgh, Penn. The glass is held between asphalt cushions, protected by asbestos felt above and below, and the entire joint is shielded above by a protected-metal cap and below by a protected-metal gutter that drains off any condensation water. In sawtooth construction or continuous monitor sash, the condensation gutter is omitted. The caps form a convenient support for the window cleaners' boards, which do not touch the glass.

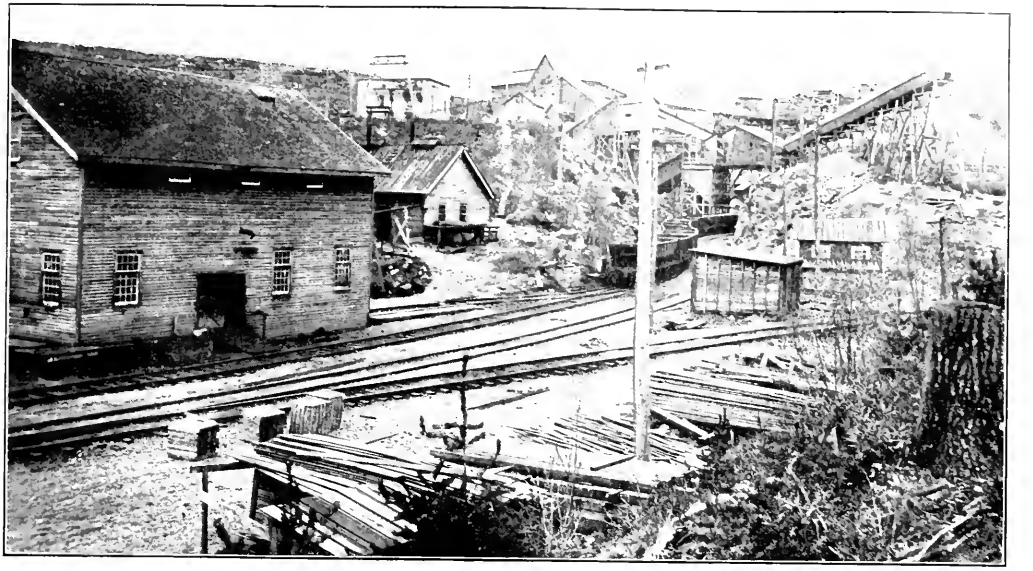
Photographs from the Field



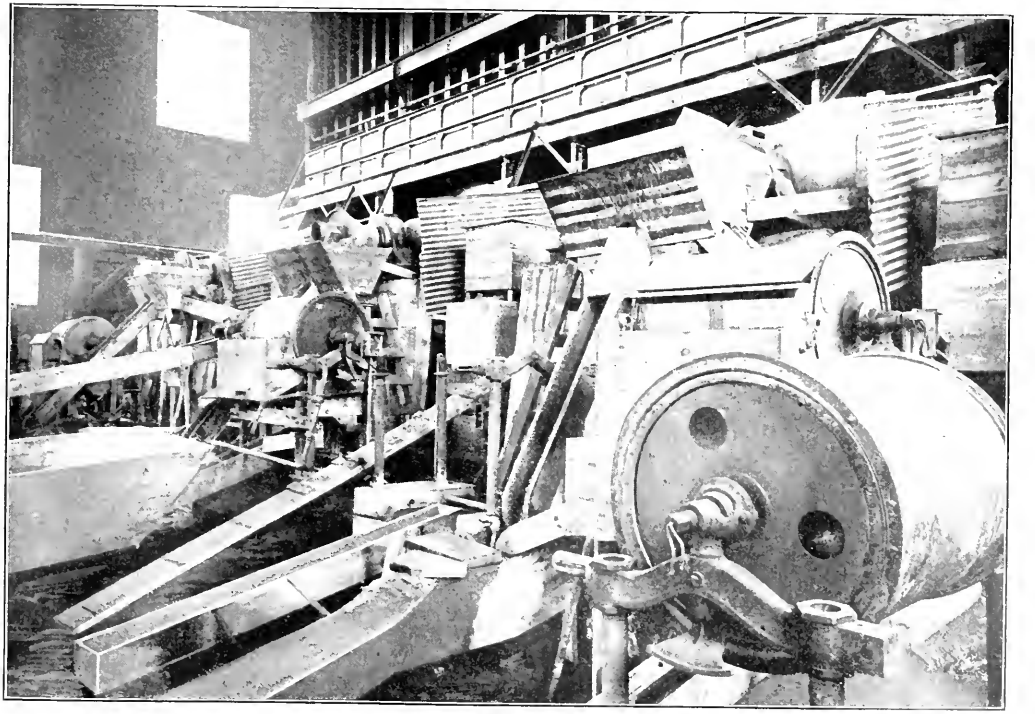
ANACONDA COPPER MINING CO.'S ACID PLANT AT ANACONDA, MONT., SHOWING BRICK PLANT NO. 2 AT THE RIGHT



THE ARROWROCK DAM, NEAR BOISE, IDAHO; THE HIGHEST DAM IN THE WORLD
Construction was completed on Oct. 4, 1915. It is on the Boisé project of the United States Reclamation Service, is 348.5 ft. above bedrock and 270 ft. above river bed. About 330,000 cu.yd. of cyclopean concrete was used



VIEW OF SURFACE SURROUNDINGS AND EQUIPMENT AT No. 1 PLANT OF MOOSE MOUNTAIN, LTD., SELLWOOD, ONT.



INTERIOR VIEW OF THE MOOSE MOUNTAIN, LTD., MILL, SELLWOOD, ONT., SHOWING THE REGRINDING MACHINERY.

The Alaska Gold Mines Co.

Rumors have been current that all is not well with the Alaska Gold Mines Co., operating in the Juneau District, Alaska, which rumors have been recently reflected in the stock markets, especially that the ore is not turning out so high as expected. Referring to this, D. C. Jackling informed the *Boston News Bureau* that an unexpected occurrence of low-grade schist was encountered on the fifth level, from which point it had been hoped to draw high-grade ore with which to sweeten the lower-grade ore being mined near the surface. Strangely, not one of the many drill holes cut into this low-grade intrusion. It is estimated that three or four months will be required to remove this material and put the mine in shape to supply average ore to the full capacity of the mill.

Up to the end of October the new mill had treated about 900,000 tons of ore, assaying about $1.25 per ton instead of the expected $1.75 per ton. Ore is now being mined and milled for 60c. a ton, and the tailings are assaying only 20c. per ton. At present the company is treating about 5,000 tons of ore per day, and it is expected that by the first of next year the rate will be about 7,000 tons.

Copper Supply of Great Britain

The following is from the *Statist* of Oct. 23, 1915:

As regards copper, it may be pointed out for the benefit of the uninitiated, that the metal resulting from the smelting of ores contains impurities that have to be removed before the copper is suitable for commercial use. There are two ways of refining this rough copper, one being by passing the metal through the furnace again and the other by treating it by an electrical process that dissolves the rough copper and redeposits it in a pure form, the impurities sinking to the bottom of the tank. By the first process any gold or silver contained in the rough copper is lost, but by the second process it is recovered, hence refiners have more and more favored the electrolytic process to the disadvantage of the furnace treatment. Now British refineries are mostly of the furnace type, treating rough copper and converting it into Best Selected. On the other hand, the American refineries are mainly of the electrolytic variety and produce the well-known electrolytic copper. Each of these coppers has its special spheres of utility, "Best Selected" being mainly used in the brass trades, while "electrolytic" is used largely for the manufacture of electric wire, etc.

It has been a grievance with the British copper refiners that the government did not patronize their product more extensively. They allege that years ago leading government departments buying copper were unduly influenced to favor American electrolytic at the expense of British Best Selected, and that they, moreover, were induced to fix so high a specification for Best Selected that it became most difficult to conform to it, the result being that the supply was much less than need have been the case, while the government bought more American electrolytic copper than it need have done. Even within the last few months we have seen large quantities of rough copper shipped from here to America under special permit for refining by the electrolytic process, the resulting copper being brought back to this country, and the British makers of Best Selected have got restive because they want the rough copper themselves. There is no doubt that as a commercial transaction the purchase of rough copper here at the very cheap prices that were paid for it and its conversion into electrolytic in America were thoroughly justified, but the British refiners feel that they are being unfairly treated by this cutting off of the supplies upon which they rely for carrying on their operations, and they think, too, that the mere process of transferring copper from here to America in this way tends still further to increase the power over the market which American producers wield. They are, therefore, making protests in official quarters with a view to some alteration in this respect. It should be remembered that the copper that has been shipped to America in this way has not been shipped by producers, but by people who have bought it in the open market, and who have been able to make a handsome profit on the transaction. The British refiners, however, suggest that a much more satisfactory state of affairs can be brought about if the government require all Empire-produced copper to be refined in Empire-owned refineries.

As will be seen from the foregoing, Australia has already resolved that her copper shall be refined locally, and thus within the Empire, and an extension of this principle to cover all Empire-produced copper would have a large influence upon the world's copper trade. For years past a considerable portion of Australia's production of rough copper, for instance, has been sent to America to be refined, and naturally every extra ton that is placed under the control of American producers tends to strengthen their already powerful position. During recent years America has been stretching her tentacles further and further, until she has practically controlled the copper-refining industry of the world, and any step which our colonies can take to put an end to this supremacy is worthy of whole-hearted support. America, of course, has been able to pay more for rough copper, too, than British refiners, because by the electrolytic process the bullion values have all been recovered.

Apparently it has been nobody's business to insure that British copper was reserved for British use, and it has required a world-wide war to force home economic and commercial lessons. If we in England are still asleep, it is a matter for national thankfulness that the colonies are awake, but the British refiners should bestir themselves and get their houses in order for the new state of things that will come when the war is over

Revision of Mining Laws

The convention of mining men of the United States, who will meet in Washington, Dec. 16, by invitation of the Mining and Metallurgical Society of America, will be held in the auditorium of the National Museum, the use of which has been granted through the courtesy of Dr. Charles D. Walcott, director of the Smithsonian Institution.

All of the mining societies of the United States have been invited to send delegates to this convention, and through the United States Bureau of Mines all of the mine operators of the country have been notified and invited. Much interest in the meeting is being exhibited.

According to the tentative program, the first session will be held at 10 a.m. and other sessions at 2 p.m. and 8:30 p.m.

Japan's Mineral Output in July

The production of important minerals during July, 1915, in Japan, is reported by the Imperial Mining Bureau as follows: Gold, 557.089 kg.; silver, 10,847.955 kg.; copper, 5,385.453 metric tons; iron, 3,731.433 metric tons; coal, 7,109,052 metric tons; crude oil, 44,299,440 liters; and sulphur, 6,607.762 metric tons. Gold, silver, copper and oil showed increases and iron, coal and sulphur, decreases, as compared with the same month of 1914.

The Altai Railway Opened

Traffic on the Altai Railway, in Central Asia, says a Petrograd dispatch to the London *Times*, will open Nov. 4, fourteen months earlier than the date contemplated. The railroad, a private line 500 mi. long, will open up an immense and rich region of Siberia that hitherto has been without means of communication.

Chinese Currency-Reform Schemes have been so numerous that the latest one is perhaps to be accepted with some doubt. Under this silver coins are to be minted as follows: 200,000,000 one-dollar, 80,000,000 fifty-cent and 235,000,000 ten-cent coins. Copper, 275,000,000 twenty-cash (two-cent) coins, 858,000,000 ten-cash and 186,000,000 one-cash coins. This coinage is to be spread over 10 years.

Correspondence and Discussion

New Mining Taxes in Mexico

In Mexico the government divides the year, not into quarters, but into thirds, or *tercios*. The fiscal year begins July 1. The unit of mining field is the pertenencia, which measures a hectare (100 meters square) and is equal to about 2.4 acres.

The old Spanish mining code required properties to be worked, and to promote the industry it charged a light license or title fee and no yearly tax on the property. Instead, it taxed the gold and silver produced with a coinage or mining tax. All gold and silver exported had to pay this coinage tax. In the late '80s of the last century taxes were charged by the federal government of Mexico, as follows: Minting or export duty, 4.41%; interior revenue duty (3c. on each $5), 0.60; state duties, 1.50; federal supertax on the state duties, 0.45; stamps and assaying charges, 0.25; total, 7.21%.

In 1892 the mining law was revised and again in 1905. All old titles had to be renewed. The later law required all titles to carry internal-revenue stamps to the amount of 5 pesos per unit of mining field and further imposed a property tax on each individual mining property of 6 pesos per unit of mining field (pertenencia) up to 25, and 3 pesos per unit on the excess over 25 pertenencias.

In many ways the new mining law was an improvement on the old one, but silver mining, which had been Mexico's principal mining industry, did not flourish as well as had been expected. The price of silver was falling, and many properties of the old mining districts had to stop operations. New York quotation for silver in 1876 was $1.156; 1882, $1.136; 1887, $0.978; 1892, $0.871; 1897, $0.604; 1902, $0.522; 1907, $0.63.

It therefore was found necessary to reduce the production tax to 2½% federal export tax and 1½% state tax, plus 20% federal addition, and it stood at this figure until it was changed on Mar. 1, 1915, by decree of Carranza, which raised the title tax, or license, the property tax and the export tax. Objections were of course made by property owners, and the matter was brought to the notice of the Department of State in Washington.

On June 30, 1915, the Department sent a vigorous protest to its special representative, Mr. Silliman, in Vera Cruz, calling the attention of General Carranza to the pitiful condition of the mining industry in general and the foreign-owned properties in particular, and asking that protection be given to foreign interests holding and operating mines, and further that no more taxes be imposed "other than those fixed by the laws emanating from the constitution."

This brought from the Carranza government the following statement or argument, which, if it is to be taken seriously, gives an idea of certain Mexican revolutionary conceptions and ideas:

MEMORANDUM OF THE SECRETARY OF THE TREASURY (SECRETARIO DE HACIENDA) ON MINING TAXES

Translation by W. C. Thurston

In conformity with the laws of Mar. 25, 1905, mining properties paid taxes as follows:

Up to 25 pertenencias, 2 pesos Mexican gold per pertenencia per tercio (period of four months), or 1 dollar per tercio, ⅓ dollar per month.

From 25 pertenencias up, 1 peso Mexican gold per pertenencia every 4 months, or ½ dollar per tercio, or ⅛ dollar per month.

The exchange on New York from 1908 to 1912 reached an almost invariable point very close to ½ dollar per peso.

The decree dated Mar. 1, 1915, fixes the following taxes:

Up to 10 pertenencias, per tercio per pertenencia, 4 pesos Mexican gold, or 1 peso Mexican gold per month, or ½ dollar per month.

Up to 20 pertenencias, per tercio per pertenencia, 5 pesos Mexican gold, or 1.25 pesos Mexican gold per month, or ⅝ dollar per month.

Up to 50 pertenencias, per tercio per pertenencia, 6 pesos Mexican gold, or 1.25 pesos Mexican gold per month, or ⅝ dollar per month.

Over 50 pertenencias, per tercio per pertenencia, 8 pesos Mexican gold, or 2 pesos Mexican gold per month, or 1 dollar per month.

The decree dated Aug. 31, 1915, modified the above taxes temporarily, and only for the two tercios included between the months of July of this year and February next, as follows:

From July to October, per pertenencia, whatever be the number, 2 pesos Mexican gold, or ¼ dollar per month.

From November, 1915, to February, 1916, per pertenencia, for whatever be the number, 2.66 pesos Mexican gold, or ⅓ dollar per month.

From Mar. 1, 1916, the tax rate above mentioned as fixed in the decree of Mar. 1, 1915, will resume effect.

The law of 1905 favors monopoly, imposing upon the small properties (up to 25 pertenencias) double the tax paid by the large properties (over 25 pertenencias).

The law of Mar. 1, 1915, aims at a different purpose; that is, to favor the small properties, imposing lower taxes upon them than upon the large properties. This tendency is perfectly justified and is sanctioned by the proceedings of all civilized governments.

The decree of Mar. 1, 1915, imposes upon the large interests (over 50 pertenencias) double the tax levied on the small property (10 pertenencias).

The intermediate properties (between 10 and 50 pertenencias) pay an ascending proportional rate.

In conformity with the income-tax law effective in the United States, the small interests, with annual profits of less than $20,000, pay 1%; those whose profits are $50,000 pay 2%; up to $75,000, 3%; and so on successively to 7%, paid by those whose profits are more than $500,000 per year.

So it is seen that the large enterprises in the United States pay proportional taxes seven times greater than those paid by the small enterprises.[1] In conformity with the mining law which will commence to operate next March, the large properties (50 pertenencias) will pay only double the amount of taxes paid by the small properties (10 pertenencias).

As is seen, the progressive increase in the mining tax is very moderate when compared with the income tax.

Comparing the tax fixed by the new law for the small property with the old tax, it is seen that it is doubled, but this by no means indicates that it is a high one, because the old tax was exceedingly low.

A tax of ½ dollar per month per pertenencia cannot be called high, and ½ dollar per month is the amount that will have to be paid, beginning in March of next year.

There are some concrete cases which may be cited, of mining companies having more than 100 pertenencias denounced in one single mining district, and in some places they have been paying mining taxes during 15 to 20 years without doing one stroke of work on the ground denounced. The progressive tax tends toward eliminating these unjust and unproductive monopolies.

Some mine owners, attempting to show that the taxes are very high, argue by reducing to paper money the value of gold and comparing this to the amounts formerly paid by them when exchange was ½ dollar for one peso. This cannot be taken seriously, nor is it worthy of consideration. The

[1] Not true. The income supertax is levied on individuals, not on corporations.—Editor.

comparisons should be made between what they pay in gold and what they paid in the same money.

The only weighty argument thus far presented by those interested in the reduction of the taxes is that the great majority of mining interests have had to stop their work entirely or partially because of the European war and the state of intranquillity prevailing in this country. Precisely because this reasoning was considered just, the decree of Aug. 31, 1915, was issued, reducing considerably the rate of taxation without making the progressive increase, for the two tercios between July, 1915, and February, 1916.

The interested mine owners also call unjust the act that the taxes are collected in gold and not in paper money. They are not justified. For a long time export taxes, the stamp tax (that is, the revenue tax) on petroleum, forest exploitation, etc., have been collected in gold, and gradually it will be decreed that other taxes be paid in gold, until all fiscal collections will be made in this class of money.

This fiscal program of the government, tending to consolidate the monetary system, can in no way be called unjust. The business concerns that produce articles for exportation can object less than any other to paying their taxes in gold. These concerns sell their product for gold, but, on the other hand, pay a great part of their running expenses in paper money. Therefore they would be absurdly favored if they paid their taxes in paper money.

SPECIAL REPRESENTATIVE'S REPORT TO WASHINGTON

Vera Cruz, Sept. 13, 9 a.m.—To Secretary of State, Washington. Department's Sept. 11, 4 p.m., regarding mining taxes, Mexican Government's argument is:

First—Mining taxes have always been disproportionately low; with present depreciated currency they would be so absurdly low as to be entirely inequitable.

Second—In view of depreciated and fluctuating paper currency, the only proper and equitable unit is the Mexican gold peso, equivalent approximately to 50c. American.

Third—It is not inequitable that a product produced by labor paid in depreciated currency and sold for gold should pay its government taxes in gold.

Fourth—It is not unusual for paper currency to be of enforced circulation for the payment of public and private debts and at the same time be declared not legal tender for government taxes.

Fifth—The government's intention is to increase its revenue from productive mining properties, but not to the extent of embarrassing them or of confiscating properties that are not productive or that are undeveloped.

Observations—Inasmuch as the government has modified the decree of Mar. 1 and has expressed its willingness to deal with the owners of mining properties upon representation, it is respectfully suggested that the owners of mining properties take up their cases directly with the Secretary of Hacienda either through a commission from a given locality or by individual owners in person or through correspondence.—Silliman (State Department's Special Representative).

The Mexican argument refers only to the property tax and does not mention the tax on the product, which is by far the heavier burden on operating properties. In the argument every large business is considered a monopoly, and it holds that it is better and more just that the mining properties be divided into small units because some large properties have not done work for a number of years. It calls the aim of the new decree to bring this about "perfectly justified and sanctioned by the proceedings of all civilized governments." It therefore legislates against the principle of coöperation, association and concerted action. How a federal government promoting such principles can expect to promote modern industry or even to maintain itself is not indicated.

Evidently, in the hurry to collect taxes from those that still had property, the principles of taxation were twisted to suit the circumstances. This is shown by using the United States income tax, a tax on net profit, as a rule and guide for a tax on property, which is a totally different matter. Property may or may never produce income, and an income tax is not a tax on property, any more than is an inheritance tax.

Mine operators in Mexico will have to show and will have to convince the Carranza government that the new decree cannot possibly bring about a permanent increase in revenue, but that on the contrary, it would injure the industry and would in many cases make successful mining impossible. The yearly federal tax on mining property in Mexico is only a small part of the taxes the miner has to pay. The tax on production has always been excessive; it now has been made exorbitant and prohibitive, but this production or export tax is ignored in the argument of the Carranza government. Together with the state tax, it would be 10% on the assay value of the gold and silver produced, which most mining companies are unable to pay. It would stop production.

Mines may now and then be worked by individuals, but they will never give occupation to a mining population unless they are worked on a large scale, with sufficient capital to guarantee a steady production. This is generally beyond the scope of the individual. Capital has been invested in mining in Mexico judiciously or injudiciously, but always with faith in the permanency of existing laws after careful study of the same. To increase suddenly the taxes and change the laws is grossly unjust, because it disorganizes the carefully laid plans on which the working results of future years depend. Capital would be scared away from the country by such proceedings.

Since the yearly federal tax on mining property in Mexico is only a small part of the federal tax which the miner has to pay, the tax on production being ever so much more burdensome, it is useless to compare this special tax with the amounts paid in other countries.

In Mexico the miner pays for his mineral right according to the amount of surface by which it is covered, whether the ground is valuable or not, whether his work is profitable or unprofitable, whether he works or not; and moreover, he pays on his gross production. In the United States he pays a tax on his profits. Corporations are charged 1% on their profits, but there is no Federal tax in the United States with which the Mexican federal mining tax can be compared.

In Mexico the state tax is 1½% plus 20% additional federal supertax, or 1.8% on the gross product, and on the two million dollars produced it would be $36,000, profit or no profit.

The state taxes in the United States vary in rates and in ways of assessment. In the State of New York, in general, corporations are assessed upon their capital, "existing in money or property." If the capital were $1,000,000 and the profit $1,000,000, or 100%, the state would tax ¼ mill on the capital for each percent. of dividends or 2½%, or $25,000, but if the profits amounted to 20% on a capital of $1,000,000, the tax would be $5,000; if 6%, $1,500; and if there were no dividend, $750.

It is not possible to mention here in detail all other taxes, such as municipal taxes and the high taxes which the miner has to pay in Mexico on the supplies brought from the United States or other foreign countries.

In answer to the statement of the Carranza government that the federal mining tax has always been disproportionately low and that the new tax of one dollar per pertenencia per month is a moderate one, what else can be said than that it may be one of the last straws, and that when they break the camel's back the rider may be on foot?

New York, Nov. 5, 1915. A. J. R.

Editorials

Anaconda's New Metallurgy

In the *Journal* of May 9, 1914, there was an article outlining a new and vast plan for metallurgical improvements that had just been inaugurated at Anaconda. In summarizing this it was remarked:

> When the Anaconda plan is fully carried out the tailings discharged from its mills will carry only 0.1 to 0.2% copper, against the former 0.65 to 2.2%. Instead of recovering only about 75% of the copper of the ore, the recovery is expected to be around 95% and, best of all, the additional copper will be got at far less cost per pound than the present copper. Without increasing its ore production the company can increase its copper production by something over 50,000,000 lb. per annum and reduce its cost on the whole product by ¾c. per lb. or so; or it can reduce its ore production; or it can mine a lower grade of ore when that be advisable. However the management determines to work the thing out, it will benefit enormously by the great step that it is effecting in the conservation of its resources.
>
> Its other economies are of course of the first order of importance—the compressed-air hoisting, the electrification of the railway, the remodeling of the Washoe concentrator, the reconstruction of the Great Falls smelting works and the abandonment of concentration at Great Falls, saving the high cost of freight to there. These ought to do much more than merely offset the increased cost of living which Anaconda experiences alike with other mining companies.

At the time when that article was written, the contemplation of the Anaconda metallurgists was to go into copper leaching on a huge scale, but their attention had just been drawn to the possible economic superiority of the substitution of the flotation process for mechanical concentration, and it was suggested that they stood ready to abandon the leaching feature of their program in part or in whole if that should appear desirable. In fact, things turned out so and only the leaching unit then under construction was completed, it fitting in well for a special purpose, while steps were taken to convert the main Washoe concentrator into a flotation plant.

Since then about 18 months have elapsed, and the program of improvement is now about 75 to 80% done—completion being expected by the end of this year—and the Anaconda management feels that it may safely begin to check up with the original estimates and make up its mind as to what is going to be accomplished in a commercial way.

In September, 1915, about 8,000 tons of ore daily was treated by the new process. Applying the data derived from that month to the production figures in 1913 and computing on the basis of 14c. per lb. for copper, it is reckoned that the saving would have been about 7¼ million dollars. Putting the thing in a different way, the gain of valuable metals previously lost in tailings and slag would have been 50,000,000 lb. of copper, nearly 1,000,000 oz. of silver and about 5,000 oz. of gold. Note the coincidence between these figures and those that the Anaconda metallurgists were talking about early in 1914.

The enormous saving is being effected at the cost of about $5,000,000 for new plant. In other words, the outlay of that vast sum of money will be repaid in about eight months.

Whence has this spectacular gain been derived? Primarily, chiefly and naturally from the concentrator. We say naturally, for the art of mechanical concentration has ever been the most imperfect of our metallurgical processes and an attempt to make a big saving was logically directed to that quarter. What has been accomplished there sounds almost fabulous. Formerly the tailings wasted from the mill assayed about 0.62% copper. Now they go only about 0.10%, and there is a reasonable expectation that even that small figure will be bettered. The Anaconda ore fed into the mill contains 60 lb. copper per ton, whereof only 1⅓ lb. now goes away with the tailings. The recovery in milling is therefore $97\frac{3}{4}$%. Nothing like that in mechanical concentration was ever heard of before. The statement that about two-thirds of the net annual saving will be made in the concentrator is therefore immediately comprehensible.

The other great items of saving are: (1) The improvement of the reverberatory-smelting process by the introduction of coal-dust firing—the daily furnace duty being 583 tons against a former 239 tons and the ratio of ore to coal being 6.95:1 against a former 3.96:1, besides which there is a reduction of the copper loss in the slag; (2) the abandonment of briquetting and blast-furnace smelting in favor of the new reverberatory process; (3) the saving in freight resulting from the direction of all the concentrating ore to Anaconda instead of sending some of it to Great Falls; and (4) the operation of the leaching plant.

Not the least remarkable thing in this great transformation was the skill with which everything was done without interfering with production, there having been no general shutdown of the plant, no diminution of the regular output. The alteration of the concentrator was done section by section, and so efficiently was this managed that the time of changing a section from the old style to the new was only 26 days.

Even before these changes at Anaconda were conceived, the metallurgical practice there ranked with the best in America and the improvement of it might have been regarded as an attempt to burnish fine gold. Anyway, most metallurgists would have been satisfied with what they were doing and would have waited until the prodding of competition forced them to think. Not so with the Anaconda staff. It will now have the satisfaction of knowing that it has won the greatest triumph in the annals of copper metallurgy and has put the Anaconda company into the ranks of the low-cost producers of copper.

Revision of the Mining Laws

Much interest is being manifested in the meeting of mining men to be held in Washington Dec. 16 under the auspices of the Mining and Metallurgical Society of America. Delegates from all parts of the United States have already signified their intention to be present. It is

hoped that the attendance will be large and representative.

The purpose of this meeting is to demonstrate to Congress that the men who are engaged in the mining industry of the United States want a reform of the archaic and discordant mining laws under which they have been operating for the last 50 years. That a reform is wanted by a great majority is undubted. To be sure, there are some who say that the mining industry has thriven under the existing system and therefore it should be let alone, but the answer to this is that it has thriven in spite of the system and in most of our great mining camps the extralateral features of the law have been abolished by common consent, as also has been the requirement of discovery.

However, the purpose of the forthcoming meeting, as stated by the Mining and Metallurgical Society, is not to advocate specific reforms, not to attempt to draft a new law in convention, but to impress upon Congress the demand of the industry that something be done. The drafting of a new law ought to be the work of a commission, which will study the diverse conditions of our mineral deposits, hear the opinions of a great many people and coördinate everything for the general good.

This was recognized in bills that were introduced in the Senate and the House respectively last winter, largely through the instrumentality of the American Mining Congress. These bills were pushed far enough to have them reported out of committee, but amid the pressure of other business they failed of passage. The object of the forthcoming meeting is to give one of them, or an improved bill, the effective push that will set it rolling through the next session of Congress right into the President's office for signature.

Anaconda Produces Spelter

The Anaconda company is already turning out electrolytic zinc at the rate of 10 tons or so per day and is reported to be contemplating the erection of a great plant for this purpose at Great Falls, Mont., or some other place near hydro-electric power supply. Its initial production arrived at a happy time, the price for all spelters being phenomenally high, while high-grade spelter rivals tin in price.

The production of electrolytic spelter on a large scale has not been profitable heretofore. It may fall to the lot of the Anaconda company to tell a different story. There are several important things in its favor. The Butte zinc ore is of a character that permits a high extraction of zinc by sulphuric-acid lixiviation, the formation of zinc ferrite during the roasting being but slight. The ore is relatively high in silver, a large proportion of which is recoverable. Great Falls and other places on the Missouri River afford cheap electric power, which is produced by an allied company. Finally, the process is being developed at a time when profits are so big that they dwarf all infantile discouragements.

It will be interesting to find out what the Anaconda electrolytic spelter is going to run when the process is perfected. The electrolytic spelter produced by Brunner, Mond & Co. at Winnington, England—heretofore the only supply of this sort—is guaranteed 99.95% Zn. Using the relatively pure ore of Butte, Anaconda should be able to do as well, and probably will.

It is worth while to note that electrolytic spelter is now being produced at the rate of several tons daily by the Weedon Mining Co. at Welland, Ont., and some is also being produced by the Consolidated Mining and Smelting Co. at Trail, B. C. The Bully Hill Copper Co. in California has been working on this subject for a long time, and it also may become a regular producer ere long.

High-Grade Spelter

Previous to the war there was an official classification of virgin spelter as high-grade, intermediate, brass special and prime Western. High-grade spelter had to contain at least 99.9% zinc and intermediate from 99.5 to 99.9%, besides conforming to certain specifications respecting the contents of lead, iron and cadmium. The only high-grade spelter was the well-known Horsehead and Bertha brands, and there was but a limited market for them. By restricting the production to the relatively small demand a premium of about 2½c. per lb. was realized for these brands on the average.

Soon after the war began, an extraordinary demand for spelter of this kind arose, and in 1915 a price as high as 40c. per lb. was received, which was about 15c. per lb. above the maximum for prime Western. The classification of intermediate spelter was practically wiped out, a range of 0.5% in zinc content being too wide. Spelter assaying 99.8 to 99.9% zinc fetched one price, that assaying 99.7 to 99.8 another, and so on. In fact, there developed a market for high-grade spelter, for high-grade intermediate, for lower grades of intermediate and thus downward. Until recently the Horsehead and Bertha brands continued to be the only high-grade spelter, strictly speaking, although the high-grade intermediate was commonly referred to as such. Lately the Mascot brand, produced from Tennessee ore, has been put in the high-grade class by refinement of methods of production.

The high-grade intermediate spelter is produced by the smelting of ore selected for its purity—especially its freedom from lead—or by the redistillation of common spelter. In either case the impurity that is particularly difficult to control is cadmium. Most of the spelters that analyze about 99.85% in zinc are equal to the high-grade specifications in the matters of lead and iron, but are a little too high in cadmium.

Now whether cadmium is a deleterious element in spelter, or not, is a moot point, even with regard to a considerable proportion of it. For many purposes—even military purposes—it is inconceivable that 0.05% Cd, plus or minus, can make any great difference. Readers of the *Journal* may recollect a discussion of the subject of cadmium in spelter in these pages about 10 years ago, when some manufacturing experiments made by a well-known brass maker were referred to and the deduction was drawn that for ordinary brass cadmium is not a deleterious element. Since then Mr. Rigg and his colleagues in the New Jersey Zinc Co. have indisputably shown that cadmium—even in small proportion—is highly objectionable in spelter that is to be used for making slush castings. It is pretty well established, moreover, that for making cartridge brass the spelter should be as pure as can be obtained, for otherwise the cartridge cases deteriorate in course of time. The quality of the brass

is not apparently so important in the case of cartridges that are to be used soon.

Let the influence of cadmium in spelter be what it may, there is no doubt that military specifications have called for spelter much more highly refined than is necessary in many cases. However, discussion of this is purely academic. Some users of spelter have cadmium on the brain and are willing to pay 5c. or so per lb. of spelter for the difference between 0.1% Cd and 0.05% Cd, and the rational thing for zinc producers to do is to give them what they want and take their money. There is no use in arguing with them that they ought not to want what they think they do.

Whether it be high-grade spelter or high-grade intermediate, the preposterous premium had the natural effect of stimulating the production of those kinds, and of course, the additional supply will sooner or later reduce the premium. Of late these sorts of spelter have not been so readily salable as they were a little while ago. Some of the producers, averse to recognizing any change in the conditions and hopeful that they will once more be able to sell their product at the price for tin, are holding it back. Such accumulation of unsold spelter as is now believed to be taking place is supposed to be chiefly of these kinds. One of the reasons for the sustained strength in the market for prime Western is the diversion of so large a proportion of it to the manufacture of refined. The advent of new producers of superior spelter will naturally hasten the correction of the disparity in prices that has existed for so many months.

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Anti-Alien Laws Declared Unconstitutional

The Supreme Court of the United States decided last week that the Arizona Anti-Alien Labor Law is unconstitutional. This is the law passed recently in Arizona, which prohibits employers of labor from having among their employees more than 20% of persons not citizens of the United States. The Supreme Court decided that it is in contravention of the Fourteenth Amendment. How emphatic is the stand of the court is shown by the following from Justice Hughes' opinion:

> It requires no argument to show that the right to work for a living in the common occupations of the community is of the very essence of the personal freedom and opportunity that it was the purpose of the Fourteenth Amendment to secure. If this could be refused solely upon the ground of race or nationality the prohibition of the denial to any person of the equal protection of the laws would be a barren form of words.

If the Arizona Anti-Alien Law had been upheld, the effect upon the mining companies of that state would have been very serious. However, nobody was ever much worried about it, the intelligent opinion having been from the beginning that the law was unconstitutional and would be nullified by the Supreme Court.

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The Department of Justice has appealed to the Supreme Court in the case of the United States Steel Corporation. It thinks that the Circuit Court was mistaken in the decision that the Steel Corporation is not a combination in restraint of trade; also in the decisions respecting other matters. In the meanwhile the Department of Justice is alleged to be looking with suspicious eyes upon the Bethlehem Steel Co., Pennsylvania Steel Co., Cambria Steel Co., etc., among which one or two combinations are supposed to be impending. These companies are believed to have become so big and prosperous that the public may have to be protected against them. This notion does not, however, harmonize with the idea still entertained regarding the Steel Corporation.

BY THE WAY

The *Wall Street Journal* recently commented on the alleged ability of the ground hog to foretell an early or late spring on his first emergence from winter retirement and opines that Wall Street is not without its ground hog. This sagacious animal, resident in Massachusetts, comes out of its burrow from time to time and looks over the financial sky, eventually making a noise which sounds like "coppers." When this noise is heard one may know that a bull market is nearly over. The animal's name is supposed to be thomaswlawson.

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The sixth arrest in the alleged plot to dynamite ships leaving New York with munitions for the Allies was made on Nov. 1. The last prisoner is stated to be "Engelbert Bronkhurst, mining engineer and explosives expert." According to the reporters he is 52 years old, speaks seven languages, and is the most striking looking person in the alleged conspiracy. He was born in Hanover, Germany; won a degree in mining engineering; served in the army; worked in the South African diamond mines; came to this country and worked in the mines in the West and Southwest, and spent several years in South America.

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In the good old days of 25 years ago, in order to attract money into an alleged gold mine it was only necessary to display a truck load of the quartz in some City shop window, according to the London *Financial News*. Gaping crowds gathered around, feasted their eyes upon the unwonted sight and then hurried off to apply for shares. In one case, the *News* continues, a truck load of quartz had been utilized in this way and there was an overwhelming subscription for the shares. The amateur board of directors wished to justify its existence and immediately after allotment cabled the manager to commence crushing. He replied, also by cable, that he could not commence crushing until the reef was sent back to him from London.

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General Francisco Villa, according to the New York *Times* of Nov. 1, arrived at the international border, and announced that he intended to attack the Mexican town of Agua Prieta regardless of any action United States troops might take. "If necessary I will fight the United States army assembled along the border," he said. When he learned that General Carranza had been permitted to transport reinforcements over American territory he said: "This is the way the United States repays me for the treatment and protection I have given foreigners in Mexico. Hereafter I don't give a —— what happens to foreigners in Mexico or in my territory. I am through with the United States. I can fight my battles. Let them fight theirs. I can whip Carranza and his entire army, but it is asking a great deal to whip the United States also, but I suppose I can do that, too." Hully gee!

Accidents in Metallurgical Plants in 1913 and 1914

The first report of the United States Bureau of Mines on accidents at metallurgical works has just been issued by the bureau and includes the calendar years 1913 and 1914. The figures, compiled by Albert H. Fay, engineer, show that 119 men were killed during the two years, 2,285 seriously injured and 11,046 slightly injured at smelting plants and mills, representing fatality and injury rates of 1.55, 29.67 and 143.44 respectively per 1,000 men employed per year. The report includes the returns of 79 smelting plants in 1913 and 94 in 1914, including copper, lead and zinc, and quicksilver smelteries, as well as refineries. The iron blast-furnace figures are not included. The number of ore-dressing plants in 1913 was 311 and in 1914, 484. These represent concentrating plants of copper, lead and zinc ores, stamp mills, cyanide plants and iron-ore washers.

The total number of men employed in the metallurgical plants cited, both smelteries and ore-dressing plants, was 35,549 in 1913 and 41,461 in 1914.

In the ore-dressing plants machinery was responsible for 25.6% of all fatalities, 28.9% of the serious injuries and 16.5% of the slight injuries. Similar figures for smelting plants are much smaller, for the reason that there is more machinery in use in ore-dressing plants than in smelteries, and the men are usually in closer contact with the machinery; as, for example, at jigs, tables, stamps, rolls, and crushers. There are many revolving shafts, a large number of which have projecting keys, moving belts, wheels and cams within the reach of the operator. The machinery at smelting plants is usually confined to the power house, where the blowers, engines and dynamos are placed, and to overhead cranes, most all of which are entirely out of the reach of the regular employees.

The percentage of accidents caused by "falls of persons" and "flying and falling objects" is 15.4% apiece in ore-dressing plants, whereas at the smelteries the fatalities due to falls of persons represent 20% of the total and those due to flying or falling objects represent 5%.

Haulage systems claim 25% of the fatalities at smelting plants and about half this percentage at ore-dressing plants. The difference is due largely to the type of material handled and to the greater number of cars in operation around smeltery yards than at ore-dressing plants. In many ore-dressing plants the ore is brought to the bins in railroad cars or aërial trams, and often there is no other haulage system in connection with the plants, the tailings usually being disposed of by launders or flumes; whereas at smelting plants the molten slag is handled in slag cars and the bullion has to be handled on trucks.

At smelting plants burns from hot metal, slag, etc., claim the largest percentage of serious and slight injuries and 11.3% of the fatalities.

The tables presented will serve to call attention to the principal causes of accidents at these works and should serve as guides for the safety engineer to show where it will be possible for him to do his work most efficiently and to accomplish the best results. Little has been written on the subject of metallurgical accidents, other than for the iron and steel industry, and statistical information is far from being complete. Certainly the above figures can be bettered. One man injured in every seven employed each year is too high.

NEW PATENTS

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

LABORATORY TABLE. Emil W. Schmeling, Rockford, Ill. (U. S. No. 1,158,305; Oct. 26, 1915.)

LADLES—Improvements in Nozzles and Stoppers for Steel Ladles and the Like Appliances Connected Therewith. P. W. Fawcett and F. Batty, Sheffield, Eng. (Brit. No. 22,746 of 1914.)

LEAD—Machine for Casting Lead Pigs. John Forsyth Miller, Trail, B. C. (U. S. No. 1,157,794; Oct. 26, 1915.)

LEAD AND ZINC—Process for the Industrial Separation of Lead and Zinc Contained in the State of Sulphides in Ores. Guy de Bechi, London, England. (U. S. No. 1,157,153; Oct. 19, 1915.)

METAL COATING—Method of Melting and Spraying Fusible Substances. Franz Herkenrath, Zurich, Switzerland, assignor, by mesne assignments, to Metals Coating Co., of America, Boston, Mass. (U. S. No. 1,157,984; Oct. 26, 1915.)

METAL RECOVERY—Improved Process of Recovering Metals From Ores. New Metals Process Co., Chicago, Ill. (Brit. No. 17,324 of 1914.)

MINE-CAR BRAKE. Henry Dow Scott, Sheridan, Wyo. (U. S. No. 1,155,864; Oct. 5, 1915.)

MINE TAILINGS—Slime Thickener for Dewatering Mine Tailings. Wilton E. Darrow, Sutter Creek, Calif. (U. S. No. 1,156,276; Oct. 12, 1915.)

POTASH—Process of Recovering Potash. Arthur C. Spencer, Washington, D. C. (U. S. No. 1,157,437; Oct. 19, 1915.)

POWDERED FUEL—Engine for Utilizing Powdered Fuel. William G. Miner, Cincinnati, Ohio. (U. S. No. 1,156,702; Oct. 12, 1915.)

RADIUM—Process of Concentrating Radium Ores and Residues. Otto Paul Curt Bredt, New York, N. Y., assignor of three-fifths to Radium Therapy Corporation, New York, N. Y. (U. S. No. 1,154,231; Sept. 21, 1915.)

SEPARATION—An Improvement in the Magnetic Separation of Ores. G. B. Schwerin, Frankfurt a. Main, Germany. (Brit. No. 19,313 of 1914.)

SEPARATION—Improvements in Ore-Separating Machines. H. H. Thompson Aldridge, and A. E. Davies, Hockley Heath, Warwick, Eng. (Brit. No. 21,119 of 1914.)

SEPARATOR—Magnetic Ore Separator. August F. Jobke, Wilkinsburg, Penn., assignor of one-half to John G. Burns, Daniel Bingham, Katherine Crumay, Thomas Higgins, and H. P. Gazzam, Pittsburgh, Penn. (U. S. No. 1,157,543; Oct. 19, 1915.)

STEEL—Improvements in or Relating to the Treatment of Steel. A. Hethy, London, Eng. (Brit. No. 17,285 of 1914.)

STEEL—Manufacture of Steel. Jegor Israel Bronn, Rombach, Germany, assignor of one-half to the Firm of Rombacher Hüttenwerke, Rombach, Germany. (U. S. No. 1,156,051; Oct. 12, 1915.)

STEEL—Manufacture of Steel. William R. Walker, New York, N. Y. (U. S. No. 1,155,849; Oct. 5, 1915.)

SULPHURIC ACID—Method of Making Sulphuric Acid. Edwin Taylor, New York, and Frederick P. Bergh, Yonkers, N. Y. (U. S. No. 1,157,455; Oct. 19, 1915.)

TANKS—Lining for Tanks. Thomas E. Murray, New York, N. Y. (U. S. No. 1,156,425; Oct. 12, 1915.)

TIN—Detinning Tin Scrap. Karl Goldschmidt and Josef Weber, Essen-on-the-Ruhr, Germany, assignors, by mesne assignments, to Goldschmidt Detinning Co., Jersey City, N. J. (U. S. No. 1,158,128; Oct. 26, 1915.)

TIN—Electrolytic Refining of Tin. Robert L. Whitehead, Perth Amboy, N. J., assignor to American Smelting and Refining Co., Maurer, N. J. (U. S. No. 1,157,830; Oct. 26, 1915.)

TITANIUM—Composite Titanic-Oxide Pigment and Method of Producing Same. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,155,462; Oct. 5, 1915.)

TITANIUM—Process of Producing Titanium-Oxygen Compounds from Ilmenite or Titaniferous Iron Ores and Other Materials. Peder Farup, Trondhjem, Norway. (U. S. No. 1,156,220; Oct. 12, 1915.)

TUBE MILL. William Fennell, Southam, near Rugby, England. (U. S. Nos. 1,154,981 and 1,154,982; Sept. 28, 1915.)

TUNNELING—Method of and Apparatus for Tunnel Work. Edward G. Williams and Elmer H. Brown, Washington, D. C. (U. S. No. 1,156,830; Oct. 12, 1915.)

TUNNELING MACHINE. William E. Dean, Superior, Wis. (U. S. No. 1,156,277; Oct. 12, 1915.)

ZINC—Extraction, Purification, and Electrolytic Precipitation of Metallic Zinc from Smelter Fumes, Zinc Ores and the Like. Otto Best, San Francisco, Calif. (U. S. No. 1,151,601; Sept. 28, 1915.)

ZINC—Hydrometallurgy of Zinc. Otto Best, San Francisco, Calif. (U. S. No. 1,154,602; Sept. 28, 1915.)

ZINC—Improved Process for the Production in a Closed Cycle of Pure Carbonate of Zinc. E. Hunebelle, Paris, France. (Brit. No. 14,226 of 1914.)

ZINC—Process for the Manufacture of Spelter from Ferruginous and Admixed Zinc-Blende Ores. John James Fingland, Kaslo, B. C. (U. S. No. 1,157,375; Oct. 19, 1915.)

ZINC—Process of Smelting Zinc. Samuel Peacock, Philadelphia, Penn., assignor by mesne assignments to Agricultural Research Corporation, New York, N. Y. (U. S. No. 1,154,892; Sept. 28, 1915.)

PERSONALS

Thomas F. Cole, of Duluth, Minn., is in New York.

Walter G. Perkins, of London, is visiting New York.

Frank M. Murphy, of Prescott, Ariz., is visiting New York.

Thomas Robins is secretary of the Naval Consulting Board.

E. V. Newlands, of Toronto, Ont., has gone to British Guiana.

W. L. Saunders is second vice-chairman of the Naval Consulting Board.

Dr. L. D. Ricketts is to be the next president of the American Institute of Mining Engineers.

H. C. Hoover, who has been paying a brief visit to New York, returned to London this week.

Edmund Putnam, formerly operating at Parral, Chihuahua, Mexico, is at present in New York.

Robert Forbes, of Duluth, Minn., who is operating copper properties on Texada Island, B. C., is in New York.

F. W. Bosco has returned to Denver from a six-weeks' engagement at the Victory mine near Boise, Idaho.

Charles J. Curtin, of Brockville, Ont., is superintendent of the Kingdom lead mine at Galetta, near Arnprior.

E. Jacobs, of Victoria, B. C., is traveling through the Kootenay and Boundary districts of British Columbia.

E. B. Bronson has returned to New York from a trip to the Atlanta, Home and Calaveras properties in Nevada.

James Myers, superintendent of the Wanakah smeltery at Ouray, Colo., has resumed duties after a short illness at Golden.

Dr. T. L. Walker, of the University of Toronto, has been chosen chairman of Toronto Branch of the Canadian Mining Institute.

Robert L. Willis has been appointed steam and efficiency engineer of the Republic Steel and Iron Co., with office at Youngstown, Ohio.

Alvin R. Kenner, general superintendent of the Rio Plata Mining Co., has returned to El Paso, Texas, after spending two weeks in New York.

Mototaro Ogino, manager of the Osaka office of Furukawa & Co., of Tokyo, Japan, visited New York last week on his way from London to Japan.

Robert Marsh, Jr., of New York, has been appointed general superintendent of mines for the Nevada Consolidated Copper Co., at Ruth, Nevada.

E. J. Rogers, superintendent of the Omaha & Grant smeltery, Denver, until it was closed down, celebrated his golden wedding in Denver, Nov. 1. Shippers of ore to this once famous plant knew him well.

William D. Stevens, mining engineer and son of the late Horace J. Stevens, is reported lost in the swamp 10 miles south of Houghton, Mich. He was one of a party of seven, six of whom have found their way out.

William C. Russell, mining engineer, formerly of Denver, Colo., is now in Cardinal, Colo. He has taken the management of the Carriman Mining Co., operating the famous old Caribou property in Boulder County, Colorado.

W. R. Thurston has been appointed manager of the Mine and Smelter Supply Co.'s Salt Lake City branch. F. E. Marcy, former manager, will still be associated with the company and devote his efforts to selling and developing the Marcy ball mill.

OBITUARY

Peter Creek Fernie died recently in Victoria, B. C., aged 84 years. About 1880 he discovered outcrops of coal in the Crow's Nest Pass country, and some years later did further prospecting there, succeeding in forming a company to operate the mines. It was later absorbed by the Crow's Nest Pass Coal Co., of Toronto.

Donald E. K. Rickard, student in the College of Mining, University of California, was fatally injured in an automobile accident, dying on Oct. 23 at Berkeley, Calif. He was 21 years old, native of California, son of the late Thomas Rickard, former mayor of Berkeley, and cousin of T. A. Rickard, editor of the "Mining and Scientific Press."

Col. T. E. Vickers died recently in London, aged 82 years. He came from a family which had been in the steel trade for several generations; he was born in Sheffield and brought up to the trade. Succeeding his father in business, he gradually developed the great firm now known as Vickers, Sons & Maxim, the largest makers of war munitions in England. He was head of the company for a number of years.

Dr. James Caples died at Elk Grove, Sacramento County, Calif., Oct. 24, at the age of 92 years. He was born in Ohio and went to California across the plains in 1849. In 1849 he served as a member of the State Constitutional Convention. His first residence in California was at Hangtown (now Placerville) where he practiced medicine, ran a store and engaged in mining. His wife, to whom he was married 67 years ago, survives.

SOCIETIES

Pan-American Scientific Congress—The Second Congress will be held in Washington, Dec. 27-Jan. 8. The sessions will be held in the building of the Pan-American Union.

American Society of Mechanical Engineers—The annual meeting will be held in New York, Dec. 7-10. Headquarters will be at the Engineering Societies Building.

American Association of Engineers—The first national convention will be held at the Hotel La Salle, Chicago, Dec. 10-11. Arthur Kneisel is secretary, his address being No. 29 South La Salle St., Chicago.

INDUSTRIAL NEWS

A series of three industrial motion-picture films, illustrating the manufacture of "National" pipe, from ore to finished product, will be shown before the National Association of Stationary Engineers, No. 21, Lima, Ohio, Monday night, Nov. 15, 1915.

The exclusive manufacturing and selling rights of the Albrecht excavator and loader have been taken over by the T. L. Smith Co., 1119A 32nd St., Milwaukee, Wis. This machine is described as being halfway between the hand and steam shovel and capable of doing the work of either. Two men are required to operate it, one man in the pit to handle the scraper, and one to run the machine. A 12-hp. gas engine provides power to dig and load 20 cu.yd. per hour.

The Royal Manufacturing Co., of Rahway, N. J., extensive dealer in cotton and woolen waste, is making an attempt to standardize the trade. It has divided its wares into twelve branded grades, of which samples are furnished in a folder. The waste is bought by its branded name, and the packages are guaranteed to contain not over a certain amount of tare and to be of accurate weight, so that the payment for a lot of hoops and bagging at waste prices, or the padding of an order 30 to 50 per cent., is avoided.

Hamilton & Hansell, Whitehall Bldg., New York, report the recent sale of a 4-ton Rennerfelt electric-arc furnace to the Old Dominion Iron and Nail Works Co., Richmond, Va. This furnace will be used to make steel for rolling 2-in. billets. Of other Rennerfelt electric-arc furnaces—34 have been sold—15 are used for making steel for castings, 5 for tool steel, 4 for brass melting, 2 each for chemical purposes and iron castings, and 1 each for nickel, copper and ferromanganese melting. Some of these furnaces, however, are used for more than the one purpose listed.

More than 20 nations are represented by visitors to the United States who are now making their headquarters at the branch offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce, and who are seeking new trade relations. Many of these men are members of foreign firms which are preparing to make purchases here. Others are representatives of big commercial houses and offer unusual facilities for our manufacturers to establish agencies abroad. Their earnest efforts to meet us half-way in producing a greater volume of trade with their respective countries are making easier the progress of American commerce in this year of opportunity. Because of the foreign visitors flocking here, the Bureau is dealing directly with buyers as well as sellers, and bringing both classes of business men together so effectively that there are results—purchases of American goods and the making of contracts for agencies in other countries.

Editorial Correspondence

SAN FRANCISCO—Nov. 3

California Metal Producers Association held its first annual meeting at San Francisco, Oct. 27. Reports from President Albert Burch and Secretary-Treasurer Robert I. Kerr showed that the membership has increased from 22 to 41 and now represents approximately 90% of the aggregate capital invested and 90% of the employment of labor in the metal mines of California. The association has taken an active interest in mining affairs for the betterment of the interests of investors and producers and incidentally to the advantage of employees. The accomplishments of the past year include the reduction of workmen's compensation insurance, which resulted in a saving of many thousands of dollars to all mine operators, and the prevention of legislation detrimental to mine operations. The association also took up the question of mine safety in joint meetings with the State Industrial Accident Commission, with the result that the rules finally adopted by the commission and which become operative under the compensation and insurance act are far more favorable to the satisfactory operation of the mines than would have resulted in the absence of concerted action on the part of owners and operators of metal mines. The association financed the field meets at the Panama-Pacific Exposition in September, and will work for the proposed revision of the national mining laws. The executive board consists of Albert Burch, president; George W. Metcalfe, first vice-president; E. C. Hutchinson, second vice-president and C. E. Knox, George W. Starr, Newton Cleaveland, S. W. Mudd. Finance committee: Louis Rosenfeld, Henry Malloch, William Hauge. Secretary-treasurer Robert I. Kerr, who in the last half of the year succeeded John Mocine, resigned. The association has permanent quarters at 631 Market St., San Francisco.

Ore Transportation from the Ubehebe District, in the northeastern part of Inyo County, will be undertaken with Yuba ball-tread tractors manufactured by Yuba Construction Co., at Marysville. The district lies on the edge of the county, 60 mi. east of Laws, a shipping station on the Southern Pacific and 51 mi. northwest of Bonnie Clare, Nev., a shipping station on the Tonopah & Tidewater R.R. The trial trips of the tractors hauling the ore wagons will be made to the Tonopah & Tidewater. Yuba Construction Co. has placed one of its tractors at the disposal of the mine operators and four ore wagons have been provided for the experiment. F. A. Campbell has undertaken the contract to haul the ore to be furnished by W. W. Waterson, Archie Farrington and others, who agree to furnish 500 tons for a beginning. The road has been examined and is rated fair, with no apparent obstruction to economic operation of the tractor. The Ubehebe district contains many and large veins of copper, lead and silver ores which may be developed and operated only with the aid of economic transportation to shipping points. The district is in the same commercial situation that many other mining districts and camps in California and Nevada occupy, and which must remain undeveloped if they depend upon animal transportation of ores. Motor trucks have been used economically in many districts or camps where the transportation requirements are not large. But in cases of large amounts of ore to be shipped daily, the motor truck is not an economic transport, as a separate truck is required for each load and the labor cost is increased by the necessity of employing a driver for each truck. Another disadvantage of the motor truck is, that unusual grades or pieces of bad road require unloading of part of the ore and making two trips with a load that can be carried on ordinary grades and good roads. The same condition of heavy grades and bad roads must inevitably be met by the tractors, but the necessity of unloading and reloading is avoided by the fact that the tractor hauls the loaded wagons, which may be taken over one at a time, but carries no load on its own wheels except its engine and essential machinery and driver. The Yuba tractors are of the caterpillar type, but are light and capable of being turned in narrow roads at sharper angles than the usual type of motor truck, which must of necessity carry its load above its driving machinery and running gear, making it top heavy and unsafe on narrow roads and difficult grades. However, there are conditions in the mining districts of California and Nevada which are ideal for the motor truck method of transportation, which render the caterpillar type of transport unsatisfactory for economic ore hauling. Both methods are available under conditions suited to their respective advantages and both are gradually displacing the animal hauling and making possible the economic transportation of ores from any district where horses or mules can travel with wagons.

DENVER—Nov. 4

Colorado Fuel and Iron Co. is investigating two deposits of iron ore in Wyoming—the Popo Agie tract, 12 miles from Lander, and the Welsh tract, 19 miles from the same railroad point. Should these deposits prove of proper grade and size, company may erect a blast furnace at some central point for treating the ore from these properties as well as from the mines at Sunrise, Guernsey and Hartville.

Radium-Bearing Lands in Colorado are again in the limelight. Thomas R. Henahan, formerly Colorado's commissioner of mines and now retained by the Standard Chemical Co., after a thorough personal investigation of the radium-bearing lands in western Colorado and eastern Utah, has written an open letter to Secretary of the Interior Franklin K. Lane, strenuously opposing the proposed withdrawal of such mineral lands from public entry and making caustic criticism of statements made by Bureau of Mines experts. He contradicts the statement that these fields will supply radium for a few years only and expresses the belief that none of the experts has been 10 miles away from an automobile road while making his investigations.

BUTTE—Nov. 4

Suits Resulting from Butte's Street Riots of last year are now being heard. On Nov. 1, Judge Lynch sustained the demurrer entered by the City of Butte to the complaint of the Butte Miners' Union, which has filed a suit against the city for $140,000 damages to Union property during last year's rioting. The demurrer set up that the complaint was not sufficiently definite to constitute cause of action. Attorney for old union was allowed 20 days in which to file amended complaint. Arguing in support of sufficiency of the complaint Attorney Breen for the union alleged that mob which blew up the union hall was not restrained by policemen who had been held in reserve and that therefore liability for destruction of property fell on city which did not use its police powers. The suit brought by Charles H. Moyer and trustees of Western Federation of Miners against the Butte Miners' Union will be heard in the Federal court, according to decision handed down Oct. 28 by Judge Bourquin. Court denied motion to dismiss action. Suit was brought to get possession of property of Butte Miners' Union.

SALT LAKE CITY—Nov. 5

In the Tintic District, several new roads have been built, or are to be built. The Chief Consolidated has completed its road from the Scotia mine in West Tintic to Jericho on the Salt Lake route, and ore hauling by traction engine and trailers will begin shortly. A new wagon road is to be built between Tintic Junction and Eureka; also one south from Silver City to connect with the Millard County road near Lynn Junction.

The Strike at the Silver King Coalition in Park City is still undecided. The miners have been addressed by Thomas Kearns, general manager, who stated the company's position. About 200 men met in Park City and voted to stay out indefinitely, or until some change is shown by the management in regard to the hospital question. A few men returned to work Nov. 4, and are employed about the mill in the installation of the flotation plant. Others who have been in favor of returning to work, were kept from doing so by fear. There are 34 deputy sheriffs at the mine under Sheriff Ryan, although no violence is expected. It is thought that both sides will refuse to yield and that ultimately the company will bring in outside men.

SEATTLE—Nov. 3

A Deposit of Chromic Iron has been found in Alaska at the head of a small bay on the peninsula between Seldovia and Dick's Bay. It is about eight miles from tidewater and a valley provides easy means of transportation for ores to the beach. The deposit has been known to miners for the last year but the extent of the orebodies was not determined until recently. It is now reported to be over one mile wide and

several miles long. The contact is very marked. Vegetation grows luxuriantly up to the change in formation where the surface then assumes a dull yellow. The peculiar color of the mountain is due to the leaching. Below the surface the ore is black. A little development work has been done on some of the Elizabeth group of islands lying off the main body in the bay. The discovery is hailed by mining operators in the north as one of the most important made in recent years as chromite is in great demand.

Wood in the Fairbanks Mining District is getting to be classed as jewelry. Twenty dollars a cord is the highest price so far, but it is still going up. In the Nenana coal field, about 100 mi. from Fairbanks, are vast beds of lignite coal, which will be available as soon as some method of transportation is provided. It is expected that a railroad to these coal fields from Fairbanks, even before the trunk line is completed, will greatly increase quartz mining activity in that district. With coal available for fuel, large areas of low-grade auriferons gravel, which cannot be worked with fuel ranging from $10 to $20 a cord, will become productive, and the placer gold output will be largely increased, if not doubled. Quartz mining and milling is an established industry in which only high-grade ores can be worked with a profit, owing to the high fuel charges. Congress, which is about to meet, will be asked to appropriate money to enable the Alaska Engineering Commission to carry on its work of constructing a railroad from Seward to Fairbanks. The Fairbanks people are behind a get-together movement to push this thing, in order to get coal into the Fairbanks district.

WALLACE, IDA.—Nov. 4

The Bunker Hill & Sullivan company has made no definite announcement regarding the situation the smelter it is preparing to build, but indications clearly point to Kellogg as the place. Easements which will secure the company against possible damages from smoke have been secured in most of the land that would possibly be affected, and Mr. LaBarthe, of the engineering firm which will design the plant, has been on the ground for several weeks working out the preliminary details. The talk of tronble with the American Smelting and Refining Co., which has a contract with the Bunker Hill & Sullivan company covering a period of 15 years, was silenced a few days ago when Stanly A. Easton, manager of the Bunker Hill & Sullivan company, stated that the A. S. & R. company could no more stop the Bunker Hill from smelting its own ore than it could prevent it from concentrating it. Mr. Easton also stated that the proposed plant would be in position to handle the ores of other lead mines, an announcement that has been received with much satisfaction here, as a local plant will certainly be highly beneficial to the mining industry. It was rumored during the week that representatives of other large smelter interests which are supposed to have an unwritten agreement with the A. S. & R., have been in the district recently prepared to offer concessions to the Bunker Hill in the hope of getting the company to abandon the smelter plan, but there is no evidence that these efforts if made have met with encouragement.

In Securing Control of the Ray-Jefferson the Day family is about to embark in zinc mining in addition to its extensive operations in lead. The Ray-Jefferson owns 32 claims, with mill site and water rights, on Beaver Creek, and extensive development has disclosed large bodies of zinc and considerable lead. The property joins the Interstate-Callahan on the west and is supposed to have the extension of zinc oreshoot from which property has paid nearly $2,000,000 in dividends during the past year. A few weeks ago when the announcement was made that the Ray-Jefferson had been financed to the extent of $200,000 which would insure its further development and the erection of a 250-ton mill in the spring, it was known that the financial support had come from the Days, who were already quite heavy stockholders in the company. A meeting of the directors of the Ray-Jefferson recently submitted a proposition to the stockholders to increase the capital stock of the company from 1,500,000 shares to 2,000,000, and the stockholders will meet on Nov. 6 in this city to take action. There is no doubt that the proposition will carry, and it is understood that the additional stock will go to the Days in return for the cash they have agreed to advance. This with their present holdings and other stock that is friendly to them will make them the controlling factor. In this connection the attitude of the Interstate-Callahan company is of more than passing interest. Several months ago this company made overtures for the purchase of the Ray-Jefferson, but without success. These were renewed recently and are now being pressed, the figure being offered individnal stockholders being on a basis of near $1,000,000 for the property. The anxiety of the Interstate-Callahan people to secure the Ray-Jefferson is not due wholly to the probability that its orebodies extend into the Ray-Jefferson gronnd. Another reason of even greater importance is believed to have been disclosed in the action of the Callahan-Boutin faction of the Interstate-Callahan about a month ago in applying to the district court here for the appointment of a receiver to take charge of the company's property, and the appointment of Eugene R. Day, manager of the Hercules mine, receiver. This action was blocked by the Percival-Robbers faction, which is in control of the property, which succeeded in having the application for a receiver transferred to the federal court, where it is now pending. It now appears that the Interstate-Callahan company, as represented by the Percival-Robbers element, has discovered in this action to throw the property into the hands of a receiver, and particularly in the appointment of Mr. Day, the first step in a scheme to dissolve or unconsolidate the Consolidated Interstate-Callahan Mining Co. with the ultimate purpose in view of consolidating the Callahan with the Ray-Jefferson and leaving the Interstate to hold the bag, so to speak, as it is known that the big end of the orebodies of the consolidated property is in the Callahan ground. With the Days in control of the Ray-Jefferson and the possibility of the Interstate-Callahan company being thrown into the hands of a receiver, the men who exercise control of the big zinc producer are evidently acting upon the belief that the acquisition of the Ray-Jefferson is as necessary for the security of their present holdings as it is for its additional ore reserves.

MORENCI, ARIZ.—Nov. 5

The Western Federation has tightened the censorship in the Clifton-Morenci-Metcalf strike district. One's comings and goings are investigated closely, and woe unto him whose passport is found wanting. It is said nobody can leave camp with a ticket that reads to Duncan, where the companies have established a tent colony to accommodate such apostates as have seen the error of their way and wish to return to the good graces of the company that has given them an opportunity to earn a goodly livelihood these 20 years. All persons arriving in the district are closely interrogated as to their business, length of sojourn, etc. About 2,000 men met the train at Clifton Nov. 1, and made a public bonfire of copies of the El Paso "Morning Times," which paper is barred from the district. Governor Hunt has headed a public subscription with $500 and asks all citizens to follow suit with a donation for strikers, and the federation has assessed every member in the state from $1 to $2 a month, according to his wage. Cyclone Davis, Congressman from Texas, offers his oratorical assistanee to Hunt in fighting the recall petition.

TORONTO—Nov. 6

An Engineer of the Provincial Hydro-Electric Commission, at the request of a nnmber of the mine managers in Cobalt and Porenpine, is making a survey of the power conditions in these two camps and in Sudbury. It is the belief of a number of those interested in mining in northern Ontario that the cost of electric power is much higher than is warranted by conditions. The conditions at Sudbury will not enter very largely into the matter as the plants there are owned largely by the operating companies, but it will give them a basis for comparison of costs with Cobalt and Porcupine. While it is very unlikely that the Hydro-Commission will build in northern Ontario, it may be able to help the mines to obtain lower rates.

VICTORIA, B. C.—Nov. 1

A Rich Strike of Placer Gold has been made on Rnde Creek, a tributary of the Klotosson River, and a stampede is now on for that district, according to Commissioner George Black, head of the government in the Yukon Territory who, on his way out, met as many as 150 men on their way in to the new field. The discovery of placer gold was made in September by Jens Rnde and his partner, two prospectors. The creek has been named Rude Creek. The sand and gravel of the creek has yielded $1.50 per sq.ft. to a depth of 6 ft. The prospectors brought out 50 oz. in gold at the time they staked their elaims. It has been the policy of the Yukon Government to assist the prospectors by furnishing them with free transportation when they have a grubstake sufficient to last them a year. Jens Rude and his partner were two of these prospectors who were thus assisted. They went over the waters of the Yukon, up the White River to the Klotosson River. The government is gratified to see that their efforts in assisting the prospector have met with such success. The point where the gold was discovered is 30 mi. from navigation on the Yukon. The government is cutting a trail in for the accommodation of the miners. Little work can be done this year owing to the lateness of the season when the discovery was made. The men are going in, however, to stake their claims and get ready for operations in the spring. The discoverers are allowed to stake 1,500 ft. along the stream and 1,000 ft. on each side. Those who come after are allowed to stake 500 ft. along the stream, by 2,000 ft. in width.

The Mining News

ALASKA

OUTPUT FOR THE CHISANA DISTRICT is estimated for the year at about $150,000. The mining season has closed there. Some good prospects were found just before the ground froze on Beaver Creek.

GRANITE (Port Wells)—Ore struck at 350-ft. level, through raise from lower adit.

ALASKA MEXICAN (Treadwell)—In September, mill crushed 18,690 tons, yielding $1.42 per ton; net profit, $2,342.

ALASKA TREADWELL (Treadwell)—In September, mills crushed 80,472 tons, yielding $148,842, or $1.87 per ton; operating profit, $60,590; net profit, $52,660.

ALASKA UNITED (Treadwell)—In September, Ready Bullion and 700-Ft. Claim mills crushed 20,104 and 22,890 tons respectively, yielding $1.91 and $1.35 per ton; net profits, $3,022 and $933.

EILDAGO-ALASKA COPPER (Valdez)—Supt. E. D. Reiter states that development will continue throughout the winter and more equipment will be installed next spring. Ore encountered in main raise.

WELSH (Knights Island)—H. C. Vance, who is developing a copper mine at Bay of Isles on Knights Island for Martin Welsh, of Spokane, reports that shaft has encountered ore carrying 10% copper. Plans for wharf for deep-water ships are ready and an adit will be started this winter.

ALASKA MINES EXPLORATION (Seward)—J. H. Sears, Jas. McCoy and Roy D. Fonda have filed articles of incorporation for above company at Juneau. Sears is president of Seward branch of Harriman Bank, and connected with that banking concern at its New York address. Purpose of new company to examine, develop and operate mines in Alaska.

GUGGENHEIM DREDGE (Ruby)—About 400 tons of machinery are being shipped by Guggenheim interests from Dawson to Ruby, where the new dredge will be assembled on ground recently acquired. Active operations on one of the largest dredging propositions ever started in the North will be undertaken next spring.

CLIFF LITIGATION (Valdez)—In the suit brought by Edmund Smith, George Treat and L. Archibald against H. E. Ellis for their claimed interest in the famous Cliff property, the decision in the district court gave Treat a one-tenth interest and the remaining claimants divide a tenth interest. Ellis is working the property and it promises to become a producer again.

ARIZONA

Greenlee County

ARIZONA COPPER (Clifton)—The concentrator at Clifton was burned on the night of Nov. 5. This is the No. 4 mill which was recently remodeled and enlarged to treat 500 tons daily.

Mohave County

UNITED EASTERN (Oatman)—Managing director George Long quoted as stating machinery ordered for 200-ton mill. Also installing extensive mining equipment.

CALIFORNIA

Amador County

LUDEKENS (Pine Grove)—Application made to California Débris Commission to operate by hydraulic process and impound tailings in Grass Valley Creek, draining into Mokelumne River, to be heard at San Francisco, Nov. 15.

ORIGINAL AMADOR (Amador City)—Shaft will be deepened and new levels run for development of orebody below present workings. Extraction of ore will be reduced, but 10 stamps will be kept dropping while sinking is in progress. T. S. O'Brien is manager.

Calaveras County

ASBESTOS DEPOSITS near Copperopolis reported to be in preparation for development and operation. Product will be used for manufacture of fireproof plaster. Fiber is not equal to demand for usual commercial asbestos. Ten men are now employed and number will be increased as work requires.

Eldorado County

DREDGING GROUND on south fork American River near Coloma is being prospected with No. 3 Keystone drill by J. H. Mulloch of San Francisco, who has bonded ground. This is neighborhood in which gold was discovered by Marshall causing first gold rush to California. Reported that W. R. Bell is also interested in bonding other ground in this vicinity, and that installation of California type dredges is probable.

GRIZZLY FLATS (Grizzly Flats)—Property embracing about 140 acres taken over by Los Angeles men. Tunnel is being repaired and timbers cut in preparation for extensive development. Installation of 10-stamp mill contemplated. Deposit contains cemented gravel.

Inyo County

BUNKER HILL (White Mountain District)—S. T. Paul and Tex Hall are investigating property with probable view of taking purchase option.

LUCKY JIM (Darwin)—Darwin Development Co. has option of purchase and is making examination under superintendency of S. T. Paul. Reported that 25-ton flotation plant and other essential concentration machinery will be installed if development warrants taking over property.

Madera County

ELECTRIC POWER for mines in Grub Gulch district will be provided by extensions made by San Joaquin Power Co. Enterprise and Gambetta mines are preparing for electrical installations. Lack of economic power has been largely responsible for slow development and operation of mines in Madera County since necessity for economic methods of treating low-grade ores is imperative.

Nevada County

GOLDEN CENTER (Grass Valley)—High-grade ore has been disclosed; 10 stamps are dropping on good ore and an increase of capacity of mill is contemplated.

COLUMBIA CONSOLIDATED (Washington)—Mine being placed in shape for production. Mill formerly operated at German mine has been purchased and will be put in commission immediately. Aërial tram from mine to mill is completed and underground work is progressing. Orebodies are large; ore is chiefly free-milling.

DINERO MINING CO. (Washington)—Incorporated with capitalization of $2,000,000 by A. T. Hathaway, W. J. Conners, S. Montague and others. Company will purchase Yuba group of 16 quartz claims at Maybert. Unwatering 960-ft. shaft will begin as soon as repairs are made; shaft will then be deepened to 1,000 ft. and drifting will follow. Mine is equipped with good pumping and hoisting plants and two mills of combined capacity of 30 stamps. Present plans contemplate year of development before milling of ore is undertaken.

Plumas County

GRANITE BASIN district development has brought about reëstablishment of old stage line from Oroville, which had been abandoned for several years. Distance is 50 mi., though Western Pacific Ry. passes within about 10 mi. to west of district. Quincy is nearest important town in Plumas County, situated about 40 mi. northeast.

Sierra County

RATTLESNAKE (Downieville)—Gravel yielding $4 per carload in gold is being worked by Deal & Dills, and breasting will continue during winter.

SPHOON AND LOUISE (Alleghany)—Durston Gold Mining Co. has 20 men grading for buildings, and developing quartz veins on both claims. C. O. Jackson, manager.

MINER'S HOME (Howland Flat)—Under bond to J. Nash. Much gravel worked during summer, with good results. Snowshed built, and work will be continued throughout winter.

ORIENTAL (Alleghany)—Rich ore being extracted at 600-ft. level. Grading for quartz mill under way. Under management of W. B. Pearson, for Croesus Gold Mining Co. of New York.

MOUNT ALTA (Sleighville House)—Gravel paying well. Main tunnel 300 ft. ahead of breasts, and with plentiful supply of water for washing; present crew of 10 will be doubled. Sutro and Chatfield of San Francisco are operating.

WILLOUGHBY (Sierra City)—New payshoot struck, yielding $50 per ton of ore gold in stamp mill, with rich sulphide tailings yet to be treated. An electric plant, air compressor and power drills will be installed later. Owners are Dr. R. L. Jump, of Fruitvale, and E. M. Farrell, of Downieville.

COLORADO

Lake County

DOWN TOWN MINES CO. (Leadville)—Contract let to the Providence Engineering Works for a station pump to be installed on the bottom level when unwatering is complete. This centrifugal pump will have a capacity of 2,000 gal. per min. against a head of 900 ft. and will be direct connected to a 650-hp. General Electric motor running at 1,800 r.p.m. Pumping proceeds with the sinking equipment. No attempt has been or will be made to reopen any of the old workings thus far drained until the unwatering project is finished. Weirs have been provided in the run-off ditch from the Penrose shaft and accurate flow measurements are made regularly.

Summit County

TONOPAH PLACER CO. (Breckenridge)—For quarter ended Aug. 31, net earnings were $114,000.

Teller County

CRIPPLE CREEK PRODUCTION FOR OCTOBER is estimated at 92,000 tons of ore averaging $13.80 per ton. Of this, fully 31,000 tons was waste and dump material averaging $2.60 per ton. The big Golden Cycle mill at Colorado City roasted and cyanided 1,400 tons per day—nearly one ton per minute—a record.

IDAHO

Shoshone County

GOLDEN WINNIE (Murray)—Bennett Bates, who has option on this old gold-tungsten property, is getting out tungsten ore for test run.

HAMBURG-AMERICAN (Little North Fork)—Crosscut at this property has been driven in lode 26 ft. without reaching wall. Assays of 4 to 6% copper are reported.

TERRIBLE EDITH (Little North Fork)—Charles Conn, lessee, received $5,200 from two cars of zinc ore shipped during September. Payment of $80,000 on option falls due Dec. 1.

HYPOTHEEK (Kellogg)—J. O. Tucker, who owns ranch below this mine, has filed suit against company involving water right. Asks damages of $5,000 for diverting water belonging to him and $5,000 for destroying agricultural value of land.

H. E. M. (Wallace)—New 100-ton capacity mill, situated about mile west of Wallace, made its trial run this week with satisfactory results. It is plan of company to connect mine and mill by ½-mi. electric tram, but for present ore will be delivered at mill by wagon.

SUCCESS (Wallace)—At meeting of directors at Wallace Oct. 30, it was stated that orebodies already developed were sufficient to run mill at capacity for about a year. New pump on 1,200 level will be in operation soon, and sinking to 1,400 will commence.

SILVER CABLE (Mullan)—Carload of 30% zinc ore shipped from this property few weeks ago did not yield satisfactory returns. Large body of zinc and some lead has been proven in intermediate tunnel which has recently been connected with lower tunnel by raise of 200 ft. Will continue development during winter with expectation of erecting mill in spring.

SNOWSTORM (Mullan)—No official announcement made but it is understood that Snowstorm has taken over Banner & Bangle mine near Troy, Mont. When Snowstorm was abandoned about year ago, company had $170,000 in treasury and management announced that this would be used to acquire other mining property; understood Troy property has been secured in pursuance of this purpose. Banner & Bangle has been under development for some years by Leo Greenough, manager of Snowstorm. It is silver-lead property.

ROANOKE (Kellogg)—Roanoke company this week gave lease on its property to John Grenfell, of Kellogg, for term of three years; company to receive royalty of 15% on net returns from all ore shipped; lessee agrees to keep at least two men working not less than 30 shifts per man per month. Property is on Elk Creek and is developed by tunnel 400 ft. on vein and shaft 300 ft. deep, from bottom of which vein is explored 100 ft. In both tunnel and shaft there is from 10 to 18 in. of lead ore, high in silver. Hoist is operated by electric power. Mine is 1½ mi. from railroad and is reached by good wagon road.

GEORGIA

FINDLEY RIDGE CO. (Dahlonega)—The Crown Mountain 50-stamp mill has been destroyed by fire. Owners had just completed a ½-mile mule tramway from the openpit mine to this mill and expected to add cyaniding equipment to treat tailings from the amalgamation department. A. H. Head, superintendent.

MICHIGAN

Copper

MICHIGAN (Houghton)—Operations continue at this property with 30 men employed. They are working in a field that has not been operated since the Civil War. Exploration work done to date has given fair indications.

MASS CONSOLIDATED (Rockland)—This property now working to mill capacity and handling highest grade tonnage that ever has been taken from the property, including an unusual amount of "mass and barrel stuff" that goes straight to smelting works.

LAKE (Houghton)—The one thing that is holding back work is the inability to secure drilling machines, the market for which is overtaxed. Calumet & Hecla is just getting the last consignment of one order for 500 machines. Mass expects to have more drills within two weeks, when more rock can be shipped to the mill.

Iron

FLORENCE (Florence)—Orders were given this week by Felix A. Vogel, of New York, to reopen the mine. It has been idle a long time.

BALTIC (Iron River)—About 50 men are employed opening mine. By middle of November about 150 will be at work. Mining will be pushed all winter.

LAKE ANGELINE (Ishpeming)—Cleveland-Cliffs Iron Co., the new owners, started two diamond drills Nov. 6. Some testpitting also being carried on.

FOGARTY (Iron River)—Shovel was started here this week. It is expected that mine will be opened again before long. All of other Pickands-Mather properties on range are operating actively.

CORRIGAN, McKINNEY & CO. (Crystal Falls)—All of ore in stock has been shipped from Kimball, Tobin & Dunn. Only Great Western pile remains. Company has refused to dispose of any more ore at current prices.

MORRIS (Ishpeming)—A motor-size drift was extended 422 ft. during October, breaking the Cleveland-Cliff Iron Co.'s record for rock drifting. Two machines were used and there were four muckers. The rock is hard to drill and break.

HANOUSEK (Wakefield)—Coates & Tweed are preparing to open this property situated short distance from new Wakefield mine of M. A. Hanna Co. Large orebody has been developed. Ore will be taken out with steam shovels. Northwestern road will run spur track from Mikado mine.

PENN IRON CO. (Vulcan)—The Bucyrus company is endeavoring to purchase the patents of the hydro-electric shovel invented by F. Armstrong of Penn company. It is likely that deal will be closed. One of shovels has been doing satisfactory work at Vulcan.

MINNESOTA

Cuyuna Range

HOPKINS (Ironton)—Cuyuna-Sultana Iron Company's shaft is now known as the Hopkins. Production continues at 150 tons daily. Concentrator will operate all winter.

Duluth

MINNESOTA STEEL (Duluth)—Cargo of 1,500 tons of ferromanganese was received this week from Conneaut, Ohio. It was mined in Cuba. Value of cargo was placed at $165,000. More shipments are expected to arrive in near future. Steel making to be started Nov. 10.

MINNESOTA IRON DEVELOPMENT CO. (Duluth)—Company recently organized to take over nearly 9,000 acres of undeveloped fee lands on Cuyuna, Mesabi and Vermilion ranges. E. J. W. Donahue and John Wahl, of Duluth, prominent Cuyuna Range promoters, are directors.

Mesabi Range

RUDDY (Biwabik)—Mine closed down temporarily to permit repairs to shaft.

ORDEAN (Virginia)—Stripping operations begun on this property Oct. 26. Controlled by Oliver Iron Mining Co.

HULL-RUST (Hibbing)—Is the leading 1915 shipper, with daily shipments of 700 carloads.

GREAT NORTHERN ORE—While not authoritatively announced, it is said that the newly organized Midvale Steel and Ordnance Co. has agreement or understanding whereby it controls 300,000,000 tons of iron ore owned by the Great Northern. This gives Midvale about one-third the ore reserve that the Steel Corporation has.

MACE (Nashwauk)—Big steam shovel being used by Butler Bros. in stripping here is attracting considerable attention from mining men. Results are entirely satisfactory. Boom is 90 ft. in length. First dippers used had capacity of 6 cu.yd. They wore out rapidly. Dippers holding 4 cu.yd. are giving better results.

Vermilion Range

SIBLEY (Ely)—Shaft sinking completed and erection of shaft house started. Old Sibley shaft, in which six men were buried about year ago, will be abandoned as soon as new shaft is ready.

MISSOURI—KANSAS—OKLAHOMA

DAY-COOTER MINING CO. (Commerce, Okla.)—Mill will be ready for operation soon. It is east of the Cornfield property.

BEAVER (Commerce, Okla.)—Plant completed on lease north of Commerce; ground thoroughly prospected and reported to be rich.

GARTUNG & CO. (Commerce, Okla.)—Has replaced Ripley tables by Wilfleys. Mill is only tailing mill in district where there are no cleaner jigs, ore being sent from roughers to series of tables.

BLUE GOOSE (Cardin, Okla.)—This new mill of Commerce Mining and Royalty has started producing ore. Beaver mill belonging to same company is rapidly nearing completion and will be running in next couple of weeks.

MURPHY LAND (Galena, Kan.)—Mines leased and operated by James Clifford and George Roland lost machinery and ore by cave-in and flood resulting from broken flume. A new shaft will be sunk in solid ground. The two new pumps installed by James Murphy, owner of the Murphy land, have about drained the ground and miners are returning to work.

EMPIRE MINE (Galena, Kan.)—Large compressor being installed to furnish power for drills, and large derrick is being erected at new shaft sunk recently into ore. A 900-ft. tramway will be built from shaft to mill. Empire is one of largest producers in district, 5½ tons of ore being made per shift; expect to make 10 or 12 per shift as soon as repairs are made and both shafts are in operation.

CHARLES TURNER (Joplin, Mo.)—Expects within next few weeks to commence building of new mill on his lease on Riseling land southwest of Joplin; already has 3,000 tons of dirt ready to hoist and mill. Has three shafts in ore ready to work down to 150-ft. level. Ore was struck at 60-ft. level in paying quantity, but best ore is from 110 ft. to 150 ft. Land was formerly operated by Live Oak Mining Co. of Joplin, Mo., but its mill burned about 7 years ago, and prices of ore did not justify rebuilding at that time, hence ground has been idle since then.

MONTANA

Lewis and Clark County

HELENA MINING BUREAU (Helena)—Members of bureau, incorporated some time ago to try out possibilities of promising mines and prospects in districts tributary to Helena, recently made inspection trip over new property taken over at head of Nelson Creek. Development on four gold claims consists of shaft, drifts and open cuts on surface along outcrop of vein which is 20 ft. wide. Work will be started at once. Mining activity stimulated by work on old Witlatch mine, where leasers have been steadily mining and milling at a profit.

Silver Bow County

BUTTE & BACORN (Butte)—In decree signed Oct. 28 by Judge Lynch, sale of property is ordered to satisfy claims of note holders.

BUTTE & LONDON (Butte)—Work of unwatering shaft completed Oct. 30; sinking begun Nov. 2 and will be kept up at the rate of about 100 ft. per month. Company expects to begin crosscutting early next spring. It is planned to keep three shifts of five men each at work.

BUTTE-ALEX SCOTT (Butte)—Since resuming operations, Oct. 9, 200 tons of ore per day has been shipped, 25% of which was first-class ore. All ore now taken from 2,000-ft. level. As soon as development work on 2,200-ft. level will permit hoisting ore, output will be increased to 400 tons of ore per day. Ore being smelted by East Butte company.

BUTTE & SUPERIOR (Butte)—Company broke all previous records during October, when more than 47,000 tons of ore were mined at Black Rock mine and over 14,000 tons of concentrates produced in mill. From this ore were recovered 15,500,000 lb. of zinc, equivalent to an extraction of 95%. Company's payrolls for month will exceed $180,000, based on $4-per day scale, price of copper having been above 17c. during October. Preparations are going forward for development work at Butte-New York property, which is controlled by Butte & Superior. Crosscut to Colonel Sellers vein has been run on 1,200-ft. level of Black Rock. Vein is from 7 to 8 ft. wide with 1 ft. of 17% zinc in center. Another crosscut will soon be run to Pollock vein.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Production for October was 26,500 tons of ore. Gross yield, $256,000. Net realization, $101,000. September costs were $4.44 per ton and 2,204 ft. of development was done at $4.60 per ft.

Humboldt County

ST. ANTHONY (Toy)—Situated 21 mi., southwest of Lovelock but close to Southern Pacific tracks has practically completed 50-ton tungsten concentrating plant.

Mineral County

PAMLICO PLACER (Hawthorne)—This company has closed down, operations not having been so profitable as samples indicated.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 30 amounted to 9,891 tons valued at $203,998 compared with 9,704 tons week previous. Producers were Tonopah Belmont, 2,899 tons; Tonopah Mining, 3,050; Tonopah Extension, 1,850; West End, 881; Jim Butler, 1,100; Halifax, 54; and miscellaneous leasers, 57 tons.

TONOPAH MINING (Tonopah)—For quarter ended Aug. 31, gross value of ore milled was $511,724; net realization of $166,388. Metal losses in milling and refining were $39,699.

CASH BOY (Tonopah)—Bins being erected to facilitate shipping. North drift on 1,450-ft. level shows 3 ft. of ore accompanied by 3 ft. of low-grade material. Air connections will be made with the Victor. Expect to conclude side-line agreement with Tonopah Extension.

HALIFAX-TONOPAH MINING CO. (Tonopah)—Encountered ore at a depth of 1,200 ft. and about midway between the end and side lines of their group of four claims. Drifts on vein being started, winze now down 25 ft. in ore and 54 tons shipped to West End mill are expected to yield between $35 and $50 per ton.

Storey County

ANDES (Virginia)—Cleaning out 175 level and working in old stope above level. Saved 39 cars of ore and fill.

SIERRA NEVADA (Virginia)—At 45 ft. point in west crosscut 2,500 level face in ore averaging $85 per ton. Saved 49 cars of ore averaging $32.34 per ton.

OPHIR (Virginia)—Sinking winze on vein below 2,500 level continued in low grade ore. Central tunnel extracted 355 cars of ore and milled 240 tons. North drift 250 level advanced two sets in milling ore. Jointly with Con. Virginia extended west crosscut on 2,700 level to open vein.

UNION CON. (Virginia)—Six feet of $50-ore exposed at south end of No. 3 stope 2,500 level. In No. 1 raise, best ore shifted to foot wall; ore assaying $21 per ton. Union No. 1 raise north drift face in ore averaging $19 per ton. Saved 142 cars of ore assaying $9.47 per ton and 91 cars averaging $19.73 per ton.

CROWN POINT-BELCHER (Gold Hill)—Water lowered to 70 ft. point below 1,600 level. Recovered No. 1 pump to be overhauled and put in commission 1,400 station. Milling ore saved from 1,300 and 1,400 levels and 779 tons of dump rock and 198 tons of mine rock received at Jacket mill. Bullion shipped.

SOUTH DAKOTA

Lawrence County

HOMESTAKE (Lead)—A crew of men has been put to work taking out tungsten ore from the Harrison claim and a shipment of wolframite is about ready for the market. The material occurs in the flat formation, lying above the quartzite

WASP NO. 2 (Flatiron)—Directors decided to erect a concentrator to handle low-grade tungsten ore. Capacity of plant will be about 25 tons daily. Regular shipments of high-grade tungsten ore are being made. Gold mill is operating on reduced capacity.

UTAH

Beaver County

MOSCOW (Milford)—First car of ore from new zinc strike on 200 level has been shipped.

HORN SILVER (Frisco)—Annual meeting was held Oct. 20, and report will be issued soon after first of coming year. Present directors were reelected.

UTAH LEASING (Newhouse)—Company's new mill, which is to work Cactus dump, is practically completed. Tailings carry about 14 lb. copper per ton.

MAJESTIC (Milford)—Shipments during October amounted to 20 cars of ore from large open cut at Hickory mine. Shaft at Hoosier Boy is being sunk to 600 level, where station will be cut and drifting for vein started. It is planned ultimately to sink shaft to 1,000 level.

Juab County

TINTIC ORE PRODUCTION for week ended Oct. 30 amounted to 132 carloads, estimated at 6,600 tons, valued at $165,000, compared with 121 carloads week previous.

Piute County

MINERAL PRODUCTS (Marysvale)—Initial carload of potash was shipped Oct. 22 by this company, and marks first shipment of potash from Utah fields.

Salt Lake County

UNITED STATES SMELTING (Midvale)—Recent additions having been completed, work was resumed Oct. 20 at concentrator.

UTAH METAL AND TUNNEL (Bingham)—Arrangements are being made to buy the Bingham-New Haven company's property, which adjoins the Utah Metal on the south and west.

ALBION (Alta)—Work was resumed Oct. 23 in neighborhood of caved ground. As soon as timbering is completed, raise can be started on ore. To date three cars of ore have been shipped by leasers.

ALTA RAILWAY TRANSPORTATION CO. (Salt Lake)—Men are at work clearing out right of way between Wasatch and Tanner's Flat, 3 mi. above. It is intended to put in track, 24-in. gage, and to deliver ore from Tanner's Flat to Salt Lake & Alta R.R. terminus at Wasatch for $1 a ton.

UTAH COPPER (Bingham)—The production for September amounted to 14,159,289 lb., as compared with 15,966,543 lb. in August. Company has purchased for $5,000 Ohio Copper ground, including right-of-way. Purchase was made some time ago, but only recorded Nov. 4.

SOUTH HECLA (Alta)—The lease on the Kate Hayes fissure is shipping 40 tons every other day, and 40 tons daily is being sent out by the company from the Wedge workings. The latter ore brings $30 to $40 net smelter returns. On the 250 level the large vein has been followed over 200 ft. and has been crosscut at several points. It varies from 20 ft. in width to 60 ft. at one point.

UTAH IRON AND STEEL (Midvale)—This company filed articles of incorporation Oct. 22; capitalization is $300,000, in shares of $100 each. Purpose of company as stated is to manufacture iron, steel, manganese, coke, copper, etc.; also to build bridges, machinery, and generally to engage in the manufacture of iron and steel structures. C. W. Whitley is president; N. Rosenblat, S. A. Whitney, S. Rosenblat, W. S. McCornick, L. Green, and M. Rosenblat are directors.

Summit County

DALY-JUDGE (Park City)—Development work on 1,100 level has opened full face of silver-lead ore of shipping grade. Most of ore from deeper levels has heretofore been of milling grade.

DALY WEST (Park City)—On account of the water-supply running a little low this fall, the mill has not been operating full time. Development and mining continue, however, and a considerable output of direct shipping ore is being made. Water shortage will be relieved by the first snows.

Weber County

PROMONTORY BAY MINING (Ogden)—Articles of incorporation have been filed by this company to develop zinc and lead property on Promontory Point, 30 mi. west of Ogden. Capitalization is $50,000, par value of stock being 10c. a share. D. J. Sheehan is president. Other companies recently incorporated in the district are: Lake View Mining, Little Valley Mining, Grand View, Indianola, Midlake, and Promontory Zinc.

WISCONSIN

Zinc-Lead District

OPTIMO (Linden)—Company has started construction of a new concentrating mill.

MINERAL POINT ZINC CO. (Mineral Point)—A big deposit of carbonate ore has been proved by churn drilling on the Kennedy land at Highland.

QUINCY (Platteville)—A. L. Utt and others have leased this tract, three miles southwest of Platteville; property is partly prospected by drill and shaft.

BELOIT-ELMO (Platteville)—J. M. Edwards, representing Michigan copper interests, has taken over this property, four miles south of Platteville, and has begun prospecting work.

CANADA

Ontario

TOUGH OAKES (Kirkland Lake)—An initial dividend of $2½7 has been declared.

BEAVER CONSOLIDATED (Cobalt)—This company has purchased group of 10 claims, comprising 360 acres, belonging to Kirkland Lake Gold Mines, Ltd.

SMITH-ARBINE (Sesekinika)—Representative of the United States Smelting, Refining and Mining Co. is sampling this property on which company has secured an option.

ORILLIA MOLYBDENITE CO. (Orillia)—An initial shipment of two tons of molybdenite concentrate has been made to the British War Office. Weekly shipments will be made.

CANADIAN COPPER CO. (Sudbury)—This company has taken over from Smith & Durkee, of Sudbury, the option on a copper location in Connaught Township, east of the West Shining Tree district.

HOLLINGER (Timmins)—For four weeks ended Oct. 7, gross profits were $158,342 from 27,029 tons of ore, average value of $9.66 per ton, the working costs being $3.19 per ton milled. The mill also treated 10,990 tons of ore from the Acme mine.

FOSTER & COFFIN (Sarnia Township)—This American firm has secured extensive leases of oil properties relinquished eight years ago by the Imperial Oil Co. It has cleaned out and shot two wells, now yielding total of 15 bbl. daily, and drilled one new well which started with a flow of 25 bbl. Contracts let for 10 more wells.

SOUTH AMERICA

Chile

BRADEN (Rancagua)—October production amounted to 1,863 tons of copper—a record output except for the extraordinary production of August, 1915.

ASIA

Chosen

ORIENTAL CONS. (Unsan District)—Tonnage milled during September aggregated 25,472 tons. Extraction obtained in Taracol cyanide plant was unusually high, 95.7%. Extraction obtained in the Maibong tube-mill plant was also high, 98.1%, but as extraction for August was low, average extraction for August and September in this plant is approximately 88%. Candlestick mill and cyanide plant ran 13 days 15 hr. during September and were then closed down. Cannot operate Candlestick mine at a profit owing to decrease in contents and width of orebody. Intends to lease mine to Korean tributors. Total bullion output for September as follows: Tabowie mill, $26,935; Taracol mill, $18,914; Maibong mill, $25,783; Candlestick mill, $3,341; Taracol cyanide plant, $50,627; Maibong tube mill, $5,317; Candlestick cyanide plant, $772; total, $131,693.

The Market Report

Metal Markets

NEW YORK—Nov. 10

All of the principal markets were strong and active during the last week, and in each case there was an advance in price.

Copper, Tin, Lead and Zinc

Copper—A rather large business was done during the week, about equally divided between domestic and foreign buyers. It is a noteworthy feature that domestic buyers now appear to be in the market right along instead of buying large quantities all together and then staying away for a long time, which seemed to be their policy a little while ago. On Nov. 6 there was a strike at the Nichols refinery and up to the time of our going to press the plant was still shut down entirely. The deprivation of the large output from this source combined with the well sold position of producers anyhow tended to create some apprehension respecting the supply of near-by copper, and metal for that delivery was readily sold at 18¼c., regular terms. Copper for December and January shipment was sold down to 18c., there being considerable competition among some sellers who were able to contract at relatively low prices for Chile bars and other raw material and sell electrolytic against it at a profit.

In the London market electrolytic copper was offered by American producers from £89 at the opening to £90½ toward the end of the week, but they had to meet the competition of Australian and other producers who took some desirable business at lower prices expressed in sterling, not being troubled either by the high exchange rate or the high freight rate that confront American producers. The freight, insurance and other costs in delivering copper from America to London at the present time amount to 0.75@1c. per pound.

Copper Sheets base price is now 23¼c. per lb. for hot rolled and 24¼c. for cold rolled.

Copper Exports week ended Oct. 23, as reported by Department of Commerce, were 15,229,219 lb.: the chief items being 5,341,186 lb. to France, 4,356,064 lb. to Italy, 3,198,949 lb. to England and 1,680,857 lb. to Russia. Copper imports were 1,652,307 lb. metal and 762,018 lb. in ore and matte; 2,414,325 lb. in all. The larger imports were from Canada, Cuba, Newfoundland and Japan.

Visible Stocks of Copper in Europe on Oct. 31 were: Great Britain, 18,410; France, 1,925; afloat from Chile, 1,050; afloat from Australia, 3,500; total, 24,885 long tons, being 1,068 tons more than Oct. 15, but 4,098 tons less than the Sept. 30 report.

Tin—A good business was done right through the week and the price rose further under the influence of the buying.

Visible Stocks of Tin Oct. 31, including tin afloat, were: London, 5,152; Holland, 315; United States, excluding Pacific ports, 7,687; total, 13,154 long tons, being 2,037 tons less than on Sept. 30, but 2,260 tons mor than on Oct. 31 last year.

Bolivian Exports of Tin concentrates and bars from West Coast ports, seven months ended July 31, were 20,001 tons, equal to 12,355 long tons fine tin. Adding cable reports for August and September mak s the total for the nine months ended Sept. 30 equal to 16,240 tons fine tin. The shipments to New York for the seven months were 499 tons, equal to 318 tons fine tin.

Lead—On Nov. 4 the American Smelting and Refining Co. raised its price to 5c., this following some large and satisfactory selling from that quarter which made it appear likely that the higher price could be obtained. This proved to be the case, a pretty good business on the 5c. basis being done by all of the principal producers. During the morning of Nov. 10 the American Smelting and Refining Co. made a further advance, this time to 5.15c. The St. Louis market held during the week at about 7½ to 10 points under the New York price. Sales of special brands of Missouri lead were made at as much as 10 points premium. The kind of lead that used to be known as "Chemical hard" is especially in demand, owing, no doubt, to the large requirement of it for building sulphuric-acid chambers.

Spelter—A further large business was done, and this week for the first time in many, domestic consumers figured in the market, certain prominent galvanizers being large buyers, both for delivery in this quarter and next. Some export business also was done. The natural consequence of the large buying was to advance the price further. The transactions covered a wide range of prices and deliveries. There was a good deal of business done for November-December shipment, and a good deal for shipment in the first quarter of 1916, while some sales running ahead to next June were made.

Zinc Sheets were advanced on Nov. 4, making the base price $16.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Nov. 9 the price was advanced to $17 per 100 lb., with usual discount.

DAILY PRICES OF METALS IN NEW YORK

Nov	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Spot, Cts. per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis, Cts. per Lb.	Zinc: St. Louis, Cts. per Lb.
4	4 6388	50	17.70 @17.90	36½	4 90 @5 00	4 80 @4 90	13 50 @15 00
5	4 6475	50	17 70 @17 90	36½	5.00	4.90 @4 92½	13 50 @15 00
6	4 6475	49⅞	17 80 @18 00	36½	5 00	4 90 @4 92½	13 75 @15.25
8	4.6475	50⅛	17 80 @18 05	36	5.00	4 90 @4 92½	14 00 @15 50
9	4 6450	50⅛	17 80 @18 05	36⅜	5 00	4 90 @4 92½	14 00 @15 50
10	4 6475	50	17 80 @18.05	36¾	5 15	5 07½	14.25 @15.75

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c per 100 lb. above the St Louis price.

Silver quotations are in cents per troy ounce of fine silver

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Nov.	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts per Lb.
4	24 7/16	74	74½	88½	18.26	163½	162¾	24 5/16	5 02	77	15 89
5	24¾	74	74⅜	89½	18 52	162	161¾	24¾	5 13	77	15.93
6	24 5/16	....	......	.	...	.					
8	24 7/16	73¼	73¾	90	18 62	162	161¾	24⅝	5.10	78½	16 24
9	24 7/16	74⅛	74⅝	90½	18 72	162¾	162¾	24¾	5 12	78½	16.23
10	24⅜	74⅞	75¼	90½	18 73	164¼	164	24¾	5 13	78½	16 24

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0 925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.13c.; £40 = 8 57c.; £60 = 12 85c. Variations, £1 = 0 21⅜c.

Other Metals

Aluminum—Market conditions are unchanged. Spot metal is firmly held, 55@58c. being quoted for No. 1 ingots, New York. No quotations on futures.

The reported sale of the property of the Southern Aluminium Co. to the Aluminum Co. of America is confirmed. It is announced that the purchaser will go on and complete the plant, carrying out the original plans with only slight changes.

Antimony—The market is quieter and business has been on a moderate scale, with no material change in prices. Ordinary brands, chiefly Chinese, sold at 36½c. per lb.; while 45c. per lb. is asked for Cookson's.

A United States consular report from Japan says that the large advance in the price of antimony has acted as a great impetus to antimony mining in that country, and the mines at Ichinogawa, Fujinogawa, and Tatsugawa have all been considerably extended; yet their present output aggregates only about 50 tons a month. This quantity is only a fraction of the monthly consumption in Japan.

Nickel.—Quotations for ordinary forms are nominally 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

The International Nickel Co., under date of Nov. 1 announces a base price of 31c. per lb. for Monel metal hot rolled rods. Extras are charged for hexagons and other shapes, for small quantities, etc. Price is f.o.b. works, Bayonne, N. J. Scrap allowance 18c. per lb. delivered to works.

Quicksilver—The market is strong and prices have advanced, the stocks being very light. New York quotation is $100 per flask of 75 lb. for large lots; while $105 up to $110 has been paid for smaller orders. San Francisco reports by telegraph a market strong at $98 per flask, with light stocks. London price is £16 per flask, with same quotation from second hands.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium** metal, 75c. per lb., New York.—**Cobalt** metal, 97% pure, is sold at $1 per lb.—**Magnesium**, pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.—**Tellurium** is quoted at 80s. per lb. in London.

Gold, Silver and Platinum

NEW YORK—Nov. 10

Gold in the United States Nov. 1 as estimated by the Treasury Department: In Treasury against gold certificates outstanding, $1,375,392,789; in Treasury current balances, $216,809,613; in banks and circulation, $605,911,360; total, $2,198,113,762. This is an increase of $56,331,503 during October.

Gold Sales from United States Assay Office in New York in October were $3,452,764, being $432,045 more than in September. For the 10 months ended Oct. 31 the total sales were $55,751,523 in 1914, and $27,892,701 in 1915; a decrease of $27,858,822 this year.

One shipment of gold to Europe is on record this week, $500,000 having been sent to Amsterdam by a New York branch of a Dutch house.

Platinum—The market is quiet, sales being limited by the absence of supplies and the uncertainty of obtaining more. Prices are uncertain and subject generally to negotiation. Quotations are rather nominal at $52@56 per oz. for refined platinum; $56@60 per oz. for hard metal.

Our Russian correspondent writes under date of Oct. 11 that a new sharp advance of the prices is to be noted, due to the great demand for platinum for the internal market. The consumption of platinum has greatly increased, owing to the erection of new sulphuric acid works for war purposes. Many poods have been sold in Petrograd at high prices. The metal is quoted in Petrograd at 46,000@47,000 rubles per pood; at Ekoterinburg, 11@11.25 rubles per zolotnik, for crude metal, 83% platinum. These prices are equivalent to $45.57 and $41.83 per oz. average.

Silver—Our latest advices are to the effect that there has been some substantial buying for the East, and that the low rates of exchange on London have had a hardening effect on the silver market, so that the undertone seems good, with a reasonable probability that the present level may be maintained, subject of course to some fluctuations.

Coined silver in the United States Nov. 1 is estimated by the Treasury Department as follows: Standard dollars, $578,271,655; subsidiary coins, $186,730,386; total, $765,002,041. Of the silver dollars $486,851,787 are held in the Treasury against silver certificates outstanding.

Zinc and Lead Ore Markets

PLATTSVILLE, WIS.—Nov. 6

The base price paid this week for zinc ore was $80@85 per ton for 60% grades. The base price paid for 80% lead ore was $56 per ton.

SHIPMENTS, WEEK ENDED NOV. 6

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,717,300	144,200	347,,860
Year	174,033,350	6,028,540	23,072,590

Shipped during week to separating plants, 5,354,000 lb. zinc ore.

JOPLIN, MO.—Nov. 6

Blende, high price $102.50; base per ton 60% zinc, premium ore, $100; medium, $98@99; lower grades down to $85; calamine, base per ton of 40% zinc, $60@70; average selling price, all grades of zinc, $90.28 per ton. Lead, high price $61.10; base per ton 80% metal contents, $54@60; average selling price all grades of lead, $54.82 per ton.

SHIPMENTS WEEK ENDED NOV. 6

	Blende	Calamine	Lead	Values
Totals this week..	12,893,330	724,820	2,127,050	$673,020
Totals this year..	492,174,350	36,708,990	76,723,020	21,851,590

Blende value, the week, $591,840; 45 weeks, $18,980,250.
Calamine value, the week, $22,880; 45 weeks, $859,740.
Lead value, the week, $58,300; 45 weeks, $2,011,600.

No end of excitement was thrust into the market for both zinc and lead. Advances of $10 per ton were the order all along the line in zinc, and lead also was advanced $10 per ton by the Picher Lead Co. which has declined to compete with other buyers at a price over $50 base until this week. The heavy shipment of this week shows the strong buying tendency at the close of last week, and just how heavy this week-end buying will prove cannot be estimated from the various reports current.

Iron Trade Review

NEW YORK—Nov. 10

The year which opened lamely and uncertainly is drawing to its end with a rush. October production and November active furnace capacity are about double the production in January. Export and domestic business are crowding the mills and making postponement of deliveries the rule. Some premiums for early deliveries are reported.

Pig iron is active, with large buying of basic metal, and a rapidly improving demand for foundry iron. The long expected buying movement has set in.

Pig Iron Production again increased in October. The reports of the blast furnaces, as collected and published by the "Iron Age" show that on Nov. 1 there were 276 coke and anthracite furnaces in blast, with a total daily capacity of 101,800 tons, an increase of 4,865 tons over Oct. 1. Making allowances for the charcoal furnaces the total production of pig iron in the United States in October was 3,159,500 long tons; for the 10 months ended Oct. 31 it was 23,668,000 tons. Of this total 17,354,031 tons, or 73.3%, were made by the furnaces owned or operated by steel companies.

Exports and Imports of Iron and Steel—including machinery—in the United States eight months ended Aug. 31 are valued as below by the Department of Commerce:

	1914.	1915.	Changes.
Exports	$140,245,736	$212,697,467	I$72,451,731
Imports	20,745,326	13,451,040	D 7,294,286
Excess, exports...	$119,500,410	$199,246,427	I$79,746,017

The increase in exports has been all in the later months of the year. The August exports were $37,726,822 in 1915, against $10,428,817 last year.

PITTSBURGH—Nov. 9

Movements in the iron and steel market have passed beyond all the bounds indicated by precedent. There are no longer any guesses for the future. The demand for steel is simply overwhelming. There is very little contracting being done for finished steel products, the mills being offered more business, in the form of specific orders, than they can well handle. Conditions may, of course, be easier after the first of the year when many quarterly or half-yearly contracts will have expired, but as no steel seems to be going into stocks it is doubtful whether there will be any noticeable relief. The whole course of the steel market is changing in that specific orders are the rule rather than contracts.

The war demand has broadened. Several very large inquiries have appeared for sheets for war purposes, while the demand for shell steel is heavier than ever, and long term deliveries are asked. The domestic demand has increased sharply, and particularly in railroad quarters. Estimates are made

that as many as 100,000 freight cars may be ordered within the next few weeks.

Last Thursday bars, plates and shapes advanced from 1.50 to 1.60c., through the announcement made by the Carnegie Steel Co. on that day, and it is thought possible the next advance, in the near future, will be to 1.75c., although the market was steady 30 days ago at 1.40c. Sheets are advancing sharply, with many mills practically out of the market. The few first-quarter contracts accepted are at 2.25@2.35c. for black.

Pig Iron—Following the heavy sales of bessemer and basic iron reported a week ago the market has been widely excited. Furnaces advance their asking price sharply and do not care whether or not orders come. Yesterday a sale of 2,000 tons of bessemer pig iron was made for November-December delivery to a domestic consumer at $17.50, Valley, or $1 a ton above the market quotable a few days ago and $1.50 above the market a week ago. Basic iron, which advanced from $15 to $15.50 on the last day of last month, might not be had today at $16. Foundry iron has been rather quiet but will undoubtedly advance sharply on the appearance of any buying movement. The producers are quite indifferent. We quote the market at not under the following: Bessemer, $17.50; basic, $16@16.50; foundry and malleable, $15.50@16; forge, $15@15.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The market is altogether dislocated by the heavy demand for war billets and for ordinary forging billets, a demand that has caused some sheet mills with attendant open-hearth steel furnaces to close their sheet mills or use purchased bessemer sheet bars in order to make forging billets. A mill that recently sold openhearth sheet bars for first-half delivery is now trying to buy to fill the order, and make high carbon billets. Prices are higher but are not closely quotable, being approximately as follows: Bessemer billets, $25.50@26.50; bessemer sheet bars, $26@27; openhearth billets, $26,50@27.50; openhearth sheet bars, $27@28; forging billets, $42@45, f.o.b. maker's mill, Pittsburgh or Youngstown.

Ferromanganese—Demand has increased for both foreign and domestic on contract, the former being $100 and the latter $110@115, at shipping point. Prompt lots command intermediate prices.

FERRO-ALLOYS

Ferromanganese is still quoted at $100 Baltimore for imported; $110@115 for domestic, early delivery.—**Ferrosilicon** is higher; bessemer 10% is quoted $21.50 at furnace for spot, $21.50 for first quarter and $22 for second quarter. For 15@16%, higher prices, up to $31 at furnace are charged. High grade ferrosilicon, 50%, is quoted $85@87.50 per ton at Pittsburgh.—**Spiegeleisen** is active, with sales at $28@30 per ton at furnace.—**Ferrotitanium** is $8@12.5c. per lb., according to size of order and delivery.—**Ferrovanadium** $2@2.25 per lb. of contained vanadium.

FOREIGN IRON

German steel production in August was 1,157,651 metric tons, being 19,041 tons more than in July. For the eight months ended Aug. 21 the total make was, in metric tons:

	Basic	Acid	Total
Converter	4,248,243	104,202	4,352,445
Open hearth	3,407,799	158,027	3,565,826
Direct castings	283,817	99,104	382,921
Crucible	.....	66,985	66,985
Electric	.....	74,607	74,607
Total	7,939,859	502,925	8,442,784
Total, 1914	11,094,639	469,623	11,564,262

At the close of August there were 221 steel furnaces in operation and reporting production.

The British Blast Furnace report shows that 287 stacks were active in the quarter ended Sept. 30, against 294 in the June quarter and 281 in the September quarter last year.

IRON ORE

Lake Superior iron ore shipments in October were 7,146,875 tons. For the season to Nov. 1 shipments by ports were, in long tons:

Port.	1914	1915	Changes
Escanaba	3,440,992	4,940,081	I. 1,499,089
Marquette	1,651,579	2,836,203	I. 1,184,624
Ashland	3,229,746	4,695,752	I. 1,466,006
Superior	10,320,469	7,348,916	D. 3,571,553
Duluth	6,197,043	14,108,571	I. 7,911,528
Two Harbors	5,511,976	7,886,916	I. 2,374,940
Total	30,951,805	41,816,439	I. 10,864,634

The total sales of iron ore reported for the season, with only a few mines estimated, were 46,667,796 tons. This would leave about 4,850,000 tons to be moved.

Imports and exports of iron ore in the United States eight months ended Aug. 31, long tons:

	1914	1915	Changes
Imports	985,796	797,845	D. 187,951
Exports	518,597	370,965	D. 147,632

The principal imports were 501,588 tons from Cuba, 147,694 tons from Sweden and 32,946 tons from Spain.

Imports of manganese ore for the eight months were 183,029 tons in 1914, and 145,003 in 1915; decrease, 38,026 tons.

OTHER ORES

Molybdenite, 90% MoS_2 is quoted in London at 120s.—$28.80—per unit. The Australian government takes all the ore produced in that country at 105s. per unit.—**Tungsten Ore** remains high, London quotations for wolframite, 65% WO_3, being 55s.—$13.20—per unit. Tungsten ore at New York is quoted at about $38 per unit for ore 60% or over in tungstic acid.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 432,519 short tons; shipments, 441,911 tons. Shipments of Greensburg and upper Connellsville districts, 41,700 tons.

Anthracite shipments in October were 6,505,892 long tons. For the 10 months ended Oct. 31 the shipments were 56,712,087 tons in 1914, and 53,885,003 in 1915; a decrease of 2,827,084 tons, or 5%, this year.

Foreign Fuel Trade of the United States eight months ended Aug 31, as reported by the Department of Commerce, in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	2,666,969	2,304,964	15,902	2,300
Bituminous	9,045,260	10,585,583	861,513	951,517
Coke	456,661	513,679	67,003	33,620
Bunker coal	5,038,576	5,027,027	.....	.....
Total	17,207,466	18,434,253	944,418	987,527

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The increase this year in bituminous exports was to Italy and to South American countries.

Chemicals

NEW YORK—Nov. 6

The general market has shown some activity and generally a stronger tendency.

Arsenic—Business has been fair, and the market is generally steady. Quotations are $3.75@4 per 100 lb., according to size of order.

Copper Sulphate—Business has been steady, with no material change. Current prices are $6.50 per 100 lb. for carload lots and $6.75 for smaller parcels.

Nitrate of Soda—Demand is improving, though imports have been large. Prices are firmer, quotations being $2.90 per 100 lb. for spot and $2.85 per 100 lb. for futures.

Pyrites—Imports at Baltimore for the week included 5,022 tons pyrites from Huelva, Spain.

Imports and Exports of Chemicals in the United States eight months ended Aug. 31, in pounds:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	2,861,891	2,422,514	700	8,825
Bleach	27,004,166	6,447,027	12,654	120,126
Acetate of lime	.....	.....	39,946,187	15,040,640
Calcium carbide	.....	.....	23,174,699	26,875,126
Potash salts	24,732,745	13,927,473	450,302	975,840
Sodium cyanide	218,392	3,640,488	...	1,760,387
Soda salts, value	$436,705	$320,952	$8,116	$22,375

Exports include reëxports of foreign material. This statement does not include nitrate of soda nor crude potash salts used chiefly as fertilizers.

PETROLEUM

The monthly statement of "Oil City Derrick" gives the number of new wells completed in October as follows: Pennsylvania grade, 417; Lima-Indiana, 36; Central Ohio, 75; Kentucky, 11; Illinois, 79; Mid-Continent, 576; Texas-Louisiana, 114. The total number of wells completed was 1,308, the total production being 146,291 bbl. There were 249 dry holes and 165 gas wells reported. At the close of the month 2,827 wells were under the drill.

Exports of mineral oils from the United States in September are reported by the Department of Commerce at 213,713,373 gal. For the nine months ended Sept. 30 the total exports were 1,695,583,269 gal. in 1914, and 1,733,628,143 gal. in 1915; an increase of 38,044,874 gal., or 2.2%, this year.

Assessments

Company	Delinqe	Sale	Amt.
Aetna, Ida	Oct. 16	Nov. 15	0 001
Argenta, Ida	Oct. 11	Nov. 13	0 001
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0.01
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0.002
Copper Mt. M. & D., Ida	Oct. 28	Dec. 1	0 002
Danley-Lloyd, Utah	Nov. 14	Nov. 30	0 0025
Eagle Mt., Ida	Oct. 15	Nov. 15	0 0005
Eastern Star, Ida	Oct. 29	Nov. 29	0 002
Enterprise, Ida	Oct. 15	Nov. 15	0 002
Great Western, Nev	Nov. 15	Dec. 7	0 001
Hancock Cons., Mich	Jan. 3		1.00
Hector, Ida	Nov. 18	Dec. 10	0 005
Idaho & Los Angeles, Ida	Nov. 26	Dec. 27	0 005
Idaho-Nevada Exp., Ida	Nov. 1	Dec. 1	0 002
Ivanhoe, Ida	Nov. 8	Dec. 9	0.0025
Jack Waite, Ida	Nov. 20	Dec. 20	0 01
Lewis & Clark, Ida	Oct. 15	Nov. 15	0 001
Lucky Swede, Ida	Nov. 11	Dec. 11	0 002
Military M. & M., Ida	Oct. 28	Nov. 29	0 0065
Missoula Copper, Ida	Nov. 15	Dec. 15	0 002
Montana Standard	Nov. 15	Dec. 15	0 005
Nabob, Ida	Oct. 25	Nov. 15	0 005
National Copper, Ida	Nov. 20	Dec. 18	0.01
National Lead, Ida	Nov. 15	Dec. 15	0 001
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0 50
Northern Light, Ida	Nov. 2	Dec. 2	0 004
O. K. Ex. M. & R., Utah	Nov. 20	Dec. 15	0 005
Old Veteran, Ida	Nov. 1	Nov. 27	0 002
Oom Paul Con., Ida	Nov. 16	Dec. 6	0 01
Oriental, Nev	Nov. 6	Dec. 7	0 003
Original, Nev	Nov. 6	Dec 7	0 003
Pacific M. & M., Ida	Nov. 10	Nov. 30	0 0005
Phedora, Ida (post.)		Nov. 20	0 0005
Phoenix, Mich	Jan. 1		1 00
Pioche Metals, Nev	Oct. 20	Nov. 20	0 001
Rainbow, Ida	Oct. 15	Nov. 20	0 002
Silver Cliff, Ida	Nov. 8	Dec. 6	0 0025
Silver Moon, Ida	Oct. 15	Nov. 18	0 005
Silver Pick Cons., Nev	Oct. 16	Nov. 23	0 01
Sonora M. & M., Ida	Nov. 4	Dec. 17	0 003
Sunset M. & D., Nev	Oct. 18	Nov. 22	0 02
Sunshine, Ida	Oct. 15	Nov. 15	0 0006
Tom. Gipsy Queen, Nev	Oct. 29	Dec. 6	0 01
Umatilla Ton., Nev	Nov. 8	Dec. 13	0 005
Union Cons., Nev	Oct. 25	Nov. 15	0 05
Wisconsin, Ida	Oct. 19	Nov. 19	0 003
Wolf Mountain, Utah	Nov 12	Dec. 14	0 0025

Stock Quotations

The week has been marked by persistent and apparently causeless selling of the "war stocks," accompanied by severe declines. So far it appears simply to be a sharp manipulative attack.

COLO. SPRINGS Nov. 9		SALT LAKE Nov. 9	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.02‡	Beck Tunnel	01‡
Cripple Cr'k Con.	.006	Black Jack	.05
C. K. & N.	‡ 02	Colorado Mining	.05
Doctor Jack Pot	.09‡	Crown Point	01‡
Elkton Con.	29‡	Daly-Judge	6 90
El Paso	77	Emma Cop.	26
Findlay	.01‡	Gold Chain	11
Gold Dollar	.02‡	Grand Central	50
Gold Sovereign	.05‡	Iron Blossom	80
Golden Cycle	1.79‡	Lower Mammoth	05
Isabella	17	May Day	20‡
Jack Pot	06‡	Opohongo	00‡
Jerry Johnson	06	Prince Con.	77
Lexington	‡ 005	Seven Troughs	01‡
Mary McKinney	44	Silver King Coal'n	3 00
Pharmacist	‡ 008	Silver King Con.	1 02‡
Portland	1.70	Sioux Con.	02
Raven B. H	.03‡	Uncle Sam	.07
Vindicator	1 63‡	Yankee	.35

TORONTO Nov. 9			
Bailey	‡ 04‡	Dome Exten.	‡ 27
Chambers Ferland	‡.13	Dome Mines	24 25
Conlagas	3.75	Foley O'Brien	‡ 48
Peterson Lake	22	Hollinger	25 25
Right of Way	‡ 04	Imperial	‡ 15‡
Seneca Superior	‡ 78	Jupiter	‡ 11‡
Silver Queen	‡ 01	Melntyre	56
T. & Hudson Bay	20 00	Pearl Lake	‡ 00‡
Timiskaming	40	Porcu Crown	‡ 80
Trethewey	‡ 14	Preston L. D.	‡ 06
Wettlaufer-Lor	‡ 08	Rea	‡ 09

SAN FRANCISCO Nov. 9			
Alta	05	Belmont	3.65
Andes	09	Jim Butler	.79
Best & Belcher	65	Lone Star	04
Caledonia	98	MacNamara	02
Challenge Con.	07	Midway	12
Chollar	03	Mont.-Tonopah	26
Confidence	2 00	North Star	11 00
Con. Virginia	16	Rescue Lula	06
Gould & Curry	04	West End Con.	62
Hale & Norcross	63	Atlanta	24
Jacket-Cr. Pt.	17	Blue Bell	02
Julia	01	Booth	36
Mexican	34	C O D. Con	04
Occidental	78	Comb. Frac.	08
Ophir	27	D'field Daisy	‡ 03
Overman	12	Jumbo Extension	1 20
Potosi	02	Pitts.-Silver Peak	06
Savage	07	Round Mountain	42
Sierra Nevada	57	Sandstorm Kendall	09
Union Con	62	Silver Pick	07
Utah Con	04	Central Eureka	10

N. Y. EXCH. Nov. 9		BOSTON EXCH Nov. 9	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Juneau	12‡	Adventure	2
Am. Sm. & Ref., com.	91‡	Ahmeek	393
Am. Sm. & Ref., pf.	110‡	Alaska Gold M.	30‡
Am. Sm. Sec., pf. A	86‡	Algomah	1‡
Am. Sm. Sec., pf. B	83‡	Allouez	55‡
Anaconda	83	Am. Zinc	65‡
Batopilas Min	1‡	Ariz. Com., ctfs.	7‡
Bethlehem Steel	410	Bonanza	36
Bethlehem Steel, pf.	162	Butte-Balaklava	3‡
Chino	52	Butte & Superior	65
Colo. Fuel & Iron	49‡	Calumet & Ariz.	66
Crucible Steel	73‡	Calumet & Hecla	555
Federal M. & S., pf.	50	Centennial	17
Great Nor., ore., ctf.	47‡	Copper Range	58‡
Greene Cananea	39‡	Daly West	2‡
Guggen. Exp.	70‡	East Butte	14‡
Homestake	120	Franklin	9‡
Inspiration Con.	42	Granby	83
International Nickel	186‡	Hancock	15‡
Miami Copper	33‡	Hedley	28
Nat'l Lead, com.	64‡	Helvetia	50
National Lead, pf.	111‡	Indiana	5
Nev. Consol.	15‡	Island Cr'k, com.	43‡
Ontario Min	3‡	Island Cr'k, pfd.	87
Quicksilver	4‡	Isle Royale	27‡
Ray Con.	25‡	Keweenaw	2‡
Republic I. & S., com.	47‡	Lake	12‡
Republic I. & S., pf.	105	La Salle	5‡
Sloss-Sheff'd, com.	58‡	Mason Valley	1‡
Tennessee Copper	52‡	Mass	12‡
Utah Copper	72‡	Mayflower	4‡
U. S. Steel, com	84‡	Michigan	2‡
U. S. Steel, pf.	115‡	Mohawk	82
		New Cornelian	10
		North Butte	30‡
		North Lake	1‡
		Ojibway	1‡
		Old Colony	3‡
		Old Dominion	56
		Osceola	84
		Quincy	85‡
		Santa Fe	3‡
		Shannon	8
		Shattuck-Ariz.	31‡
		Superior	27‡
		Superior & Bost.	2‡
		Tamarack	55‡
		Trinity	9‡
		Tuolumne	33
		U. S. Smelting	43‡
		U. S. Smelt'g, pf.	47
		Utah Apex	3‡
		Utah Con	2‡
		Victoria	2‡
		Winona	3
		Wolverine	59
		Wyandot	1‡

N. Y. CURB Nov. 9	
Alta Con	.14
Beaver Con	30
Big Four	05
Braden Copper	12‡
Buffalo Mines	.50
Can. Cop. Corpo	2‡
Cashboy	.06
Cerrode Pasco	35‡
Chile Cop.	24‡
Con. Ariz. Sm.	1‡
Con. Coppermines	1‡
Con. Nev.-Utah	5/16
Dia. Black B.	.05
Florence	.42
Goldfield Con.	1 1/16
Goldfield Merger	.18
Howe Sound	4
Kennecott Cop.	48‡
Kerr Lake	3‡
La Rose	4
Magma	14
McKinley-Dar-Sa	.30
Mines of Am	2‡
Mother Lode	.30
Nevada Hills	.17
New Utah Bingham	3
Nipissing Mines	6‡
Oro	06‡
St. Joseph Lead	13‡
South Utah	.25
Stand'd Oil of N.J.	482
Standard S. L.	1‡
Stewart	.75
Success	.72
Tonopah	5‡
Tonopah Ex.	2‡
Tonopah Merger	.38
Tribullion	1/16
Yukon Gold	2‡

BOSTON CURB Nov. 9	
Bingham Mines	7‡
Boston Ely	21
Butte & Lon'n Dev.	43
Calaveras	1‡
Calumet-Corbin	.02
Chief Con	.92
Cortez	.50
Crown Reserve	.50
Davis-Daly	1 1/2
Eagle & Blue Bell	1 1/2
First Nat. Cop.	4‡
Houghton Copper	3
Iron Cap Cop., pf.	6
Majestic	66
Mexican Metals	30
Nevada-Douglas	65
New Baltic	3‡
New Cornelia	8‡
Ohio Copper	15
Oneco	1
Raven Copper	10
Rex Cons.	47
Smokey Dev.	15
So. Lake	5‡
Superior Victor	30
United Verde Ext	5‡
Utah Metal	8‡

‡Last Quotations.

LONDON Oct. 28	
Alaska Tred'well	£6 10s 0d
Burma Corp.	1 0 0
Cam. & Motor	0 13 9
Camp Bird	0 7 6
El Oro	0 10 6
Esperanza	0 11 3
Mexico Mines	4 10 0
Nechi, pfd.	0 12 9
Oroville	0 14 0
Santa Gert'dis	0 10 0
Tomboy	1 1 0
Tough Oakes	0 7 0

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.855	28 983	26 553	22.731
February	61 642	57 506	48.477	28 357	26 573	22.753
March	57.870	58 067	50.421	26 669	26 788	23.208
April	59 499	58.519	50 250	27 416	26 958	23 709
May	60 361	58 175	49.915	27 825	26 704	23.570
June	58 990	56.471	49.034	27 190	25 948	23.267
July	58 721	54 678	47.519	27 074	25 219	22 597
August	59.293	54 344	47 163	27 335	25 079	22 780
September	60 640	53.290	48.680	27 986	24 260	23 591
October	60 793	50.654	49 385	28 083	23 199	23.925
November	58 995	49 082		27 263	22 703	
December	57.760	49.375		26.720	22.900	
Year	59 791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66 274	95.333
July	13.223	18.796	60.540	76.011	64 855	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	17.686	‡	72.601	‡	88.000
November	11.739		53.227			
December	12.801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33 360	38.790	150.702	162.675
June	30 577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33 080	‡	151.554
November	33.304		1 9.391	
December	33.601		147.102	
Av. year	34 301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4 111	3.729	4 011	3.548	19.666	18.606
February	4 048	3.827	3 937	3.718	19.606	19.122
March	3 970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3 384	4.499	‡	23.994
November	3.683		3.585		18.500	
December	3 800		3.662		19 097	
Year	3 862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5 262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5 074	14.781	4.924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	19.028	4.770	18.856	21.568	97.250
August	5 568	12.781	5.418	12.611	‡	67.786
September	5 380	13.440	5.230	13.270	‡	67.841
October	4 909	12.800	4.750	12 596	‡	66 536
November	5 112		4.962		25.016	
December	5 592		5.430		27.369	
Year	5.213		5.06			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14 08	13.90
March	15 07	14.55	13 91	13.45	14 10	13.95
April	14.90	14.55	13 90	13.45	14 13	13.95
May	14 90	14.61	13 90	13.60	14 27	13.83
June	14 90	14.70	13.90	13.67	13.96	13.77
July	14 90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14 08	14.75
September	14 90	16.86	13 90	15.95	14 03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14 88		$13.78		$14.01	

The Engineering and Mining Journal

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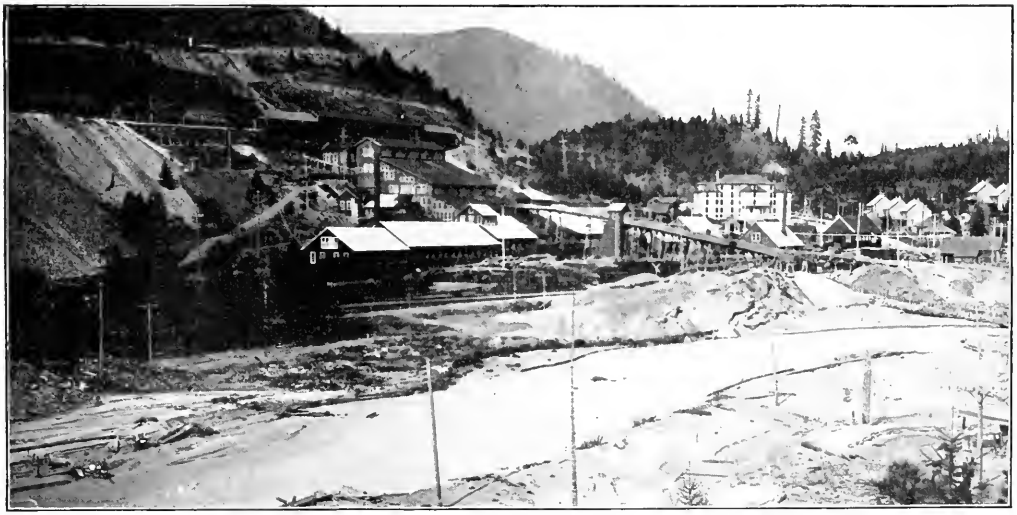
Metallurgy in the Coeur d'Alenes

By Herbert A. Megraw

SYNOPSIS—The ores of the Coeur d'Alene district are varied and complex and have been difficult to treat economically. Their fine structure and the presence of blende and siderite induce serious metallurgical problems. Flotation has been of great assistance in aiding metal recovery from finely ground pulp.

The metallurgical problems of the Cœur d'Alene district of Idaho are varied. The variation is in extent rather than character. Many of the mines produce ores that present only the simple problem of extracting the greatest quantity of commercial metals at the lowest cost, while others, producing ores of highly complex mineralogical character, involve not only the extraction problem, but that of separating the various minerals contained. Upon these problems all the metallurgical plants of the district are working intently and with a degree of success depending largely upon the character of ore to be handled.



THE MORNING MILL, AT MULLAN, WHICH CONTAINS A WIDE VARIETY OF CONCENTRATING MACHINERY

The Metallurgical Problem Not a New One

In considering the metallurgy of the Cœur d'Alenes it may be well to remember that the district is not a new one, but one in which the problems have been attacked over a period of a number of years. Metallurgical skill of a high grade has been employed, and all the successes obtained have been truly earned. With these facts in mind it is clear that any suggestion of improvement ought to be based on careful study of the facts at hand. It would be rash to make superficial observations regarding possible improvements.

The principal part of the Cœur d'Alene district is in Shoshone County, Idaho, in the narrow part of that state, between Washington and Montana. It is near the Montana border and in fact extends close to the state line. There are even one or two properties over the line in Montana. The productive part, however, is principally on the west slope of the Cœur d'Alene Mountains, a rather complex part of the North American Cordillera. The geology, topography and general features of the district are so well known that any review of them here would be entirely superfluous. It is sufficient to say that the structure of the region is complex and that the ores present a great many obstacles to successful metallurgy. This statement ought to be modified to the extent of saying that some of the mines produce ores that are fairly simple and in which one metal will so predominate that all energies are bent toward its recovery. But in other cases the ores are complex and great pains have to be taken, not only to recover the commercially

valuable metals, but to separate them after or during the recovery process.

According to the more careful studies already made, both by the United States Geological Survey and by the companies operating in the district, it has been shown that a large number of metals and minerals exist. Gold and silver have both been found in the native form, but the former is rare in that or any other state, and its recovery has not been found commercially profitable on a large scale. Where found, it is in quartz veins in which some free gold occurs together with auriferous pyrite, chalcopyrite, galena and sphalerite. Native silver was found in the upper levels of some of the mines, particularly in the oxidized ore of the Last Chance mine and in the Hercules. In the lower levels, however, silver is found in combination with lead and with zinc, but its quantity is such that the recovery of the other metals is an essential to the profitable operation of the properties. It is in view of this latter fact that highly developed metallurgy has become an important factor in the life of the district, since it is well known that lead and zinc must be separated if either is to be counted as an asset.

Among the minerals occurring in the Cœur d'Alene ores, galena should be mentioned first, since it is the most important mineral in the district, being a source of the large production of lead and the medium that carries a great part of the silver. It is probable that galena is the most widely distributed mineral in the district, with the possible exception of pyrite. The sulphide of antimony (stibnite) is not rare. It is common in the Wardner district. It forms in small needles or clusters in quartz or, more rarely, in siderite. Chalcocite is found occasionally, but like the antimony, is comparatively rare. Sphalerite, the well-known zinc mineral, is found rather widely distributed, but in quantity not so great as might be expected in view of the great quantity of galena. Sphalerite seems to be more abundant in the mines in Ninemile Cañon and in the neighborhood of Mullan, where it occurs in the Morning mine and considerably complicates the treatment at the mill. Pyrrhotite has been found in Cañon Creek and Ninemile Creek. There is a little of it also in some of the ores from the Morning mine. Both bornite and chalcopyrite occur, although neither of them in large quantities. Pyrite, as has been mentioned, is abundant and widely distributed. All the lead-silver deposits have it, and in the poorer ores it occurs without any valuable metal in combination with it. Pronstite occurs seldom. Tetrahedrite occurs sometimes and has been noted at the Gold Hunter and in small quantities at the Morning mine, near Mullan. It is said to contain antimony but little arsenic, and usually to be in combination with considerable silver.

Influence of Siderite on the Metallurgy

Among the oxides may be mentioned quartz, the most abundant in many of the mines and occurring in all the ore deposits. Magnetite occurs occasionally, as do also limonite and plattnerite, the latter a rare form of lead dioxide. Among the carbonates, calcite is not common, but occurs, as does also dolomite. Siderite, the carbonate of iron, is the most abundant characteristic gangue mineral of the Cœur d'Alene silver-lead deposits. Its presence as a replacement of quartzite constitutes a striking mineralogical feature of the ores. This siderite is one of the most important features of all the Cœur d'Alene ore constituents, and any system of metallurgy must be based upon a thorough cognizance of that fact. It is by no means equally abundant in all the mines, but is prominent in the ores of the Wardner and Mullan group. There are a large number of other minerals that occur in the various ores, all of which tend to complicate the metallurgy of the material. The principal ones have already been mentioned, but the other rarer minerals, which undoubtedly have an influence upon the methods of ore handling, are explained at length in Professional Paper No. 62 of the Geological Survey, to which those who desire further detailed information upon the subject are referred.

Siderite has an important influence upon the handling of the metallurgical problems presented and has been given careful attention and study by the operators of the district. In the paper already referred to, the typical Cœur d'Alene siderite is described as massive, a pale-brown fine-grained aggregate, being not always distinguishable at a casual glance from the quartzite that it has in part replaced. Near the orebodies all gradations exist between nearly pure siderite and a somewhat sericitic quartzite.

The character of the siderite of the Cœur d'Alene district is considered so important in connection with its metallurgical problems that it seems worth while to include the following paragraph by F. C. Calkins in the Geological Survey paper mentioned.

> Siderite occurs in individuals of varying size, but probably the majority of them are larger than the clastic grains of the rock, the mineral being in places crystallographically continuous for a diameter of several millimeters. The form of the individual varies much in regularity. The outlines of many of them, especially of the larger grains, appear ragged, but in such cases the boundaries are seen on close examination to be determined in large part by rhombohedral planes. In other individuals the rhombohedral form of the crystal is more marked, in some being perfect. It is an important fact that in any specimen the crystallographic boundaries can be seen cutting sharply across quartz grains, which proves that the siderite has been developed by molecular replacement of the quartz and not by filling in of cavities. The larger grains in the sandstone and quartzite frequently inclose grains of quartz and, much less commonly, scales of sericite. It is thus evident that the siderite replaces the sericitic fine-grained cementing material more readily than the larger grains of quartz.

A knowledge of the characteristics and formation methods of this mineral will be of great importance in considering the question of ore treatment.

Silver and Lead the Principal Products

In many of the mines there have been large productions of silver and lead from the oxidized galena, which has changed to cerussite. This has practically disappeared, however, at the present time, and the essential lead and silver production is from galena. This mineral occurs in many forms, varying from fine-grained to massive, but is always argentiferous, although the ratio between the lead and silver varies in the different parts of the district. In many of the mines some of the galena occurs so nearly pure that it can be shipped directly without milling, but of course the quantity thus obtained is of no consequence in comparison with the milling production of the district.

The ores are treated in a number of milling plants situated in different parts of the district. The mills now in operation do not include all of those that have

existed in the history of the camp, since some of them have disappeared. The National and the H.E.M. are new. The former is a modern all-slime table and flotation mill, designed and constructed to work the ores of the National mine, but is not yet in operation. The H.E.M. mill has just been completed.

It is a characteristic feature of the Cœur d'Alene district that the mines in different parts produce ores of widely different character. The Bunker Hill & Sullivan mill, at Kellogg, treats a lead-silver ore that is characteristically simple. It consists principally of galena and siderite, there being only minute portions of sphalerite and pyrite. The ore is treated in a series of rock crushers in a separate crushing house and is then delivered over an incline belt conveyor to the mill bins. It is separated by trommels and then concentrated in Harz jigs. Both rolls and Hardinge mills are used for regrinding and Bunker Hill screens for reclassifying.

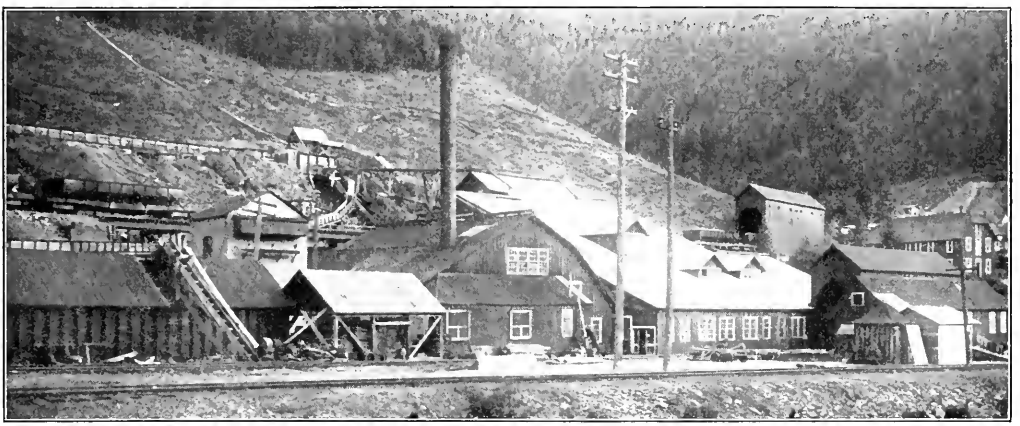
Card tables are used for concentration, and vanners handle the slimes. The slimes tailings are thickened in Dorr thickeners and then sent to the flotation department for further treatment. The whole object of milling treatment at the Bunker Hill is to produce only high-grade material in concentrates. The middlings are all reground and returned until a high-grade product is secured. This extends also to the flotation department, in which cleaning and recleaning are resorted to until a high-grade shipping product is secured.

Complex Ores at the Morning Mill

At the Morning mill, situated just below the town of Mullan, the conditions are noticeably different from those obtaining at the Bunker Hill. The ores are essentially complex, and their treatment is difficult. Galena, the principal ore in all the mines, is here associated with sphalerite, pyrite and pyrrhotite. Siderite, the principal gangue, is accompanied by barite and quartz.

The Morning mill, one of the reduction plants belonging to the Federal Mining and Smelting Co., is one in which all kinds of treatments have been tried in an effort to get the best possible recovery from the ore, and in consequence it contains a widely diverse assortment of machinery. The straight concentration treatment, of course, is patterned after the standard of the district in which rolls, jigs and concentrating tables are used. But there are interesting additional features. There is here one of the few installations of Macquisten tubes. These are designed to make a flotation separation, taking advantage of the tendency of the sulphides to float upon the surface of water when they are gently deposited upon it. The principle is well known, but the plants making use of it are few, there being only two, so far as is known, in the United States. At the Morning mill the process is considered an important step in mill treatment and operates satisfactorily. In addition, a system of froth flotation is also used.

At the Gold Hunter mill, above Mullan, conditions are somewhat similar in that the ore is quite complicated. Besides galena, it contains sphalerite, pyrite, tetrahedrite, stibnite and the gangue materials, siderite, calcite and quartz. The treatment is after the standard system, using rolls, trommels, jigs, tube mills and concentration on Wilfley tables. Flotation is used on the slime tailings, and the flotation concentrates are filtered in an Oliver filter. At the Hunter mill, flotation has been a very considerable aid in the metallurgy of the ore. The Callow flotation machines have improved the mill recovery from 50 to 60%, as obtained by ordinary concentration, to 80%, the concentrates containing only about 6% of silica.



HECLA MILL, NEAR GEM, IDAHO, TREATING ONE OF THE SIMPLER ORES OF THE DISTRICT

The Hercules mill, just below Wallace, has been treating an ore consisting principally of galena. At present the mill is not in operation, there having been some difficulty in making smelting arrangements. It is said that the company has acquired an interest in the Northport, Wash., smelting plant, which is being equipped with lead furnaces and will be used for treating Cœur d'Alene ores. The Hecla mill, near Gem, is another which has an ore of simple construction. The main mineral constituent is galena, and there are only small quantities of sphalerite and pyrite. The ore is treated by the usual combination of jigs and tables, followed, as is now common in the Cœur d'Alene district, by a flotation installation for handling the mineral in the slime tailings. The Hecla mill handles the ores with considerable success and accomplishes a material saving of the contained values.

The Green Hill-Cleveland and the Stewart mills, in Wallace, are both operating after the characteristic system of the district. At the Green Hill mill a large number of experiments in ore treatment have been tried and a large number of flotation tests have been put through. Flotation forms a part of the treatment system here, as in the other mills of the district. Both mills are the property of the Federal Mining and Smelting Co., but the Stewart is under lease to the Stewart Mining Co.

The Frisco mill treats ore that is complicated, since it contains galena, sphalerite, pyrite, chalcopyrite, pyrrhotite and some quartz. It is to be noted that the ores treated at the Frisco mill, as well as those at the Hecla, are noticeably deficient in siderite, a fact that contrasts the treatment with most of the other mills in the district. At the Hecla mill the treatment is simple and easy, but at the Frisco the ore itself is complicated and preparation is not so easy. The general treatment seen at the Frisco mill is that of the standard practice of the districts, which has already been described.

An extremely interesting mill now at work is the Interstate, in Ninemile Cañon, which is treating ores of the Interstate-Callahan Mining Co. This mill is a new one and was prepared for operations just about the time the rise in the price of zinc began. This company took advantage of the situation and, since its product is largely zinc, has made a great deal of money through the operation. The treatment system is the standard crushing, jigging and table concentration system followed in the district, with the addition of a flotation plant for the treatment of the slimes. Other mills working in the same cañon are the Success and the Tamarack.

The National mill, at National, has just been completed and is a modern all-slime table and flotation plant, designed to treat the copper ores of that section of the Cœur d'Alene district. The mill was started and operated successfully, but for some unknown reason has been shut down for some time. Another mill now operating, which has not been described, is the Sweeney mill, at Sweeney, the property of the Federal Mining and Smelting Co. The practice in use there is the same as at the principal mills of the district. The Success, Marsh and Tamarack & Custer are other mills now in operation.

Metallurgical Problems of the District

The principal problem in Cœur d'Alene metallurgy, in common with any metallurgy anywhere, is the separation of the minerals from the gangue. With the simpler ores of the district there has been no great difficulty with this problem, since all that is necessary is a moderate degree of crushing to enable the minerals to be isolated. The separation is accomplished by means of jigs and concentrating tables, usually giving good results. The problem occurring in former times was one principally of handling the slimes produced in the normal course of crushing. The character of the minerals (galena, siderite, etc.) tends perceptibly toward brittleness, and therefore much slimed material was produced in the crushing process. It was formerly handled by slimes tables or vanners when it was handled at all, but the recovery was not all that could be desired. The introduction of flotation has been of great assistance to this step in the metallurgy, making it possible to recover much more of the minerals contained in the slimes.

In the cases where the gangue is principally siderite, the separation of this material from the minerals desired is not so easy. Siderite is an iron mineral itself, and in the rough concentrating processes it is likely to remain largely with the lead and zinc minerals, since its specific gravity is nearly the same as that of blende. In such cases recrushing and stage concentration were necessary. The usual process is to concentrate first, giving a clean mineral, a clean tailing and a mixed middling. The last is then recrushed and reconcentrated, the process being repeated several times until the amount of middling is so small as to be negligible.

After the separation of minerals from gangue, the great problem is in the separation of the lead and zinc. The only way in which this can be accomplished is by repeated step concentrations and regrinding of middlings. Here the flotation process has been of immense assistance, since it enables the successful concentration of minerals ground to an extreme state of fineness—a material that would have been unmanageable under the conditions obtaining a few years ago.

Influence of Microstructure on Metallurgy

Among the complex minerals of the Cœur d'Alene district, there are some in which the ore structure is so complex that successful concentration results are not possible. In many cases the character of the ore is identical with that of ores of extremely high grade, and in many cases the assays show so much value that it might be supposed that a slight degree of concentration would produce concentrates of salable grades. A study of the structure of the ores, however, shows that they are no better than waste. The galena, pyrite, siderite and sometimes chalcopyrite are variable and sometimes extremely complex. The problem hinges entirely on the microstructure of the ores, since there are fine inclusions of ore minerals in gangue. Under the microscope the essential and characteristic feature is the distribution of multitudes of microscopic specks and threads of galena and siderite as inclusions in a mass of nonmetallic gangue. The galena is held in microscopic threads and specks as inclusions in the siderite gangue. This fine dissemination compels extremely fine crushing and complicates the metallurgy. In many cases the intermingling of the minerals is so finely grained as to be microscopic, making it altogether impossible to crush fine enough to allow a separation of the two minerals. It is possible, however, to improve the extraction with the finest of grinding, and it is upon this point that flotation has come to the aid of metallurgists and allowed successful handling of these materials ground to an extreme state of subdivision.

Japanese Sulphur Industry

The export of sulphur from Japan has for years been on the decline, some of the small mines having been compelled to stop working. But since the war broke out, the demand in the foreign market has improved and quotations have gradually risen. The export this year up to the end of August, according to the *Japan Advertiser,* was 27,948,607 lb., valued at $203,048, showing an increase of 4,638,451 lb., compared with the figures for the corresponding period of last year. The destinations have in the past been the United States and Australia in the

main, with Canada and India coming next, only an insignificant amount being shipped to Europe. Since the war, however, the European supply to Oriental countries has been stopped and the demand in Europe itself has increased.

Mineral Output of New York

The mineral production of New York in 1914 is given as follows in a report on the mining and quarry industry of the state, by David H. Newland, assistant state geologist: Cement, portland and natural, 5,899,804 bbl.; salt, 10,389,072 bbl.; natural gas, 8,744,681,000 cu.ft.; iron ore, 751,716 long tons; gypsum, 513,094 short tons; petroleum, 933,511 bbl.; mineral waters, 8,480,669 gal.; talc, 74,075 short tons; pyrite, 61,513 long tons; graphite, 2,483,339 lb.; garnet, 4,026 short tons; feldspar and quartz, 2,375; metallic paint, 7,321; crude clay, 7,109; emery, 763 short tons. Other mineral substances, including limestone, sand and gravel, sandstone, granite, marble, apatite, diatomaceous earth, etc., to the value of $8,164,810 were also produced.

The production of iron ore showed a marked decline from that of the preceding year, which was 1,217,899 long tons. Other changes were not large, except in the case of salt, which declined about 430,000 tons, and talc, which increased about 11,000 tons.

Advance in Chemical Prices Due to the War

The Boston *Transcript* has compiled a table showing the advance in chemical and drug prices caused by the war. From this table some of the chief inorganic items are reprinted here.

CHEMICAL PRICES

Material	June 1, 1915	Nov. 5, 1915
Acetate of lime, cwt.	$2.50	$14.50 @ $14.55
Acetic acid, U. S. P., lb.	$0.04½ @ .05	.07½ @ .08
Alum, potash, cwt.	3.50 @ 4.00	6.25 @ 7.00
Arsenic, red, lb.	.07¾	.19 @ .20
Bichromate of potash, lb.	.16	.24 @ .25
Bichromate of soda, lb.	.06	.17 @ .18
Bromine, lb.	.82	5.00 @ 5.50
Chrome alum, lb.	.08	.21 @ .23
Lead acetate, lb.	.10½	.13 @ .13½
Magnesium chloride, ton	$32.00 @ 36.00	75.00 @ 80.00
Muriate of potash, ton	155.00	300.00
Permanganate of potash, lb.	.65	1.25 @ 1.50
Prussiate of potash, red, lb.	.70	4.25 @ 4.75
Prussiate of potash, yellow, lb.	.53	.80 @ .85
Zinc dust, lb.	.16 @ .16½	.35 @ .40

Mining in India in 1914

The Chief Inspector of Mines in India has just issued his annual report for 1914. In addition to information regarding persons employed, accidents, health and sanitation, the following figures of output are given: Mica, 38,189 cwt.; manganese, 555,672 long tons; gems, 304,042 carats; gold, 19,813 oz.; copper, 4,400 long tons; wolfram, 31,526 cwt.; bauxite, 9,280 cwt. Iron, slate, fuller's earth, salt, chromite, magnesite and other minerals were produced, but the quantity is not stated.

It should be noted that this report does not give a complete review of mining in India, but confines itself to those mines and quarries coming under the scope of the Indian Mines Act of 1901, which excludes quarries under 20 ft. deep. The complete figures are given in the records of the Indian Geological Survey.

Mining Methods at Braden*

"El Mineral Teniente" property of the Braden Copper Co. at Rancagua, Chile, is situated on the rugged slopes of a part of the main Andean Range in latitude 34° south and longitude 71° 20′ west, at an altitude of about 8,000 ft. The mine is a very old one, dating its history, as stated by William Braden†, back to the Eighteenth century. The mine operations up to 1906 were on a very small scale and consisted of a gopher system of mining rich veins, concentrating by hand sorting, and transporting about 15 mi. by mule-back for direct smelting. At that period the operations of the American company commenced in earnest, and from that time on the mine has gradually been enlarged, until it has attained its present 3,000- to 3,500-ton daily output.

The deposit consists of a series of irregular lenses formed about the periphery of an old volcanic plug slightly tilted to one side. On one edge the surface has been eroded and has lost its mineral completely; for active mining operations about four-fifths of the circumference of the crater is left. The volcano itself would rank as a fairly large one, having a diameter of about ¾ mi. and a roughly circular outline about 2½ mi. long. The country about the mine consists of andesite flows through which the tuff plug now occupying the crater was forced.

Brecciation Favorable to Ore Deposition

The materials close to the volcanic center were so thoroughly shattered that they formed a brecciated deposit, making a most favorable point of deposition; and it is in the brecciated portions of the lenticular orebodies that the richest ore is found. The mineral sulphides, however, formed ore in the andesite at some distance from the crater. Generally speaking, the materials with which the mine is interested are the tuff composing the volcanic plug, the breccia, and the andesite composing the country rock. As a rule, the tuff is not mineralized except close to the breccia contact or at such points as fumarolic vents have been formed. The actual contact between the tuff and breccia is not always distinct, but the former includes rounded fragments of porphyry and the latter, angular fragments of andesite, which makes the difference easy to detect.

The contact between breccia and andesite is easy to note as a rule, but on the Teniente side the gradation from shattered andesite to andesite breccia is a most perplexing one. The breccia does not always appear as an intermediate material between the tuff and the andesite, but on the tuff-andesite contact the ore is not so rich nor the width so great. At various places in the mine old fumaroles are encountered in which oxidation has taken place at depth, and at times small chambers containing heads of wire copper coated with oxide are found in company with the usual black sulphides and oxides and yellowish iron stains of limonite.

The limit of ore on the crater side is generally the tuff, although sometimes false contacts—thin tongues inserted into the breccia—occur, on the inside of which there is good ore-bearing breccia. On the country-rock side the limit of ore has to be determined by assay, but is also detectable by the lessening of the fractures and the blockier appearance of the andesite.

*Excerpts from article by H. R. Graham in "Teniente Topics," Sewell, Rancagua, Chile.

†"Eng. and Min. Journ.," Sept. 4, 1915.

The copper ore occurs in both breccia and andesite, essentially as primary sulphides in the form principally of chalcopyrite, as bornite, as secondary chalcocite, a black sulphide between tetrahedrite and enargite and some of the carbonates, silicates, sulphates and oxides of copper. Zinc blende, iron pyrites, magnetite, galena and occasionally native copper are also found.

The topography of the region is steep and rugged, devoid of vegetation, frequently visited by strong winds, heavy snows and snow-slides. This topography aids mining, drainage and ventilation by allowing the mine to be opened by adits, but makes difficult its operation by the lack of safe room for buildings and storage of supplies and by the difficulty of access.

On the upper levels of the mine live between 500 and 800 people, who are housed either in large rooms cut in the rock or else in wood and *calamina* houses perched on the hillsides.

The Mine Development

The mine consists of three principal orebodies—the Fortuna, the Regimiento and the Teniente—with a total reserve of about 90,000,000 tons, developed and probable, with good prospects for largely increasing this tonnage by future development. The two smaller orebodies, of secondary importance but included in this tonnage, are the Centinela and the Bornite. The Teniente orebody is now being developed to an operating stage. The full extent of ore in this section has not as yet been determined.

The Fortuna orebody, from which all the ore at present is being won, is operated by the principal levels, where, with the exception of three, shrinkage stoping operations have been nearly completed and caving is now in progress.

Development consists of driving adits along the contact of the tuff and breccia or andesite. Once the ore is reached, crosscuts are put in about every 34 m., and in this way, blocking out every 100 ft., the plan area of the ore at that level is determined. The extent of ore was first determined in the Fortuna on the No. 2 level, then blocked out on the No. 3 level in the same manner, and the ore between them proved up by inclined raises running from the tuff to the limit of commercial ore and back, to ultimately connect to the level above. The tuff is on the hanging wall.

After a block of ore is outlined the crosscuts used in developing the body are utilized as starting points for the actual mining operations. In these crosscuts small raises, at from 7- to 8-m. centers, are driven up into the ore at 45 deg. until the face of the raise reaches the far side of the stope. In some cases this is 10 m. on the incline in the old system; in the present Teniente system it will be about 5 m. When this drive is completed, a timber chute with an arc gate is erected. A machine of the standard stoper type is put to work, and these various raises are connected, one to the other, by a belling-out process, which ultimately leaves a series of circular holes. These at last extend across the orebody.

In the meantime, in the pillar left between each two of these sets of openings an inclined raise has been driven, and at a point about 12 m. vertically above the level a horizontal working known as *cruzado* is driven from the raise to a stope formed by the joining of all the chute holes. The width of this stope, depending on the kind of rock, is generally 22 ft., and the length, dependent on the width of the orebody, varies from 60 to 350 ft.

Once the *cruzado* is connected, the chutes are allowed to fill up with broken ore, after which all communication between stope and level is by these *cruzados*. The stope is filled with broken ore to within 6 to 8 ft. of the back and then trimmed into shape by means of carefully placed holes put in by the hammer drills. Pipe lines are run up the inclined manway raises to supply air for the operation of the drills and to the rooms for ventilation. Once the stope is "lined up," machine drillers start work in the ratio of about one drill to every 40 ft. of stope length. An average drill shift consists of fifteen 5-ft. holes per machine, which should break, with 1½ sticks of ordinary 34% gelignite per hole, about 60 tons of average stope rock. On the principle that each cubic meter of rock in place occupies $1\frac{3}{4}$ cubic meters when broken, it is possible then to draw out 24 tons for each 60 tons broken and leave the same distance of 6 to 8 ft. between the unbroken back and the broken ore pile.

Stoping and Caving

No holes are drilled in the center of the stope, but each drill from the extreme wall drills one vertical hole and one slightly inclined hole toward the center of the stope. Then at a 5-ft. distance, the miner drills two more similar holes and continues thus until his shift is over. By alternating this process from one side day shift and the other side night shift, a great deal of rock in the center of the stope is robbed of its side supports and has to fall by itself, which tends to cheapness. All stope work is done on contract price per foot of hole. Additional men are employed to deliver steel to the stopes; mechanics repair machines and keep air lines in shape; and on the level below, trammers continually draw off the excess break to leave the working space necessary between the back and the ore pile.

This stoping operation goes on until the back reaches a point 30 ft. below the level above, at which point a final blast to fill the stope is fired and the work discontinued. The raises in the pillars are continued to connect to the level above for ventilation, and as one pillar raise is run in the hanging-wall end and in the next pillar in the foot-wall end, each stope always has at least two entrances and a continuous natural ventilating draft. The drillers load and shoot their own rounds; each shift at 15 min. before quitting time has all its holes ready to spit. When the raising is finished, the stopes are left filled until caving operations above have been completed.

The best arrangement of stopes as developed here, to suit the ground, is to have a 7-m. stope and a 5-m. pillar, which, in the case of bad ground, can be changed by narrowing up the stope and increasing the pillar without having to change in any way the level workings. Chutes are best spaced about 7-m. centers, and it has been found by experience that 50-m. differences in elevation between levels make stopes most easily worked. Each stope has its crosscuts immediately under it and running parallel to it, that is, across the width of the orebody.

In the beginning of operations no timber except chute sets and a slight amount of material for crossings and station sets is needed, but when stoping operations cease and caving begins, more timber is necessary to hold open the haulage drifts. As the whole success of caving depends on the superincumbent pressure that can be brought to bear on the unbroken pillars, it is necessary to secure weight as quickly and as evenly as possible, and that means heavy ground on the haulage ways. These ways then have to be timbered, relieved, caught up, angle-braced and kept in repair.

The process of caving consists of cutting off the pillar at the foot wall and hanging wall by means of small stopes, or by running raises in which large blasts are fired, either electrically or with fuse, and then by running a pillar drift along the bottom of the pillar immediately above the level and blasting a series of pits here, the pillar is completely cut off and has to fall. If by any chance it tends to arch, this arch is broken by a heavy blast. The material resulting from the chute blasting is pulled out and the pillar caves down.

The most important consideration is the securing of even weight and then an even pulling so that the extraction is not spoiled by waste admixture. Definite data are kept on each chute; its expectancy above the level is figured and its extraction calculated when waste definitely appears. Careful chute sampling is done on the caving level, and chutes running below commercial grade are abandoned unless it is known that the chute has ore above it. In case there is known ore above and the waste is merely a little fine material that has sifted through, the chute is run, the material sent to waste and samples taken until it runs ore again.

Nevada Consolidated Report

Nevada Consolidated Copper Co. reports for the third quarter of 1915 a production of 18,516,121 lb. of copper, divided as follows: July, 6,292,413 lb.; August, 6,201,858 lb.; September, 6,021,850 lb. During the quarter 837,374 dry tons of Nevada Consolidated ore, averaging 1.66% copper, was milled, a decrease of 11,781 tons from the previous quarter. Of the tonnage milled, 98% was supplied from the pits and 2% from the underground workings of the Ruth mine. In addition, 29,681 dry tons of Giroux Consolidated ore was milled. The cost of copper produced, including Steptoe depreciation and all charges except ore extinguishment and after crediting all miscellaneous earnings, was 8.01c. per lb., as compared with 8.93c. for the previous quarter. The earnings for the quarter are computed on the basis of 15.876c. per lb., and all unsold copper on hand and in transit is carried in inventory at 13½c. per lb. Gross earnings for the quarter were $1,590,621. Depreciation of plant and equipment was $143,879; ore extinguishment, $84,593; and $749,796 in dividends were paid, leaving a net credit to earned surplus of $612,352. At the pits 866,713 cu.yd. of overburden was stripped during the quarter. Work was also actively continued in preparing the Ruth mine for underground operations, with the result that at the end of the quarter the hoist and underground trolley were running smoothly, the living quarters were about finished, and it was expected that all of the surface work with the exception of the installation of a larger air compressor, already ordered, would be complete by the end of October.

Earth Tremors on the Rand

By A. Cooper Key*

Johannesburg has been experiencing earth tremors lately. No serious damage has been done to buildings, but in some cases cracks have developed and the question of insurance against damage is being discussed. The subject of causation and prevention of tremors is being investigated by a committee consisting of R. N. Kotze, government mining engineer; R. A. T. Innes, Union astronomer; and David Wilkinson, consulting engineer of S. Neumann & Co., mining financiers.

In the year ended June, 1911, there were 19 tremors; to June, 1912, 36; to June, 1913, 113; to June, 1914, 186; and to May, 1915, 466. The shock zone has a radius of about 3 mi. from the center of the town of Johannesburg.

H. E. Wood, chief assistant at the Union Observatory, Johannesburg, believes the shocks were due to mining operations, but does not think there is any danger to life and property on the surface by the tremors. Earthquakes, said Mr. Wood, always went over fairly large areas and involved the shifting of hundreds of millions of tons. In the case of the Rand, the amount of energy distributed could not be very large and local tremors were probably occasioned by relief of local strains only. A self-recording seismograph in use at the observatory enabled the separating, with no difficulty, of records of local tremors from those of more distant origin.

The record tended to show a rapid increase in the annual frequency of the tremors, but the numbers were affected by increased sensitiveness of the machine. The frequency and intensity of the tremors should increase from year to year, but there was no definite sign of any annual, weekly or diurnal period. The source of the disturbances was in the near vicinity of the Witwatersrand and confined to a small region at a comparatively shallow depth. If the source of disturbance were very deep, say several miles, the tremors would be felt simultaneously over a much larger area. But records of simultaneous shocks along reef towns are rare.

This led to the inevitable conclusion that the local tremors must be considered the result of mining operations. He did not think water pumping was a serious contributory cause, nor that air blasts or pressure bursts were directly connected with a local tremor. He considered the local tremors were the result of the natural tendencies of large subterranean cavities to close up under the influence of gravitation. This tendency is more marked as the horizontal dimensions of the cavities are greater than their vertical dimensions, which is the case on the Rand. The greater part of Johannesburg is built on strata below the reef, and the region will be subject to vibration effect, but not to any actual bodily displacement or subsidence. The possible danger has been recognized and methods of mining have been adopted to combat it.

Mr. Kotze, government mining engineer and chairman of the commission, said that in some instances where there had been underground subsidence, the surface of the mine had dropped 14 in., yet no shock had been recorded. On the other hand, it seemed that shocks had been simultaneously recorded with mine-working subsidences.

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*P. O. Box 3621, Johannesburg, South Africa.

E. J. Moynihan, an official of the Union Mines Department, declared that the primary cause was that the mining companies had made a tunnel in the earth some 30 mi. long and a few feet high. They had been widening this for 20 years until, on the average, it was something like a mile wide. The tunnel was also inclined in the direction of its width. Well, the roof was falling in. That was all. Then there were secondary causes. There was the contraction of the wedge overlying the tunnel due to its falling temperature, as the air circulating through the tunnel had cut off the upper wedge from direct conduction of heat from the mass of the earth below. Temperature in the upper wedge had consequently been greatly changed and much lowered in course of time. The wedge as a whole contracted and its center of gravity moved downward, which accounted for the shearing of formation above the drive pillars on the southernmost of the reefs worked. It also tended to make the strata part on the lines of strike faults, thus allowing fault blocks to slip vertically. Pumping operations tended to produce effects similar to those caused by contraction. A possibility to be borne in mind was that the thrust against the granite boss, which had tilted and faulted the Rand beds, was not a "dead" thrust, but still "living" and in operation.

Sand filling or something better would have to be adopted systematically and generally. Even so, the increase in the severity of the tremors was likely to continue for many years. He suggested filling stopes with coarse rock, then filling with stuff the size of macadam and finally flushing in as much sand as possible into the remaining interstices. The total compression in such a mass would be very much less than in the mere mass of sand flushed down with water. He believed that, with a proper amount of compression, sand filling would stop the tremors in five or ten years.

J. H. Twiddy, deputy inspector of mines, attributed the tremors to mining operations. He thought the tremors were caused by slips along faults.

A. C. Sutherland, mining surveyor in the Mines Department, thought a connection had been clearly established in some instances between the shocks and underground happenings. He believed they could be lessened by the removal of the small pillars. The pillars to be left should be very big. Sand filling would lessen the tremors, as it would pick up a certain amount of weight, but it would not do away with the shocks altogether.

Business of Henry R. Merton & Co. Supervised by British

An inquiry to the president of the Board of Trade in London, regarding the supervision that was being exercised over Henry R. Merton & Co. and other companies in which alien enemies were interested, elicited the response, according to the *Financial Times* of Oct. 29, 1915, that an inspector of Henry R. Merton & Co. had been appointed on Oct. 3, 1914, and that subsequently a supervision of the business had been appointed under the provisions of Section 12 of the Trading With the Enemy Amendment Act of 1914.

Speaking generally, the president of the Board of Trade is quoted as saying that "it was not proposed that all companies controlled by alien enemies be stopped from continuing to do business, as some of these companies serve a useful purpose. The businesses are conducted under restrictions imposed by the Trading with the Enemy acts and I doubt whether it would be expedient in the public interests to prevent their being carried on."

Metal-Mine Accidents, 1914

According to figures compiled by Albert H. Fay, mining engineer, Bureau of Mines, the number of fatalities in the metal mines of the United States during 1914 was 559, as compared with 683 in 1913. The number of men employed, however, for 1914 was 158,115 as compared with 191,276 in 1913. There is a slight reduction in the fatality rate over the previous year, the rate being 3.54 per 1,000 employed in 1914, as against 3.57 in 1913. There were 5,073 serious injuries, which resulted in a loss of time of 20 days or more, as compared with 5,890 for the preceding year. The serious-injury rate for 1914 is 32.08 per 1,000, as compared with 30.79 for 1913. There were reported 25,143 slight injuries, which resulted in a loss of time of less than 20 days, as compared with 27,081 for the previous year, or 159.02 per 1,000, as compared with 141.58 for the preceding year.

The higher injury ratios, however, for 1914 are not necessarily due to the increased hazard of mining. The enactment of workman's compensation laws and the educational campaign that has been carried on for the last three or four years by the state inspectors, mine operators and the Bureau of Mines have resulted in the mining companies keeping better records than formerly. The figures reported for 1914 are therefore more nearly in accordance with the hazard of the industry than were those for previous years. The number of companies reporting accidents in 1914 was 4,805, of which number 585 represented copper mines; 3,536, gold and miscellaneous metal mines; 196, iron mines; 248, lead and zinc mines in the Mississippi Valley; and 240, miscellaneous mineral mines.

The metal-mine-accident report for 1914 contains also a study of mine accidents by mining methods, which is a departure from the previous reports and brings out some valuable information concerning stoping, caving and room-and-pillar systems of mining as related to mine accidents. This part of the report deals with 258 mining companies representing 75,453 employees actually engaged in underground or openpit mining, exclusive of those employed at surface shops and yards. The fatality rate for the various mining methods, classified, is as follows:

Overhand stoping in narrow orebodies	4.90 per 1,000
Overhand stoping in wide orebodies	5.23 per 1,000
Room and pillar	5.76 per 1,000
Caving systems	5.10 per 1,000
Openpit with steam shovel	2.50 per 1,000
Openpit without steam shovel	2.28 per 1,000

The average fatality rate for this group of mines, based on underground and openpit employees, is 4.78 per 1,000 men employed. The serious-injury rate for the same group of mines is 51.67 per 1,000, while the slight injuries show 270.46 per 1,000.

The states of Kansas, Minnesota, New Jersey, New Mexico, Oregon, South Dakota and Virginia, and the territory of Alaska show a reduction of more than 20% in the fatality rate as compared with the preceding year. Nevada and Montana are the only states that show a continuous reduction of fatal accidents during the four years covered by the bureau's reports.

Motor Travel in Desert Country

By Lewis H. Eddy*

SYNOPSIS—Record of 500 miles of automobile travel over mining districts in southern California desert country. An average of $25 per day, or 40c. per mi., for use of automobile and service of driver, carrying two or three passengers, is the usual rate. Even this high cost is more economical than horse stage or team transportation if saving of time and the opportunity to travel at will are important. Motor vehicles are coming to be the logical successors to horse stages and freight teams in desert transportation and in the development of opportunities for railroad advancement.

The automobile is crowding the burro off the desert and rapidly reducing the number of horse-stage stations. The motor truck is gradually displacing the freight wagon and lowering the cost of haulage. The railroad is advancing into the regions explored by the automobile and broadening the trail of the prospector. During three weeks of travel by rail and automobile we saw only six burros in action—five at Randsburg ready for the trail, and one under the saddle in Panamint Valley. We saw only two horse stages—one between Ballarat and Skidoo, the other between Ogilby and the American Girl and Tumco mines. But we saw probably 50 automobiles carrying passengers or loaded with parcel post, express and mail, and motor trucks hauling ore and supplies. Deserted stage stations were numerous—concrete railway stations increasing. The automobile and motor truck are on the desert to stay, and the manufacturer that studies desert transportation will find a large field for exploitation and opportunity for improvement in design and construction.

THREE METHODS OF TRANSPORTATION IN THE WESTERN DESERT COUNTRY
First the "desert rat" with his burro; then the classic stage coach, and now the automobile

Crossing the Desert to Reach the Hills

Desert travel and the geological and topographical situation of the mines and their relation to the desert regions in southern California are not generally understood. Metal mining on the flat floor of the desert is not common practice. Some of the mines are situated in low isolated hills immediately surrounded by broad plains more or less arid, but usually they are in the foothills that form the rim of the desert, or in the higher ranges that separate the regions. The gold placers are in the gulches and low hills. Saline deposits are in the lower flat regions or in natural depressions. However, it is necessary to cross desert country to reach most of the mines in the Mojave, Death Valley and Yuma regions, and the most economical mode of travel is by automobile to points where the railroads have not been extended. If you own your automobile you may, with assured economy, start from any point south of Tehachapi and cover the entire desert regions of southern California and southwestern Arizona without going a mile by rail. If you are dependent on hired automobiles and unacquainted with the country and the roads, you had better make some use of the railroads. In either case it is not wise to travel alone. My visit to mining districts in these regions was in company with H. M. Wolflin, mining engineer, of San Francisco, whose duty was the inspection of mines under the workmen's compensation law.

We started from Los Angeles, traveling by rail via San Bernardino to Kramer, a station on the main line of the Santa Fe, where we transferred to the Randsburg branch. This runs north through the main body of Mojave Desert and has its terminus at Johannesburg, 35 mi. north of Kramer. Johannesburg is situated at the eastern edge of Kern County in a small basin between Rand Mountains on the west and Red Mountain on the east. Randsburg is a mile and a half west, situated in a similar basin in the Rand Mountains. Both towns are geographically and topographically of the desert. But the midsummer visitor imagines he is on the desert, and imagination goes a long way toward establishing belief.

Mining Camp on the Edge of the Desert

Atolia, the tungsten camp, 5 mi. southeast of Johannesburg, on the western edge of San Bernardino County, is geographically within the Mojave Desert, though the elevation is only 300 ft. lower than at Johannesburg and Randsburg. The contour line of the United States Geological Survey places Atolia at 3,250 ft., and the bench marks give the elevation of Johannesburg at 3,536 and Randsburg at 3,523 ft. above sea level. Considering the altitude, you would say this is not much of a desert. It is a desert only by distant relation and by lack of greater development of water resources. Wait till you get to Panamint Valley and on the edge of Death Valley or down Yuma way. You will then recall Atolia as merely a warm spot on the railroad and Johannesburg and Randsburg as oases. We suffered as much discom-

*Associate editor, San Francisco, Calif.

fort from the heat of the sun in the garden regions of Sacramento and San Joaquin valleys as in the Randsburg region.

Some people imagine that Skidoo is a desert mining camp and a pretty close relation to Death Valley. It is 15 miles west of the center line of the valley and about 6,000 ft. higher. You must cross either Panamint Valley or Death Valley to reach Skidoo, but after you are there you forget all about deserts.

These statements should not be construed to mean that desert travel in the regions we traversed is an enjoyable outing. On the contrary, it is a man's job to cross Mojave Desert and Panamint Valley in any month between April and October, and the wise man keeps away from Death Valley during that period unless his wisdom is of the desert. During the two weeks spent in these regions we made headquarters at Johannesburg, visiting the mines in the Randsburg, Stringer and Atolia districts afoot and by automobile, and made two visits to Searles Lake and one to the Skidoo district. After completing work here, we traveled by automobile from Randsburg to Mojave, stopping on the way at Kaehn Springs and Cisco; thence by rail to Yuma and from that point by automobile to the American Girl and Tumco mines in Imperial Valley. In Randsburg region and the Searles Lake and Skidoo districts and to Mojave, we traveled in an Overland machine driven by Ed Neihaus, of Randsburg.

Cross-Country Motor Travel not Cheap

The usual charge for automobile service in the mining districts of southern California and southwestern Arizona is $25 a day for two or three passengers. This charge varies according to roads, distances, and other conditions that may not always be foreseen. A short day and an easy road may reduce the cost, and a long hard day over bad roads may increase it. For the first trip to Trona and return to Johannesburg we paid $25. The direct distance to Trona and return is 80 mi. The trip included an early morning visit to Atolia and a 10-mile drive over Searles Lake. Including the time spent at supper at Garden station the trip occupied 14 hr. For the journey to Skidoo and return to Johannesburg, including two nights and one day at the mines, we paid $100. We occupied one day each way on the road, including a short run off the road to the Cashier mine at Harrisburg and two stops at Trona and time consumed with motor and tire troubles. The total distance traveled was 220 mi.

One hundred dollars for two days' actual use of an automobile and three days' employment of the driver seemed quite liberal and 45c. per mile a rather high transportation rate. But there were compensations. We saved two days' time and traveled when we pleased and stopped where we liked. We could have stopped two or three days longer at the mines or anywhere on the road at an additional cost of $5 per day. We could have made the trip to Skidoo by stage and return for $34 each, a saving of $16 each in money, but we would have been obliged to travel to Ballarat both going and returning and to remain there two nights. The travel would have occupied two days by automobile and two days by horse stage, without opportunity to make the desired stops.

Prior to the completion of the Trona R.R. a motor stage between Johannesburg and Ballarat and a horse stage between Ballarat and Skidoo were operated by Rinaldo & Clark, of Johannesburg, and since the completion of the railroad the auto stage runs between Johannesburg and Trona, connecting with trains, and thence between Trona and Ballarat. The horse stage still operates from Ballarat to Skidoo, but arrangements can now be made for direct service between Skidoo and Trona. Ballarat is 20 mi. northeast of Trona and several miles off the direct road through Panamint Valley to the Skidoo district. The Trona R.R. connects with the Southern Pacific (Olanche branch) at Searles station, 12 mi. north of Randsburg. There is no stage connection between Randsburg and Searles, but special auto service can be provided.

Some Visits Made Conveniently Afoot

Much of the visiting at Randsburg and vicinity, including the Yellow Aster, the Consolidated, the King Solomon, the Butte and the Phœnix mines and the Phœnix and Red Dog mills, was done afoot, where an automobile would have been practically useless. It can be done with less effort and about the same speed by saddle horse, but if your legs are good you had better use them and not bother with a horse. The cost of automobile travel in Randsburg and Stringer districts was not enough to warrant the time and worry of finding and trying out a cheaper mode of transportation. One day we covered a large amount of ground by automobile and afoot at a cost of $7.50 each. On two half-days we accomplished a surprising amount of work by automobile at a total cost of $8.50. The journey from Randsburg to Mojave, a distance of 60 mi. over the worst sand road in these entire regions, cost us a total of $25. We started at 7 a.m., stopped five or six hours at the Consolidated Salt Co.'s works and at the California Gypsum and Hollow Tile Co.'s plant, and arrived at Mojave at 3:30 p.m. We used the Overland in actual service six days, traveling 430 mi., for which we paid $172—an average of 71.5 miles a day at an average rate of 40c. per mile. Including one day's layover at Skidoo and one day spent overhauling the machine, Neihaus was employed a total of eight days, making his average earnings $21.50 per day. The higher cost in the Mojave district and the Yuma region brought the average cost for the entire trip to 42.5c. per mi. This rate should be lowered on a second trip, but there is no certainty that it would be.

Immediately upon arriving at Mojave, we engaged a Buick and driver at the outrageous rate of $4 per hr. for a short visit to the Mojave Consolidated mine, four miles distant by fair road. The travel occupied about 30 min. and we were at the mine about an hour and a half. Wolflin made another visit to the Mojave on the following day and the next day visited the Tropico mine at Rosamond, 15 mi. south of Mojave, with the same automobile at a more reasonable rate. I was due at San Bernardino on the day following our arrival at Mojave and left on the Santa Fe at 2:45 a.m., arriving in time for breakfast; Wolflin joined me three days later.

We left San Bernardino by evening train on the Southern Pacific, arriving at Yuma about midnight. We immediately engaged a Reo machine and driver at a cost of $25 to carry us the next day to the American Girl and Tumco mines in Imperial County, Calif., 20 mi. northwest of Yuma. We could have made this trip by horse stage from Ogilby, a station about seven miles southwest of the mines on the Southern Pacific, but owing to lack of hotel accommodation it would have been necessary to go

to Yuma and then return next day by rail to meet the stage at Ogilby. This meant over night at the mines, where there is no hotel. While negotiating for automobile service we were informed that the mines were 39 mi. distant from Yuma. We knew from the Geological Survey Yuma quadrangle that the American Girl mine is 9 sectional miles north and 11 sectional miles west from Yuma and that the Tumco mine is just 2 sectional miles farther north and the same distance farther west. Anyway, the automobile hire would be $25.

When ready to start in the early morning, there was delay due to the assembling of a committee of citizens in two other automobiles, who were going along to view out a new and shorter road to the mines, and we were supposed to follow them and make the travel easier for ourselves. Of course we did not follow them. They followed us. That is why we waited for them. Our driver knew the way because he and his business partner had been traveling this new road and some parts they had pioneered. The fact is, that after crossing Colorado River we followed approximately the road delineated by the Geological Survey 10 years ago, though some shorter cuts had recently been made and others were being tried out. The road mentioned as being 39 mi. long is the road to Picacho mine, 20 mi. almost due north of Yuma, from which a branch road runs west and through the cañon to the American Girl. The distance to the Tumco by this road is about 30 mi., but by the road we traveled not more than 20 mi.

I returned to Yuma in the automobile that afternoon, making the run from the American Girl in about an hour and a half, and that was lively going considering the character of the road. I ventured to express surprise at the speed we were making after I had stood about as much jolting as I thought was due, and was informed that the buoy ferry quit running at 5 o'clock, and if we did not beat it we would have to walk across the railroad bridge. Loss of one minute caused us to walk the bridge. Yuma goes by the clock. Wolflin stayed over to complete his work and went out (at a cost of $2), by horse stage, which takes 2½ hr. from Tumco, and connects with the westbound Southern Pacific passenger train about noon at Ogilby.

The mines are situated each in a broad cañon at an elevation of 700 ft., surrounded by hills that rise to a maximum elevation of 2,225 ft. above sea level. There is a gradual slope from the mines to the north bank of Colorado River, where the Survey bench mark at Rio indicates an elevation of 156 ft. Yuma elevation is 137 ft. at the station and 297 ft. one mile south. This is sure enough desert country. Nobody denies it, but nobody responsible for Yuma complains about it. In the old burro and horse-stage days the people moved slower, but they lasted longer. Looking back over a period of 20 years, I recall that the Yuma people I knew in that day were as progressive, considering the means at hand, as they are today. But the automobile is broadening the trail in this, as in other desert regions. There are many roads in this region that only an experienced automobile driver can get over in any type of machine.

The Marketed Production of Silica in the United States in 1914, as reported by the United States Geological Survey, amounts to 181,731 tons. This includes the production of silica from vein quartz, pegmatite and quartzite, and the output of tripoli and diatomaceous earth.

The Juneau Gold Belt*

The Juneau gold belt comprises a mainland strip running from Windham Bay northwestward to Lynn Canal and Berners Bay. It contains some mines and prospects south of Juneau, those in the vicinity of Juneau, including Douglas Island, those in the Eagle River and Yankee Basin regions and those in the vicinity of Berners Bay. The geology and mineral resources of this region have been described in full by Spencer[1] and Knopf.[2]

The developments near Juneau, because of their magnitude, overshadow the operations in other parts of the gold belt, yet some of these are of importance. The active small-scale mining and milling operations that were conducted a few years ago in the Eagle River and Berners Bay districts have recently experienced a decided falling off, due in part to the failure of some of the properties to meet expectations and in part to consolidations preliminary to operations on a larger scale.

Gold lode mining in this field, already developed on a scale that ranks the Juneau district with the foremost in the industry, is rapidly assuming still greater proportions. The growth is a natural response to a fuller knowledge of the size and character of the orebodies and the economic possibilities of large-scale operations.

Climatic conditions are favorable to continuous operation. The large size of some of the orebodies, the physical character of the ores and a strong topographic relief favor the production of large quantities of ore with a minimum of labor and power. Water power, marine transportation and a local supply of timber and lumber reduce general expenses to a low point. The extraordinarily low costs of operation make available low-grade ores that under conditions only slightly different would be valueless. The milling operations in the vicinity of Juneau, in 1914, were equivalent to the constant operation of about 1,000 stamps. Mining and milling operations combined gave employment to an aggregate of about 2,250 men.

Chino Copper Quarterly Report

The Chino Copper Co., working at Santa Rita, N. M., reports for the third quarter of 1915 a gross production of copper in the concentrates of 18,545,638 lb., divided as follows: July, 6,650,429; August, 6,640,923; September, 5,254,286. The total tonnage of ore treated for the three months was 690,400 tons, an average of 7,504 tons per day. This is the highest average tonnage treated by the mill since the beginning of operations. The average copper content of the ore treated in this quarter was 1.98%, against 2.38% for the previous quarter. The average extraction for the third quarter was 67.82%, as against 65.34% in the previous quarter.

The cost per pound of net copper produced for the quarter, after allowing for smelting deductions and crediting all miscellaneous income, was 7.18c., as against 6.10c. for the second quarter and 6.38c. for the first quarter. The increase in cost per pound is due to the fact that the average grade of the ore was lower during the third quarter, with a resulting lower recovery in pounds per

*Excerpt from Bull. 622-C, U. S. Geological Survey, entitled "Mining in the Juneau Region, Alaska," by Henry M. Eakin, 1915.

[1]"The Juneau Gold Belt, Alaska," U. S. Geological Survey, Bull. 287, 1906.

[2]"Geology of the Berners Region, Alaska," U. S. Geological Survey, Bull. 446, 1911; "The Eagle River Region, Southeastern Alaska," U. S. Geological Survey Bull. 502, 1912.

ton of ore. These costs include all operation, administration and general charges, and the regular charge of 30c. per ton of ore treated, for the extinguishment of mine development and stripping expense.

The net profit from milling operations for the quarter was $1,503,846; miscellaneous income, $51,568; a total of $1,555,414, on which dividends were paid of $652,455, leaving a net surplus over dividend requirements of $902,959.

The earnings for the quarter were based on 16.003c. per lb. of copper, as against 17.54c. in the second quarter, and 14.37c. in the first quarter. All unsold copper on hand and in transit is inventoried at 14c. per lb. During this quarter there was moved a total of 1,222,097 cu.yd. of material in place, as against a total of 1,208,360 cu.yd. for the previous quarter. Of the total amount of material removed for this quarter, 841,055 cu.yd. was stripping, the remainder being equivalent to 724,723 tons of ore.

Utah Copper Co.'s Report

The Utah Copper Co. reports for the third quarter of 1915 a production of 44,766,841 lb. of copper, divided as follows: July, 14,641,009; August, 15,966,543; September, 14,159,289. The production in the second quarter was 40,799,825 lb. During the period in question a total of 2,498,400 tons of ore was treated, which was 283,241 tons more than the previous high record of the preceding quarter. The average grade of the ore was 1.4089% copper, as compared with 1.42% for the second quarter of the year, while the average extraction was 63.59%. The low extraction was said to be due partly to the presence in the ore of considerable copper in the form of carbonate, but principally to the unusually large tonnage treated.

The average cost per pound of net copper produced during the quarter, after allowing for smelting deductions and without crediting miscellaneous income, was 7.64c., as compared with 7.19c. for the second quarter of 1915. If the net miscellaneous earnings in Utah, including those from the Bingham & Garfield Ry. were credited to the cost of operations, the net cost would be 6.76c.

Earnings for the quarter were as follows: Net profits from milling operations, $3,663,708; other incomes, rent, etc., in Utah, $25,668; income from Nevada Consolidated Copper Co.'s dividends, $375,188; Bingham & Garfield Ry. Co.'s dividend, $350,000; total net profits, $4,414,564, from which dividends of $1,624,490 were paid, leaving $2,790,074 surplus. Earnings for the quarter are computed on the basis of 16.252c. per lb. for copper, as compared with an average price of 16.984c. for the preceding quarter. All unsold copper on hand and in transit is carried in inventory at 13½c. per lb.

The daily average of ore treated for the quarter was 27,157 tons. Of the total tonnage for the quarter the Magna plant milled about 60%, and the Arthur plant about 40%. During the period under review there was removed a total of 1,617,779 cu.yd. of capping, as compared with 1,548,432 cu.yd. removed during the second quarter of 1915. The Bingham & Garfield Ry. handled an average of 17,856 tons of ore per day from mine to mill, as compared with an average of 16,798 tons for the preceding quarter. An average of 4,269 tons of other freight was transported, as compared with 2,921 tons per day for the second quarter of 1915.

Tin Mining in Alaska*

The first discovery of stream tin in Alaska was made by the Geological Survey in 1900, on Buhner Creek in the York district, which occupies the western extremity of Seward Peninsula. In 1901-02 considerable prospecting for stream tin was carried on, the first commercial production of tin ore being made in 1902. From that time until 1911, when the first tin dredge was installed, the placers were worked on only a relatively small scale. Since 1911 the dredge on Buck Creek has operated successfully each season, and in 1914 two dredges were installed on Anikovik River, for the recovery of gold and tin together.

Lode tin was first discovered at Cape Mountain in July, 1902, and lode mining has been carried on to a greater or less extent ever since. Stream tin has also been found in different parts of Yukon Basin—on Cleary and other creeks of the Fairbanks district in 1904, in the Circle and Hot Springs districts probably in 1908, and in the Ruby district in 1912. There has been no com-

* Locality where tin has been mined ■ Locality where some tin has been found

MAP SHOWING ALASKA TIN DEPOSITS

mercial development in any of these fields except in the Hot Springs district.

Since the discovery of tin in Alaska, a total of 526 tons of metallic tin had been produced to Jan. 1, 1915, having a value of $380,006. Practically all the tin mined in Alaska has been shipped abroad for reduction. The earlier shipments went mainly to Swansea, Wales, but lately a large part of the production has been sent to Singapore, in the Far East.

Tin Mining in the York Region

Tin ore in both lode and placer form is broadly distributed in the western part of Seward Peninsula, but commercial development has taken place at only a few localities. Lode properties have been prospected at Ear Mountain, Buck Creek, Cape Mountain, Brooks Mountain, Lost River and a few other localities of minor import-

*Abstract from Bull. 622-B, United States Geological Survey, 1915.

ance, but the only productive lode mine at present is that of Lost River. Considerable underground work has been done on the Cape Mountain property, but the mine has been closed for several years. Placer tin has been produced in commercial quantities from Buck Creek and from Anikovik and Lost Rivers. Placer operations in 1914 were confined exclusively to Buck Creek and Anikovik River.

The mining activity of the region in 1914 included the operation of three dredges for all or a part of the season, the preparation of a tract of tin-placer ground for the installation of an additional dredge, and the operation of the Lost River lode mine and mill. About 40 men were engaged directly in mining operations—20 men on Buck Creek, 5 on Lost River and 15 on Anikovik River, where two dredges operated for both tin and gold. About 25 men were also employed temporarily in the construction of the new dredge on Anikovik River. The only winter mining done in the district was at the Lost River mine, where three men were employed.

Lost River is a small stream that heads in the York Mountains and flows southward into Bering Sea, about 10 mi. east of Cape York. Freight charges from Seattle, including lighterage at Lost River, on ordinary merchandise are $12.50 per ton. The return freight rate on ore shipments is $15 per ton.

The general country rock is limestone, and there are a considerable number of vertical quartz porphyry dikes piercing the limestone. A few of the quartz porphyry dikes are highly altered and contain more or less of tin and tungsten minerals. Two dikes of this character, known as the Cassiterite and Ida Bell lodes, are being explored and developed by the Jamme Syndicate as the Lost River mine.

Tin Placers on Buck Creek and Tributaries

Placer tin occurs on Buck Creek for its entire length, about 4 mi., and on Sutter Creek and Left Fork, its principal tributaries. Gravels of Grouse Creek are tin bearing for over ¼ mi. below the mouth of Buck Creek.

Cassiterite occurs in bedrock in three ways in the Buck Creek area: As an impregnation in quartz porphyry dikes; in quartz stringers cutting the slates; and intergrown with arsenopyrite in a gangue of radial actinolite. The chief source of the stream tin is the abundant quartz stringers of the Buck Creek areas, being supplemented somewhat by the other forms of bedrock deposit.

Commercial tin placers have been developed for about 3¾ mi. along Buck Creek, and for over ¼ mi. on Grouse Creek below the mouth of Buck Creek. The development work includes drill prospecting, opencut mining and dredging. About 1½ mi. of the placer had been mined out at the close of the 1914 season. The average depth to bedrock on upper Buck Creek is only 4 ft. Downstream the depth increases slightly, and at the mouth of Sutter Creek and below it is 5 to 6 ft. The width of the placer is 60 to 200 ft.

The concentrate derived from placer operations contains cassiterite, sundry heavy iron minerals and a little gold. The average metallic-tin content of the concentrate is reported to be about 60%. The gold content is worth only a few dollars a ton, and so far it has not affected the selling price of the product.

In 1914 the American Gold Dredging Co. put two dredges into operation on the lower Anikovik. One of the dredges, formerly on Peluk Creek near Nome, was moved along the coast of Bering Sea intact, and was made to ply its own way across the bar into the mouth of the river. The other dredge was new and was installed on an artificial pond ¼ mi. from the beach. These Anikovik River placers are shallow, ranging generally between 6 and 8 ft. in depth. The chief value is in their gold content, but sufficient tin is present in them to make a valuable byproduct.

Placer Tin in Hot Springs District

Placer tin, accompanying placer gold, was discovered on Sullivan Creek in the Hot Springs district, probably in 1908. Gold mining in the district developed rapidly, but in the earlier mine development no attempt was made to save the tin ore. During clean-ups more or less of tin concentrates were thrown aside and disregarded until 1911, when 1,200 lb. was collected and shipped. The ore was found to be of high quality, and the returns from the small shipment directed attention for the first time to the possible value of tin as a byproduct.

The freight rate on tin ore from Hot Springs to Seattle is not definitely known, but it probably does not exceed $55 per ton, which is the tariff on ordinary merchandise. The shipments from Seattle to Singapore in 1914 were charged approximately $15 per ton.

The known area of occurrence of cassiterite in the Hot Springs district coincides in general with that of the productive gold placers of the Sullivan Creek Basin. The general placer zone is about half a mile in maximum width and extends for about 6 mi. from Upper Cache Creek to Woodchopper Creek.

Prospecting for Lode Tin Deposits

The local derivation of the tin ore should be emphasized, on account of the belief current in some quarters that the material of the placers has come from the vicinity of Roughtop Mountain, a belief that has led to much apparently useless prospecting for lode deposits at that locality. The so-called prospects near Roughtop Mountain were examined and samples taken, which, being tested chemically for tin, gave no trace of the metal. The prospect pits were sunk on what appears to be the ordinary country rock in a more highly altered phase near its contact with the intrusive granite. Nothing resembling the tin ore of the placers was found, nor anything that suggested the presence of cassiterite in any other form. Prospecting for tin lodes should be done in the bedrock in the vicinity of the placers, especially of the placers that contain many angular, slightly worn ore fragments. It seems certain that the bedrock source of much of the tin is to be found between Sullivan Creek and the north margin of its drainage basin, west of Quartz Creek. Whether lodes of commercial value occur in this area can be determined only by an examination of the bedrock, a difficult and expensive matter except in the mine workings or along the ridge tops, because of the thick accumulation of alluvium and rock waste.

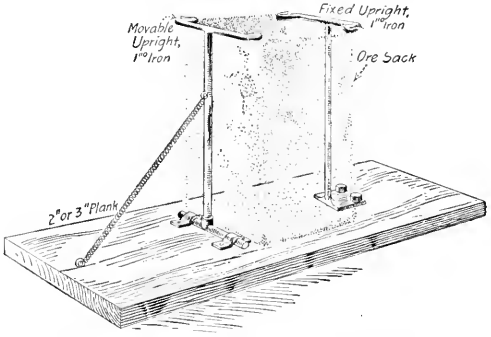
Iron-Zinc Alloys—F. Taboury (Comptes rend., 1914, 159, 241-243; abstr. "Journ. Soc. Chem. Ind.") states that crystalline deposits from galvanizing baths, separating somewhat above 422° C., were in all cases constituted of solid solutions containing 7.3% Fe. There was no evidence that these reacted with zinc at a lower temperature, even when slowly cooled, to form mixed crystals containing 0.7 Fe

Details of Practical Mining

Simple Holder for Ore Sacks

The time required for filling ore sacks is to a large degree dependent upon the rapidity with which a filled bag can be removed and an empty one put in place for the shoveler and by the effectiveness of the device used to hold the sack open and upright while it is being filled. The accompanying sketch shows a simple device (used at the United Verde mines at Jerome, Ariz.) that fully meets all the requirements of a good holder and can be easily and quickly made by any blacksmith from materials to be found at any mine, whether operations be on a large or a small scale.

The base for the bag holder is a 2- or 3-in. plank 12 in. wide and 5 or 6 ft. long, to which, as shown in the illustration, are attached two uprights of iron, each of which has a horizontal top piece curved to resemble a horn



DEVICE FOR HOLDING ORE SACKS OPEN DURING FILLING

and sharpened at the end to grip the material of the sack. One upright is secured rigidly to the base board, while the other is attached to the base by a spring, at such distance from the fixed upright that when both are in a vertical position a bag or ore sack will hang between them when the open end is supported by the horn-shaped pieces. A coil spring, one end of which is attached to the board and the other to the movable upright, stretches the opening in the sack and holds it for easy filling.

Cheap Distillate for Oil Engines

In the Piñon Range, Eureka County, Nev., during the sinking of a 900-ft. shaft a 60-hp. Fairbanks-Morse, horizontal, one-cylinder, 4-cycle, oil engine and hoist combined was used. This was belt-connected to an Ingersoll-Rand Imperial 2-stage air compressor, 12x7½x12-in., capacity 310 cu.ft. per min.

This "oil engine" in that district was an innovation. The fuel used (variously known as "slop distillate," "No. 2 Tops" and "stove oil") was purchased of the Union Oil Co. as "stove oil," gravity of 32° Bé. guaranteed. This oil was invoiced at 3c. per gal. and the total cost laid down at the shaft was 8c. per gal.

The use of this low-grade fuel for internal-combustion engines is desirable chiefly because of the saving in cost over distillate. It is very satisfactory for use in pulling a steady load such as the compressor. When handling variable loads, as in hoisting, it does not give the satisfaction hoped for. When picking up the loaded bucket from the bottom after running "light," the engine is apt to be "killed" or miss explosions. The engineer must then leave his hoisting levers, run around to the throttles and, after adjustment, run back again. Unless he be of a specially conscientious disposition he does not run, but walks leisurely, thus losing time and boosting costs.

Speeding Up the Plane Table

By R. T. Hancock*

The use of a plane table provided with a telescopic alidade fitted with stadia points and vertical arc enables detail mapping to be done with a speed, accuracy and economy scarcely obtainable by any other means, but the weight of the alidade, concentrated as it is near one end, makes it awkward to handle, and there is difficulty in keeping the alidade edge accurately aligned on the station dot. Moving the heavy end is liable to throw the table out of orientation, and repeated trials are often necessary before the dot and the edge are near enough together to enable a ray to be drawn by inclining the pencil more or less.

The following described device overcomes all this trouble and greatly increases the speed and accuracy of the work. The alidade is placed on the board, pointing in the required direction, with its edge an inch or so from the station dot. By a single sweep of the light end—the alidade naturally revolving about its center of gravity—the distant rod is sighted and read, and a celluloid set-square, about 12 in. long and cut to an angle of about 10° or so, is laid against the alidade edge with its butt away from the observer and slid along till its outer edge is in alignment with the station dot. This is easily seen, as refraction causes the dot to jump, directly the transparent celluloid covers it. The scale is then brought up against the celluloid with its zero corresponding to the station dot, the celluloid slipped out of the way, and the distance as read by the stadia pricked off, giving the location of the rod on the map.

Assuming that, with a telescopic alidade used without this modification, the collimation line of the telescope lies exactly above the alidade edge and parallel to it—a combination rarely to be found—all the lines on the map are accurately parallel to the corresponding lines on the ground when the table is correctly oriented. If the collimation line is not thus parallel to the alidade edge, but makes an angle with it, all the lines on the map will be

*Jemoa, Northern Nigeria.

inclined at this same angle to their originals on the ground when the table is correctly oriented, but no error or distortion is introduced into the work, as the orientation was done under the same conditions of eccentricity. The use of the supplementary celluloid demands, therefore, that the table should be oriented by its means.

Resecting and Locating

In resecting from three fixed points already marked on the map, the celluloid is laid against the magnetic meridian as drawn, in the same manner as it is laid against the alidade edge, the trough compass laid against its outer edge and the table swung till the needle points to zero. The alidade is then laid pointing to each station in turn, but with its edge an inch or so from the corresponding dot, the distant station sighted by a sweep of the alidade, the celluloid brought up into alignment with the dot as described, and the back ray drawn. Some little extra care may be taken here to keep the distance between alidade edge and station dot reasonably uniform in the three cases. The triangle of error, if any, is eliminated in the usual way. If preferred—but the surveyor who has once used the "celludade" will not prefer it—the table can be oriented in the usual way by the alidade alone, and when the resection point is accurately found, the celluloid and alidade are brought up together so that the outer edge of the former touches both resection point and the most distant station dot, and the table is swung until the distant station is sighted, leaving the table in correct orientation for subsequent work with the celluloid.

In locating the position of a set-up to which a forward ray has already been drawn, the celluloid and alidade together are brought up till the outer edge of the former aligns with the ray, and the table is swung till the back station is sighted. The alidade is then laid with its edge an inch or so from another station dot, the original of which is visible from the set-up; the telescope sighted on that station by a swing of the light end of the alidade; the celluloid slid up into alignment with the station dot; and the back ray drawn, fixing the position of the set-up on the map by its intersection with the first ray and leaving the table with the required orientation.

It will be noticed that in working with the celluloid it is never necessary to move the alidade bodily while observing or to trouble to keep its edge against a particular dot—a point which surveyors who have worked with a heavy alidade will appreciate.

The error introduced by the employment of the celluloid is extremely small and amounts to an actual error in the location of a fixed point on the ground equal to the difference between the distance of the dot from the real alidade edge used for that particular fix and the distance which may be regarded as the normal distance of the dot from the edge, which latter has been referred to throughout this article as an inch or so. It is similar to, but much less in amount than, the error introduced by not centering the station dot accurately over the station, a detail which is usually regarded as a needless refinement in plane-tabling.

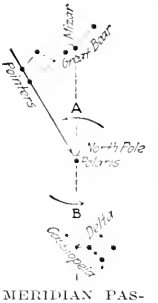
A specially cut set-square is not really necessary, but its cost is so trifling that it is well worth getting. An ordinary large 60° set-square can be used, but the consequent skew of the map as compared with the ground as it lies before the eyes of the surveyor is a little disconcerting at first.

Azimuth by Simple Method

The usual method of obtaining azimuth from Polaris is by making observations at elongation. The following method, not new but little known, will be found much simpler in application and fairly accurate. No instrument and no nautical alamanac or mathematical tables are needed.

This method is based on the fact that Polaris and two adjacent bright stars are in the same vertical plane only a few minutes before Polaris crosses the meridian. It can be used at only one moment in each 24 hr., and a fairly clear sky is required to enable the stars to be sighted behind a plumb-line. The two stars that can be used in this observation are Mizar, the middle star in the tail, or handle, of the Great Bear, or Dipper; and Delta, in the constellation Cassiopeia. The former can be used only when it is below the pole during the night; when it passes the meridian above the pole it is too near the zenith to be of service, in which case the latter star is observed. The accompanying diagram shows the principal stars of the constellation of Cassiopeia and the Great Bear, with Delta Cassiopeia, Mizar and Polaris on the meridian. The table shows the exact time at which these stars are in the same vertical plane on given dates. The time for other days can be secured by direct interpolation, the daily variation being 4 min. of time.

OBS. ON MIZAR		OBS. ON DELTA CASSIOPEIA	
Jan. 20	5:22 a.m.	July 20	5:30 a.m.
Feb. 20	3:20 a.m.	Aug. 20	3:28 a.m.
Mar. 20	1:30 a.m.	Sept. 20	1:26 a.m.
Apr. 20	11:24 p.m.	Oct. 20	11:24 p.m.
May 20	9:26 p.m.	Nov. 20	9:22 p.m.
June 20	7:24 p.m.	Dec. 20	7:24 p.m.



MERIDIAN PASSAGE OF POLARIS

When it has been determined by observation that Polaris is in the same vertical plane with one of these stars, it can be shown that it will pass the meridian 1.8 min. later during 1915. This interval is increasing from year to year at the rate of 0.33 min., so that in 1916 the interval will be about 8.14 min. The observation can be made either indoors or out by suspending an ordinary plumb-line and marking the direction of the meridian by setting a second point at the stated interval after the two stars are in the same vertical plane.

*J. A. Macdonald, Topographical Surveys Branch, Ottawa, Ont., Canada, in "Engineering News," Oct. 21, 1915.

Accident Prevention During Construction Work

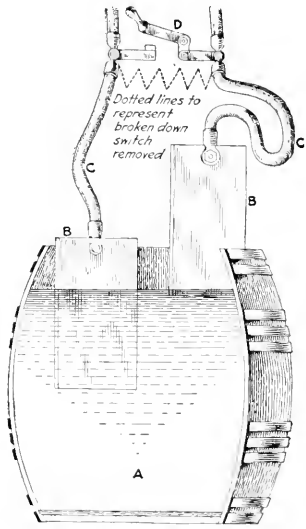
During the construction of industrial plants, one of the most productive sources of accidents is improperly built scaffolding. Scaffolds are frequently built of any sort of lumber that is quickly available for the purpose, whereas only first-class material, free from knots, should be used. Generally, anything from a single board up that will meet the need of the immediate moment is considered sufficient. Serious accidents are often caused by men, particularly iron workers, taking with them heavy tools and equipment, working on a single-plank staging that had been built for the use of one man with no heavy tools. When scaffolds are raised 10 ft. or more above

the ground, they should be provided with toe-boards to prevent the falling of tools and material. When light swinging scaffolds, such as employed by painters, are used, all tools and materials not immediately necessary to the work in hand should be removed from the scaffold.

Working floors should be kept as clean as possible, and all permanent openings should be closed in with planking that is kept in place. These floors should always be made as tight as possible, in order to prevent tools and material from falling through onto men below. All planks on stagings or working floors should be fastened so that a man stepping on one end will not tip the plank up. Accidents from this kind of trap are almost innumerable.

Improvised Motor Starter*

Some years ago, while in charge of a small repair shop, I was called upon to repair a breakdown. The starting switch of a 100-hp. continuous-current motor driving the coal washers at a colliery had burned out. The coils had



SUBSTITUTE FOR A MOTOR SWITCH

become covered with coal dust and had short-circuited, rendering the switch useless.

The voltage was only 110, so the amperes amounted to 680 on full load. There was no spare switch sufficiently large, and another could not be obtained from the makers for some days. It was necessary to get the plant in operation as quickly as possible, and all sorts of plans were discussed, but it was thought unlikely that it could be restarted within 48 hr.

Some method of doing this work quicker had to be devised and the illustration shows what it was.

A wooden cask *A* was obtained and filled with water acidulated by the addition of a little sulphuric acid. There was no time for calculations, so we erred well on the safe side by adding more than was absolutely necessary.

Two sheet-iron plates *B* about 1 ft. 6 in. by 2 ft. $\frac{1}{16}$ in. thick were cleaned, and holes drilled in the top. By means of pieces of cable *C* and terminals, these were attached to the cables leading to and from the burned-out switch, which was removed. An ordinary knife switch *D*, large enough to take the full current, was also connected with the terminals.

When all was ready the main knife switch was put in, the switch *D* being left open, as shown. One of the plates was placed at once in the water and the other dipped in slowly, bringing it also nearer the first plate until the motor started and got up speed, when finally the plates were brought up so as to touch each other and the knife switch *D* put in. The plates were then taken out of the cask until required again.

Safe Distance for Powder Houses

How far powder houses should be kept away from railways, roads and buildings is set forth in a table drawn up by Col. B. W. Dunn, of the Bureau for the Safe Transportation of Explosives and Other Dangerous

SAFETY DISTANCES FOR EXPLOSIVES STORAGE

Quantity — Blasting Caps, Number		Quantity — Other Explosives, Pounds		Safety Distances, Feet — From Nearest Building	From Nearest Railroad	From Nearest Highway
1,000 to	5,000			30	20	15
5,000 to	10,000			60	40	30
10,000 to	20,000			120	70	50
20,000 to	25,000	0 to	50	200	120	80
25,000 to	50,000	50 to	100	240	140	100
50,000 to	100,000	100 to	200	360	220	140
100,000 to	150,000	200 to	300	520	310	200
150,000 to	200,000	300 to	400	640	380	260
200,000 to	250,000	400 to	500	720	430	290
250,000 to	300,000	500 to	600	800	480	320
300,000 to	350,000	600 to	700	860	520	340
350,000 to	400,000	700 to	800	920	550	360
400,000 to	450,000	800 to	900	980	590	380
450,000 to	500,000	900 to	1,000	1,020	610	400
500,000 to	750,000	1,000 to	1,500	1,060	640	420
750,000 to	1,000,000	1,500 to	2,000	1,200	720	480
1,000,000 to	1,500,000	2,000 to	3,000	1,300	780	520
1,500,000 to	2,000,000	3,000 to	4,000	1,420	850	570
2,000,000 to	2,500,000	4,000 to	5,000	1,500	900	600
		5,000 to	6,000	1,560	940	620
		6,000 to	7,000	1,610	970	640
		7,000 to	8,000	1,660	1,000	660
		8,000 to	9,000	1,700	1,020	680
		9,000 to	10,000	1,740	1,040	700
		10,000 to	20,000	1,780	1,070	710
		20,000 to	30,000	2,110	1,270	840
		30,000 to	40,000	2,410	1,450	960
		40,000 to	50,000	2,680	1,610	1,070
		50,000 to	60,000	2,920	1,750	1,170
		60,000 to	70,000	3,130	1,840	1,250
		70,000 to	80,000	3,310	1,990	1,330
		80,000 to	90,000	3,460	2,080	1,380
		90,000 to	100,000	3,580	2,150	1,430
		100,000 to	200,000	3,670	2,200	1,470
		200,000 to	300,000	4,190	2,510	1,680
		300,000 to	400,000	4,670	2,800	1,870
		400,000 to	500,000	5,110	3,070	2,040

Articles. The table is published by the Bureau of Mines in a bulletin[1] just issued.

The recommended distances vary with the quantity of explosive to be stored, up to a maximum of 2,000 to 5,100 ft. (from roads and from buildings respectively) for 200 to 250 tons of explosive.

An important auxiliary rule is given by the authors of the bulletin quoted: "No detonator shall be stored within 100 ft. of other explosives underground, or within 300 ft. of other explosives above ground. No detonator shall be taken into any magazine containing other explosives."

A Hydraulic Jack should be filled with alcohol 1 part, water 2 parts, with a tablespoonful of sperm oil added. It should never be filled with water, kerosene or wood alcohol. Water is liable to freeze or rust the jack; kerosene destroys the packing; wood alcohol destroys packing and corrodes the metal.

*John G. Grant, Surrey, England, in "American Machinist," Oct. 21, 1915.

[1]"Rules and Regulations for Metal Mines," by Ingalls, Douglas, Finlay, Channing and Hammond; Bull. 75.

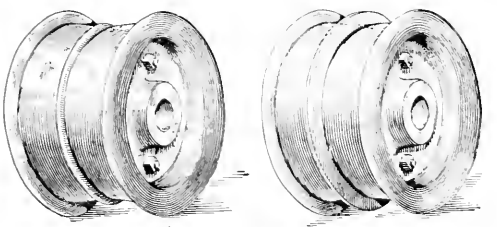
Details of Milling and Smelting

Old Car Wheels as Sheaves

By M. L. O'Neale*

Supplementary to Jesse Simmons' article in the *Journal* of Oct. 16, regarding the use of old car wheels for sheaves and carriers, I would like to give our experiences along this line.

We used these old wheels, that were worn out in the hubs, for sheaves and carriers and in some places for knuckle sheaves, where considerable weight was carried. In this latter case wear was rapid and threatened to use up our stock of discarded wheels. I therefore had our blacksmith make hoops of round iron ($\frac{3}{4}$-in. in our case) with inside diameter equal to the diameter of the worn



SHEAVES FROM OLD CAR WHEELS

wheels at the bottom of the grooves, and as soon as a sheave was cut nearly through, the two wheels were unbolted and this hoop inserted. This gave three wearing points instead of one, as shown in the accompanying sketch.

To accomplish the same result in another case, a circular plate of a diameter a little greater than the wheel was inserted between the wheels, the plate being punched to take the same bolts that held the wheels together.

*Superintendent, City Mining Corporation, Coal City, Ala.

Turbo-Blowers as Compressors of Furnace Air

The turbo-blower is gaining in favor for blast-furnace and converter work, according to Frederick Laist, who discussed advances in copper smelting before the recent International Engineering Congress at San Francisco.

The new plant at Mt. Morgan, Australia, consists of four turbo-blowers for blast-furnace air and three for converter air, all electrically driven. Each furnace blower is capable of compressing 18,000 to 20,000 cu.ft. of free air per minute to 64 oz. per sq.in. They are each driven by a 500-volt direct-current variable-speed motor. The three converter blowers have a capacity of 5,000 cu.ft. of free air per minute and compress to 12 lb. per sq.in. They are of the latest Parsons multiple-stage centrifugal type.

A new turbo-blower for converter air, having a capacity of 35,000 cu.ft. per min., compressing to 16 lb. per sq.in., has just been installed in the smeltery power house of the Washoe Reduction Works at Anaconda, Mont. It was built by the Ingersoll-Rand Co., and is driven by a Parsons turbine rated at 2,000 hp. when running at a maximum speed of 3,500 r.p.m.

Protecting Reverberatory Walls at Douglas, Ariz.

Forest Rutherford, superintendent of the Copper Queen smelting works, in reviewing[1] the metallurgy of this plant and the changes in equipment, comments on the installation of the reverberatory furnaces because of an increase in the amount of fine sulphides. The slags made are usually high in alumina—11 to 13%—and are rather viscous.

The method of protecting the side walls of the reverberatory furnaces differs from that found at most plants. Practically no barren siliceous material is used. At first, this was the case, but it was soon found that with the very basic slags made, it was too expensive to keep the furnace properly fettled with this material, and also that in dropping it through holes in the roof, along the side walls, there was a great tendency to blanket the bath and thereby reduce the smelting capacity of the furnace.

"A series of experiments was started," writes Superintendent Rutherford, "which ended in our using, for this purpose, ores running as high as 35% Fe, as low as 25% SiO_2, with sulphur from 15 to 18% and copper about 5%. It was, of course, impossible to use this class of material throughout the full length of the furnace, because if used too close to the skimming door, some of it was carried out in an unfused state, making the slags too high in copper. We therefore lined the front half of the furnace with magnesite brick and did not attempt to clay it at all. This method, under our condition, seems to work very satisfactorily. In any case, as far as the method is concerned it is essential that the ore used must contain enough sulphur to matte all the copper, or otherwise it will stay in the slag in the form of prill and be carried out; whereas, if in the form of matte it will go through the slag into the bath below and the slag will be clean."

Electrolytic Antimony Refining

In discussing the conditions for electrolytic antimony refining, Anson G. Betts recently stated to the American Electrochemical Society (San Francisco meeting) that the fluoride electrolyte is preferable to the chloride, as no salt is carried down with the metal in fluoride electrolytes. For easy anode action the solution should contain no sulphates or other oxyacids. For instance, with sulphuric acid there is a formation of antimony sulphate, which quickly forms an insulating coating of insoluble

[1] "Symposium on the Metallurgy of Copper," International Engineering Congress, 1915, San Francisco, Calif.

basic sulphate. In addition, the fluorine anion has a comparatively low velocity, and other anions should be excluded as completely as possible, in order to promote the formation of antimony fluoride. A high hydrofluoric acid content is beneficial. While copper, lead, bismuth and silver are eliminated by electrolysis of impure antimony in a fluoride electrolyte, arsenic is not, nor is gold, so that further experiment is demanded. Mr. Betts suggests that in his experiments traces of H_2SO_4 and H_2SiF_6 may have vitiated the results and also suggests that the effect of alkaline fluorides (including ammonium) should be studied.

Harrison Weir-Flow Recorder

A flow recorder to be used in connection with small V-notch weirs has been designed by the engineers of the Harrison Safety Boiler Works. This device seems to have many possibilities of use in cyanide and other wet metallurgical plants, in hydraulic operations, etc.

There is a float which moves with each change of head on the weir and in turn rotates a spiral cam (laid out according to the law of the weir, $CH^{\frac{5}{2}} = Q$) through a multiplying gear. The cam moves a pen carriage which records on a paper drum the quantities corresponding to each position of the float. Backlash has been eliminated by the use of a cable drum instead of a gear and pinion, while friction has been reduced as much as possible by mounting the spindle of the cam upon antifriction rollers. The pen carriage is provided with large rollers or wheels, which rest upon horizontal ways, so that the cam follower which is attached to the pen carriage moves diametrically to the cam disk. The pen is suspended from the pen carriage so that it rests lightly against the chart drum and can readily be removed for cleaning or renewing the chart.

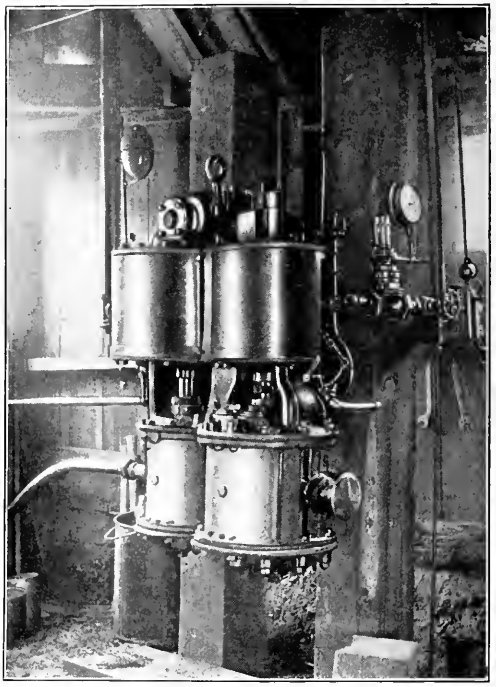
HARRISON WEIR-FLOW RECORDER

An integrating attachment consists of a counting train, likewise suspended from the pen carriage and driven by a small roller which rests upon an aluminum clock-driven disk. When the float and cam are at the position corresponding to the zero head, this roller is at the center of the disk, and hence receives no motion from the rotation of the latter. As the pen carriage is moved away from the zero position, the small roller is carried away the same distance from the center of the aluminum disk, and hence is propelled at a rate corresponding to the rate of flow over the weir. The total movement of the counting train will therefore correspond to the total flow. Further, a visible pointer moving along a large scale with open divisions has been added, making it possible to read the rate of flow from a distance.

All parts of the mechanism of this recorder are made to accurate dimensions by means of templates and limit gages. To be sure of the accuracy of the instrument it is only necessary to know that it is properly adjusted—that is, when the float is at zero position; in other words, when the level of water upon which it rests is at the zero level of the weir, the cam must be at zero position, the pen on the zero line of the chart and the integrator roller at the center of the aluminum disk.

Air Compressor for Prospecting

In prospecting work, when economy is the watchword, it is often possible to make profitable use of a locomotive-type air compressor. This is done at the Columbia mine, Keystone, S. D., where the installation shown in the photograph has been put up. It has a capacity of 151 cu.ft. of free air per minute, and is used for operating jackhamer drills. The machine weighs 1,850 lb. (2,125 when crated for shipment) and is erected on two 10x10-in. posts set 4 or 5 ft. into the ground.



A LOCOMOTIVE-TYPE AIR COMPRESSOR

Roasting Wisconsin Sulphides for Magnetic Separation

The improved Campbell kiln, now operating in the plant of the Linden Zinc Co., Linden, Wis., is making a record in magnetizing the coarse Wisconsin ores for magnetic separation. Recent tests show 10 tons roasted in 3 hr. and 50 min. Other tests show 15½ tons per hr. average run, using only one fuel-oil fire. An average of 8 lb. of flue and smoke-box dust is recovered per ton of ore treated.

The Cost of Doing Things

Cost of Sinking 900-Ft. Shaft

By H. A. Linke*

During the year 1913 an exploratory shaft was sunk 900 ft. in the Piñon Range, Eureka County, Nevada. The general arrangement of the surface equipment is shown in Fig. 1. It consisted of a 60-hp. Fairbanks-Morse horizontal one-cylinder 4-cycle oil engine and hoist combined, belted to an Ingersoll-Rand Imperial-type 2-stage air compressor, 12x7½ in.; capacity 310 cu.ft. per min. The receiver was 42 in. by 8 ft.

The substantial timber headframe had backstays 10x10 and front posts 8x8. The height from collar of shaft to center of head sheave was 50 ft. The hoisting rope was ¾-in. Hercules, "Red Strand." A sinking bucket of ½-ton capacity was used and drilling was done with two Ingersoll-Rand jackhamers.

Two 8-hr. shifts were run, the day shift consisting of 2 miners at $4, 1 topman at $3, 1 engineer at $4.50, 1 timberman at $4 and 1 teamster at $3; and, in the night shift were 2 miners, 1 topman and 1 engineer; making a daily complement of 10 men.

The size of the shaft inside timbers was 3 ft. 6 in. by 7 ft. 8 in., divided into 3 ft. 6 in. by 3 ft. 6 in. hoisting compartment and 3 ft. 6 in. by 3 ft. 8 in. manway and pipe compartment. The shaft was timbered with 6x6 ring sets, 6x6 divider and 6x6 posts; the sets were 6-ft. centers in upper portion of shaft, but lengthened out as ground became firmer with depth; the guides were 4x4. Lumber procured from northern Washington was excellent red fir costing $32 per M laid down.

The cost of sinking this shaft, the excavation for which measured approximately 5x9 ft., is given on page 847.

*Newhouse Hotel, Salt Lake City, Utah.

It will be noted that the work is divided into two separate sections; that is, from surface to 515 ft. and from 515 ft. to 900 ft. When the shaft had reached a depth of 515 ft. the engine house was lost by fire. When sinking was resumed after reconstruction, the footage cost was considerably higher than that immediately preceding the fire, owing to breaking in a new crew of men and the delays incidental to readjustments and repairs to machinery.

The costs given cover only labor, material and supplies used; no overhead charges are included.

The engine cost, laid down at the site, including 5 cooling-water tanks, 1 water-circulating pump, 50 ft. 8-ply rubber belt, tank pump, tools and incidentals was $4,371.05; material in foundation, laid down, $318.52; labor—foundation and installation of engine—$567.18; making the total cost of the hoisting engine complete in place, $5,256.

The engine house was originally a box-type battened building with matched floor and roof covered with roofing paper. This building was easily heated in winter. After the destruction of this building the new shelter was of much cheaper construction—boxed and roofed with red corrugated iron and the floor filled in with fine stuff from the dump. Although the metal-covered house was nearly fireproof, it was very difficult to keep warm in winter and the general unsightliness of a dirt floor did not tend to promote tidiness on the part of the engineers.

The jackhamers used in sinking the shaft were also an innovation in the district. They gave excellent service at a minimum cost for upkeep and repairs. Drilling was performed with two machines, but three were in commission, one being kept clean and in readiness for use as a spare.

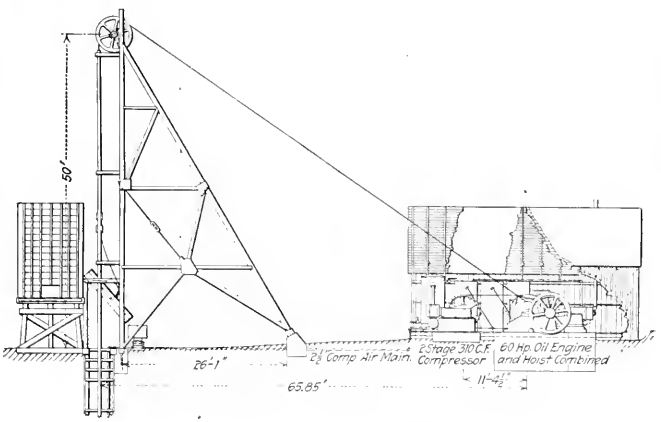


FIG. 1 HEADFRAME AND SURFACE PLANT FOR SMALL EXPLORATORY SHAFT

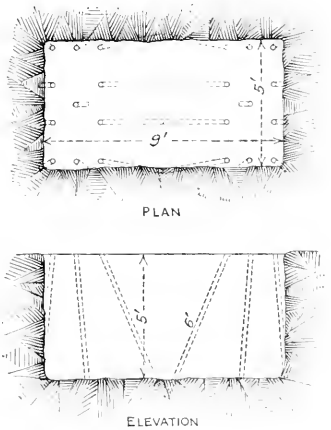


FIG. 2. LAYOUT OF HOLES FOR SHAFT ROUND

The shaft round consisted of from 18 to 22 holes. An average round was drilled approximately as per sketch (Fig. 2).

Electric exploders were tried at first, but those purchased were so unsatisfactory that their use was discontinued and the old-time reliable fire fuse was then used with satisfactory results. The ground was dry and broke very poorly. Being much shattered and faulted, it broke "short" and often to horizontal slips part way the depth

COSTS OF SECTION ONE OF SHAFT

Sinking Costs

Labor	Dec., 1912 to Mar., 1913, 0-193 Ft.	Apr. 1913, 193-296 Ft.	May, 1913, 296-406 Ft.	June, 1913, 406-490 Ft.	(16 Days) July, 1913, 490-575 Ft.	Totals
Drilling	$691 08	$305 58	$313 66	$252 27	$199 43	
Mucking	814 99	371 02	347 68	302 90	205 79	
Steel sharpening	43 05	6 76	22 50	16 50	12 00	
Gen. repairs	318 73	21 64	32 09	10 25		
	$1,867 85	$705 00	$716 53	$581 92	$417 22	$4,288.52
Material						
Drilling	$368 04	$260 17	$298 58	$184 67	$145 61	
Mucking	156 00	120 53	99 81	87.46	63 07	
Steel sharpening	3.94	2 98	2 12	.95	1 21	
General expense	100 36	53.56	57 20	43 68	43 70	
	$628 34	$437 24	$457 71	$316 76	$253 59	$2,093 64
Totals	$2,496 19	$1,142 24	$1,174 24	$898 68	$670.81	$6,382 16

From the foregoing are computed the followiog:

100-Ft. Intervals	Cost per 100 Ft.	Av. Cost per Ft.
0-100	$1,293.00	$12 93
100-200	1,280 82	12 81
200-300	1,107 31	11 07
300-400	1,067 52	10 67
400-500	1,041 60	10 42
500-575	591 91	7 89
Depth sunk.. 575 ft.	$6,382 16	$11 10

Timbering Costs

Labor	Dec. 12 to Mar., 1913, 0-148 Ft.	Apr., 1913 148-244 Ft.	May, 1913, 244-368 Ft.	June, 1913, 368-478 Ft.	(1 to 16) July, 1913, 478-525 Ft.	Totals
	$635 41	$226 53	$253 28	$310 10	$125.77	$1,551.09
Material						
Timber, etc.	$515 39	$303.73	$279 30	$326.31	$140.63	
Apportionment of gen. expense	15.39	9 98	12 90	11 44	4 89	
	$530 78	$313 71	$292 20	$337 75	$145 52	$1,619 96
Totals	$1,166 19	$540 24	$545 48	$647 85	$271 29	$3,171 05

From the foregoing are computed the following:

100-Ft. Intervals	Cost per 100 Ft.	Av. Cost per Ft.
0-100	$787 90	$7 88
100-200	670 92	6 71
200-300	493 95	4 94
300-400	487 60	4 88
400-500	586 38	5 86
500-525	144 30	5 77
Depth timbered . 525 ft.	$3,171 05	$5 99

Total Cost of Sinking and Timbering

100-Ft. Intervals	Cost for 100 Ft.	Av. Cost per Ft.	
0-100	$2,080 90	$20 81	
100-200	1,951 74	19 52	Av. cost of completed shaft per ft., $17.44.
200-300	1,601 26	16 01	
300-400	1,555 12	15 55	
400-500	1,627 98	16 28	
500-525	341 60	13 66	
525-575	394 61	....	Not timbered
Total depth.. 575 ft.	$9,553 21	= Total cost sbaft to date.	
Timbered to 525 ft			

Station Cutting

Labor	Mar. 1913, 1st Sta.	Apr., 1913, 2nd Sta.	May, 1913, 3rd Sta.	4th Sta.	June, 1913, 5th Sta.	Total
Drilling	$50 05	$55 95	$54 58	$27 75	$58 23	
Mucking	68.64	41.10	63.88	56 67	58.29	
	$118.69	$97 05	$118.46	$84.42	$116.52	$535.14
Material						
Drilling	$46 58	$37.51	$51 28	$22 57	$45 06	
Mucking	23 40	14.49	11 60	10 62	14 34	
	$69.98	$52.00	$62.88	$33 19	$59.40	$277 45
Timbering						
Labor	$57 30					
Material	36 17					
	$93.47					$93 47
Totals	$282 14	$149 05	$181 34	$117.61	$175 92	$906 06

Average cost per station, $181 21

COSTS OF SECTION TWO OF SHAFT

Sinking Costs

Labor	Oct 14-31, 1913, 575-605 Ft.	Nov. 1913, 605-675 Ft.	Dec 1913, 675-760 Ft.	Jan., 1914, 760-845 Ft.	Feb. 1-21, 1914 845-900 Ft.	Totals
Drilling	$151 25	$281 88	$339 23	$205.00	$155 69	
Mucking	133 49	366 63	312 67	293.26	159 54	
Steel sharpening	20 65	32 50	25 68	17 75	42.35	
General repairs	12 38	23 19	28 47	71.13	27.35	
Wood for fires		.....	18 00	.....	..	
	$317 77	$704 20	$724 05	$587.14	$384.93	$2,718.09
Material						
Drilling	$137 63	$233 88	$277 12	$195.66	$170 40	
Mucking	32 80	87 05	87 20	58.32	43.28	
Steel sharpening	2 00	4.35	2 62	1.18	4.39	
General expense	49 50	115.50	140 25	140 25	90 75	
	$221 93	$440 78	$507 19	$395 41	$308 82	$1,874 13
Totals	$539 70	$1,144 98	$1,231 24	$982.55	$693 75	$4,592.22

From the foregoing are computed the following:

Intervals	Total Cost	Cost per Ft.
575-600	$449 75	$17.99
600-700	1,596.93	15.97
700-800	1,331 64	13 32
800-900	1,213 90	12.14
Depth sunk.. 325 ft.	$4,592 22	$14 13

Timbering Costs

Labor	Oct 14-31, 1913 525-566 Ft.	Nov. 1913, 566-646 Ft.	Dec., 1913, 646-725 Ft.	Jan., 1914, 725-830 Ft.	Feb. 1-21, 1914, 830-875 Ft.	Totals
	$124 25	$225 07	$275.88	$142.41	$165.78	$933.39
Material						
Timber, etc.	$30 12	$142 73	$147 92	$185.77	$29.43	
General expense	$13.98	27 28	26 95	35.82	15.35	
	$44 10	$170 01	$174 87	$221 59	$44 78	$655.35
Totals	$168 35	$395 08	$450 75	$364 00	$210.56	$1,588 74

From the foregoing are computed the following:

Intervals	Total Cost	Cost per Ft.
525-575	$212 79	$4 48
575-600	123 45	
600-700	534 99	5 35
700-800	403 20	4.03
800-875	314.31	4 19
Depth timbered. 350 ft.	$1,588 74	$4.54

Total Cost of Sinking and Timbering

Intervals	Total Cost	Cost per Ft.	
525-575	$212 79	$4.48	(timbered only)
575-600	573 20	22 93	Av. cost of completed shaft per ft., $18.88.
600-700	2,131 92	21.32	
700-800	1,734 84	17 35	
800-875	1,224 73	16 33	
875-900	303.48	12 14	(not timbered)
	$6,180 96		

Note: Total cost of sinking and timbering from surface to 875 feet is $15,430.69; giving average cost per ft of $17.75. Total cost of 8 stations is $1,395.51; giving average cost per station of $174.44.

Station Cutting

Labor	Nov. 1913, 6th Sta.	Dec., 1913, 7th Sta	Jan. 1914, 8th Sta.	Totals
Drilling	$38 59	$36 19	$56 69	
Mucking	56 63	45.46	41 82	
	$95 22	$81.65	$98 51	$275 38
Material				
Drilling	$35 43	$40 75	$32 50	
Mucking	19.20	16 43	11 07	
Apportionment of gen. expense	20 23	20 23	20 23	
	$74.86	$77.41	$63 80	$216.07
Totals	$170 08	$159 06	$162 31	$491 45

Average cost per station, $163.82.

Cross-Cutting on 100-Ft. Level

Labor	Sept. 20-30, Oct 1-14, 1913, 0-26 Ft.	1913, 26-74 Ft.	Totals
Drilling	$71 50	$194.25	
Mucking	48 51	127 78	
Repairs, etc	10.13	.. .	
Steel sharpening		23 09	
Gen. labor	26 00	48 00	
	$155.14	$393.12	$548.26
Material			
Drilling	$48 23	$154 60	
Mucking	19.10	38 78	
Steel sharpening	.....	2 00	
	$67.33	$195 38	$262.71
Totals	$222 47	$588 50	$810 97

74 feet of drifting, giving average cost per ft. of $10.95.

of the round. The endeavor was to pull a 5-ft. round; the cut holes drilled 6 ft. and the balance of round 5 ft.

Powder of various strengths was used—60%, 40% and 35%. The best all-round results were obtained by loading with 35% throughout. There was 8.4 lb. of powder used per foot of shaft, which is equivalent to 1.45 lb. of powder per ton of rock removed; there being approximately 5.8 tons rock per foot of shaft.

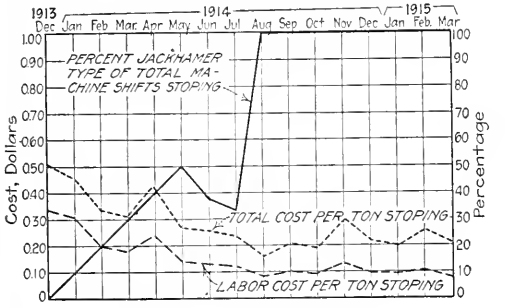
Sinking progressed from Dec. 1, 1912, to July 17, 1913, and from Oct. 18, 1913, to Feb. 21, 1914, or 354 days, at the rate of 7614 ft. per 30-day month. This includes all delays due to repairs and temporary shutdowns due to labor shortage. The first 60 ft. was handwork, using the windlass for hoisting.

The use of candles for illumination when drilling the shaft round was out of the question. The dust raised in drilling and cleaning holes was very thick, and the exhaust from two machines extinguished candles as soon as relighted.

Two Wolf No. 1 carbide lamps were used and gave general satisfaction. As they furnished a very brilliant light, they could be hung high up in links of the chain ladder, beyond reach of the drill exhaust.

Stoping Costs at Iron Mines, Mineville, N. Y.

At one of the large iron mines, Mineville, N. Y., charges to stoping cover the expense of breaking the ore after it has been developed by drifts and raises. The principal labor items so charged are for machine runners and helpers, blasters, roofmen, drill sharpeners and drill-



STOPING COSTS AT MINEVILLE

machine repairs. The principal supply charges are for explosives and compressed air. Therefore the cost per ton for stoping, more particularly the labor cost, is a direct measure of the efficiency of the drilling. There are, however, some fluctuations in the cost curve due to varying tonnage hoisted each month, it being impossible to get the number of tons broken each month from which to derive stoping costs per ton.

The accompanying curves cover a number of months during the period from when we started to use Jackhamer-type machines for stoping up to the present. They give for each month the labor cost per ton for stoping, the total cost per ton for stoping and the percentage of total machine drifts charged to stoping which were Jackhamer-type machines. They show that while the percentage of the Jackhamer type rose from zero to 100% the total stoping cost per ton fell from 51c. to 20c. and the labor cost per ton stoping fell from 31c. to 8c.

Milling Costs in Alaska

The following figures on milling costs were taken from the annual reports of the Alaska Treadwell Gold Mining Co., Alaska United Gold Mining Co. and the Alaska Mexican Gold Mining Co., Douglas Island, Alaska, for year 1914:

	Alaska Treadwell 240-Stamp Mill	300-Stamp Mill	Alaska Ready Bullion Mill	United 700-Ft. Claim Mill	Alaska Mexican Mill
	COST PER TON MILLED				
Crushing	$0.038	$0.037	$0.016	$0.021	$0.022
Tramming	.016	.016	.016	.015	.016
Stamping	.172	.138	.165	.166	.159
Concentrating	.054	.050	.067	.052	.048
Total	$0.280	$0.241	$0.264	$0.264	$0.245
These costs consisted of:					
Labor	$0.110	$0.079	$0.112	$0.099	$0.098
Supplies	.053	.063	.046	.062	.043
Subsidiary accts.	.117	.099	.106	.103	.104
Tons ore crushed	382,652	527,633	233,100	225,214	233,457

There were 33,774 tons of concentrates produced from the ore treated by these mills. This product was treated by cyaniding at a cost of $2.756 for operating, not including general expenses, train service, etc. This cost per ton consists of the following charges only: Grinding, 49.6c.; dissolving, 97.7c.; filtering, 32.6c.; precipitation, 42.6c.; and refining, 53.1c. These charges were made up of $1.271 for labor, 93.1c. for direct supplies and 55.4c. for subsidiary accounts.

Cost of an Electric Iron-Smelting Plant

The electric iron-smelting furnaces at Hagfors, Sweden, are 4.7 m. across the widest portion of the crucible, 14.7 m. from ground to feed floor and 11.4 m. from the bottom of the crucible to the feed floor. Each furnace is fed by three 1,000-kw. transformers. The cost of this installation of three furnaces is given by *Le Genie Civil*, Aug. 28, 1915, as follows:

Foundations	$59,000
Furnaces	61,500
Transformers and accessories	71,000
Crushing apparatus	9,500
Ore and fuel bins	28,000
Pumps and piping	3,350
Grading and industrial railways	9,650
Accessories	1,360
Cost of research and experiment	9,200
Total	$252,560

Cost of Road Building

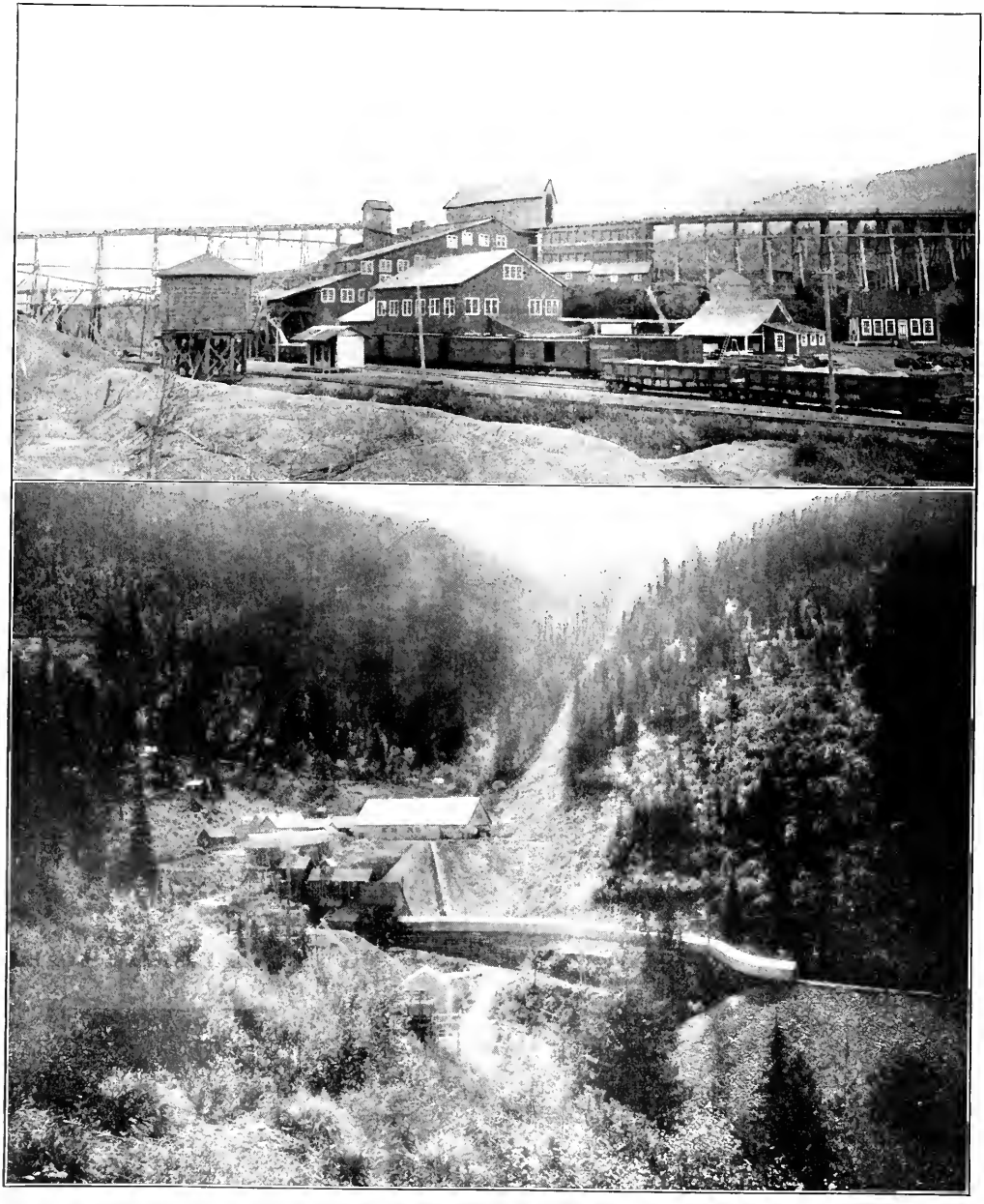
While carrying on an extensive campaign of churn drilling at Sacramento Hill, Bisbee, Ariz., by the Copper Queen, it was found necessary to do much road building to facilitate moving the drills from hole to hole. Drilling was continued for a period of 22 months.

The cost[1] of the road building for the period was as follows: Labor and supplies, $22,065.77; footage of road, $15,092; cost per foot, $1.02.

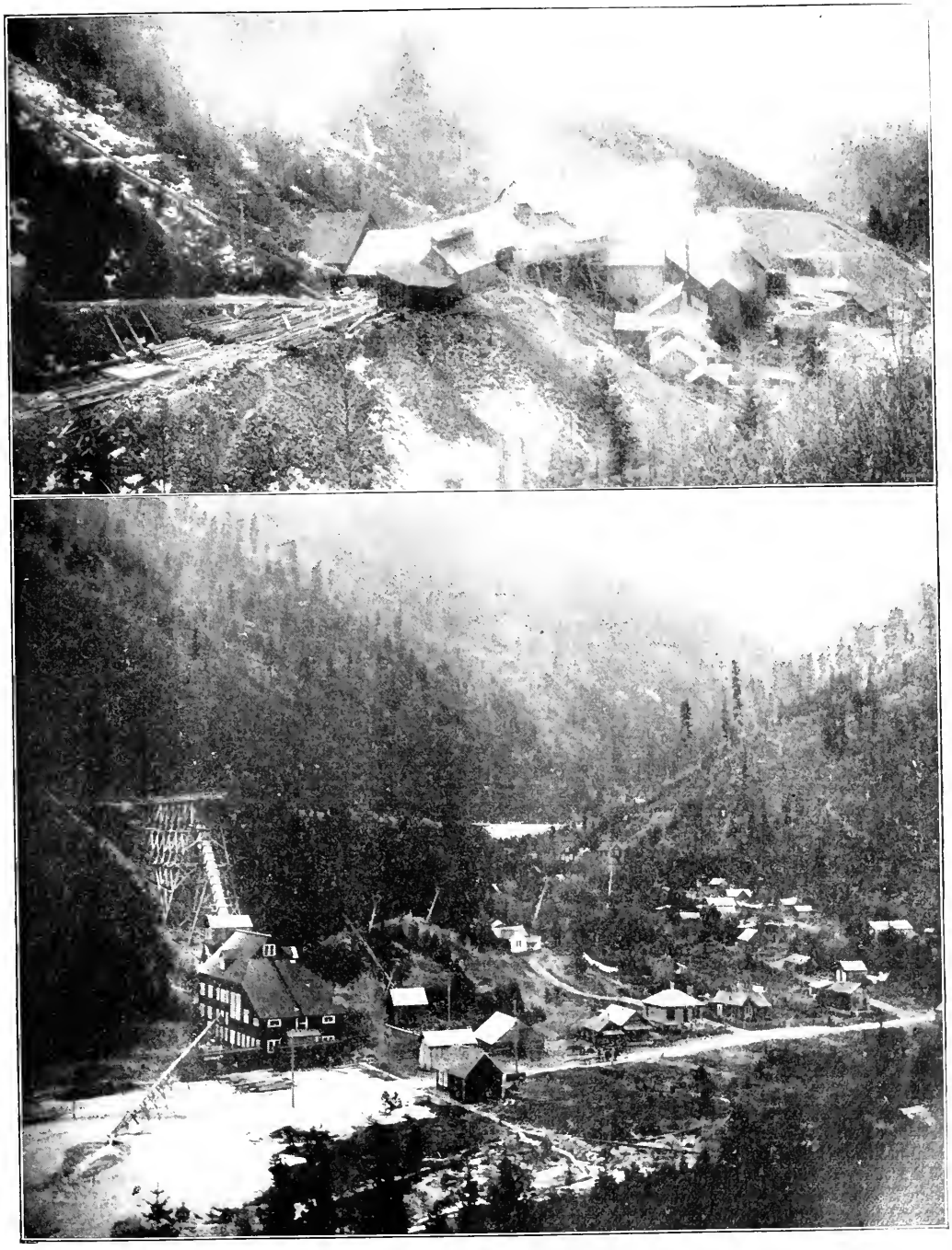
The Cost of Unloading Brick at a Salt Lake Valley smeltery was as follows: With labor at $1.75 per 9-hr. day the average cost of unloading brick from gondola and box cars, inclusive of wheeling an average distance of 100 ft. and stacking, was $0.50 per 1000 brick, labor cost only.

[1]From "Churn-Drilling Costs, Sacramento Hill," presented at San Francisco meeting, A. I. M. E., September, 1915.

Mills of the Coeur d'Alene



THE SWEENEY MILL AT SWEENEY, FORMERLY THE LAST CHANCE, AND THE TAMARACK & CUSTER MILL



THE SUCCESS MINE AND MILL AND THE MARSH MILL, BOTH IN NINEMILE CANON. BOTH ARE [illegible] PROFITABLY UNDER PRESENT MARKET CONDITIONS

Correspondence and Discussion

Anaconda's Campaign for Safety First

The editorial on "Anaconda's Campaign for Safety First" in the *Journal* of Oct. 30, 1915, contains some criticisms of matters of "pure statistical practice," which charge us, at least by inference, with certain errors of which we are not guilty.

In taking these matters up in detail, I wish first to call attention to the *Journal's* objection to our practice of determining the accident rate by dividing the number of accidents by 10,000 shifts. The objection is supported by the statement that both the divisor and classification are odd, and that the results obtained cannot, therefore, be compared with figures given by other companies. You also contend that the correct basis is, of course, the number of accidents per 300,000 man-days, basing your contention upon the fact that the United States Bureau of Mines is trying to introduce this system. Subsequently, you discuss "What is a serious accident?" and say that in the statistics we have given we have left you quite in the dark by lumping fatal and serious accidents.

In reply I may say that the data published in the *Anode* are published primarily for the information of the Anaconda Copper Mining Co.'s employees for the purpose of enlisting their interest in our safety-first campaign. It is therefore necessary to present the data that we publish in such form as will be most readily understood by them. Everybody in Butte knows what a "shift" means, and has therefore some comprehension of what is implied by the number of accidents per 10,000 shifts. Should we publish information concerning the number of accidents per 300,000 man-days, I believe there would be many who would not so readily understand what was meant.

In view of the fact that there is no universally accepted standard method of reporting accident data, I do not see how we can report ours so that they will be universally comparable.

In regard to the discussion "What is a serious accident?" there will be found at the head of each monthly tabulation published in the *Anode,* a statement that the accidents considered are those that caused at least a certain number of days' lost time. During the months of January, February and March we classified as serious all accidents that caused the loss of more than 12 days' time, and on Mar. 1 we raised this limit to 14 days' lost time. No correction was necessary to make the accident rates for the months of January, February and March comparable with those of the succeeding months. There is also at the bottom of each tabulation a note giving the number of fatal accidents included in the tabulation and the names of the mines at which they occurred.

In the September number of the *Anode* we published a tabulation showing the accident rates for the first six months of the present year and the decrease in these rates. In this tabulation no separation was made between fatal and serious accidents. Possibly this should have been done, but as I have mentioned, this information was published solely as a news item of interest to employees.

In another paragraph the *Journal* takes our figures giving the number of accidents per 10,000 shifts and by a mathematical process deduces the number of accidents per thousand men employed per year, assuming that each man works 25 days per month and 12 months per year. Then you say, "However, this figure is not comparable with anything else that we know of." May I call attention to the fact that the figure complained of is the result of your own deductions and that we have not used it? As a matter of fact, it is identical with the accident rate per 300,000 man-days, the use of which the Bureau of Mines is advocating, and which the *Journal* previously assured us was the correct basis that all should use.

In conclusion, I may say that the Bureau of Safety of the Anaconda Copper Mining Co. is most anxious to cooperate with all those engaged in this work of preventing industrial accidents. Any information it may have will be freely given to those desiring it, and if the publication of statistical data in any particular or standard forms will assist the work, it will be only too glad to use those forms.

A. S. RICHARDSON.

Butte, Mont., Nov. 5, 1915.

Technical Journalism and Mining Brokers

I have read Arthur Prill's article in the *Journal* of Oct. 16, anent the desirability of mining engineers, as a profession, making serious efforts to better the standard of the mining industry, particularly in relation to promotions. As to the merits of the remedy suggested—a sort of Dun and Bradstreet applied to mining reports, etc.—although most laudable, I am afraid it is lacking the most direct principles for coping with the situation.

In this, as with any other phase of commercial or professional morality, we are confronted with a condition that Tolstoy recognized when he postulated that the evolution of society is based on the evolution of the individual units constituting society. And although it may seem a hard assertion to make, yet the fact remains that the standard of morality existing in regard to mining promotions is a direct reflex product of the standard of morality existing among mining engineers themselves. The one is a corollary of the other. For that matter, in this particular we are confronted with a fundamental of the psychology of morals; for example, that the principles of an aggregate are but the sum of the individual contributions.

Some months ago I received a circular letter inviting me to attend a meeting for the purpose of forming a local chapter of the American Mining Congress. At that particular time there was an effort being made by sundry people, who probably designate themselves as "mining men," to "boom" a particular mining district not a thousand miles from Salt Lake City, the "messiah" of the

movement being a gentleman who has known what it is to be a guest of the authorities at a certain institution of detention. In reply to this invitation I wrote, asking for particulars as to specific directions in which it would be aimed to advance the mining industry and, *inter alia,* what would be the attitude of the organization in the case of some plan being incubated for fleecing the public; whether it would be the taking of a "club" and beating the gentry involved into insensibility, or the attitude of unctuously prostituting the "am I my brother's keeper" query, and sitting back waiting to join in that old, old refrain, "Dilly, dilly, come and be killed," as the old lady plaintively sang to the duck that was marked for the next day's dinner. My letter remained unanswered.

It doesn't take much moral "guts" to speak the truth when the truth fits the situation better than lying, and there is scant credit in being honest and in meeting one's just obligations when the bank account is in a healthy condition. But to tell the truth when it hurts, and to "play the game" when it means practically almost financial suicide, is quite another matter. It is comparatively an easy matter to grow orchids in a hothouse, and there is no great tax on moral effort to restrain from evil under the hypnotic influence of music in a revival meeting. As a matter of fact, however, there is no greater asset that a professional man can have than the justly earned reputation of being straight. True ability is not such a very scarce commodity in these days of intensive technical application, but we have only to follow some lawsuit to be driven to forceful conclusions as to the other phase of the question, for expert services are by no means always "retained"—"bought" would be a more fitting expression.

Some years ago a certain doctor found the plodding life of practicing in a small country town rather hard hoeing. His first choice was for the honorable life, but the financial results were hurting. And so he conceived of a plan to make some easy money, which consisted in floating a company to advertise the curative properties of applying various so-called secretions of certain animal functions to corresponding physical ailments. In about a couple of years this man became wealthy and then withdrew from his publicity campaign and once more entered the professional fold, specializing as a high-class practitioner in a fashionable part of New York. He placated his conscience by the "auto-suggestion" that he diverted from professional morality only once. The burglar or murderer could utilize the same mental palliative with equal justice.

As to the profession of mining engineering, there is a remedy, and although I dislike the rôle of being dogmatic, I believe such remedy leaves no alternative: The formation of a society wherein every member shall place his professional record and moral entrails before a council before admission thereto, and then subscribe to a severe standard of ethics, any deviation from which—which action would be open to the formation of definite charges by brother members—to be erasure from the rolls. And in addition to general ethics, for the members of this society to be governed by a standardization of technique as to reports or the utilization of the name in relation thereto, etc. A society which, by the rigidity of the moral qualifications and deportment imposed would mean something—both to the member utilizing its insignia and to the public. Not necessarily that the fact that a man is such a member would by any means imply guarantee of any technical opinion expressed, for there is too much to learn to hope for any such degree of definiteness; but at any rate we could insure absolute professional honesty.

When, as a profession, we have purified ourselves, we can with good grace take the proper steps to prevent the shyster promoter from prostituting our profession.

Any society, to be worthy of its object, should make its standard of requirements one which a member could utilize with assurance in proffering them to a surety company if applying to such company for indemnity bonds. Such societies would require applicants to place their whole life's record upon the table.

The remedy is simple enough. There is only one question involved: Do we want to "take the medicine?"

Salt Lake City, Oct. 24, 1915. JOSEPH RALPH.

Society Employment Bureau

It is possible the Western Society of Engineers, 1745 Monadnock Block, Chicago, Ill., may attempt seriously the establishment of an employment bureau for the benefit of technical men and employers of technical men.

Active coöperation is desired. We wish to receive from officers and past officers of societies that have made similar attempts the reasons for failure, if failure was met, and what degree of success was encountered. We should like to hear from every man that has any ideas on the subject and we shall not be appalled if the mails are filled with letters of advice or information. We know the task, if properly attempted, is a big one, hence the desire to receive the benefit of experience and information that is certainly available.

The bureau will be run—if it is started—as an adjunct to the society, and there will be no fees to pay. It will be free in every way and designed to take the men out of the hands of employment agencies, which bleed unfortunate technical men that have no other means for securing positions. ERNEST MCCULLOUGH,

First Vice-President, Western Society of Engineers.

Chicago, Ill., Oct. 27, 1915.

Fettling Reverberatories

Referring to the correspondence printed in the *Journal* of Jan. 23 and Oct. 16, 1915, with regard to the first roof-fettling of large reverberatory furnaces, I find that the Charles who was at Cananea is not the Charles who took out the patent, but is a cousin of his and is a brick mason. The name, Harry Charles, was given me under a misapprehension, my informant thinking that I wished to know the name of the patentee, and not of his cousin, who worked for us at Cananea. L. D. RICKETTS.

Warren, Ariz., Oct. 29, 1915.

Fineness of Ore Crushing for Assaying

Remembering that "it is a condition and not a theory that confronts us," I would be very glad to have E. J. Hall give the practical data to show that the decomposition $2NaHCO_3=Na_2CO_3+H_2CO_3$ "is to all intents and purposes complete before any fusion takes place"[1] in an ore-assay fusion. FREDERIC P. DEWEY.

Washington, D. C., Oct. 25, 1915.

[1] "Eng. and Min. Journ.," Oct. 16, p. 649.

NEW PUBLICATIONS

THE PHOSPHATE DEPOSITS OF FLORIDA. By George Charlton Matson. Pp. 101, illus. Bull. 604, U. S. Geological Survey, Washington.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE. Vol. XCI, No. I, 1915. 5¼x8¼, pp. 714, illus. Iron and Steel Institute, 28, Victoria St., London, S. W.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. 6x9, pp. 308, illus. Vol. VII, 1914; $6. D. Van Nostrand Co., New York.

WABANA IRON ORE OF NEWFOUNDLAND. By Albert Orion Hayes. Pp. 163, illus. Memoir 78, Canada Department of Mines, Geological Survey Branch, Ottawa.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1914, with Subject Index. By John M. Nickles. Pp. 167. Bull. 617, U. S. Geological Survey, Washington.

THE PEAT RESOURCES OF WISCONSIN. By Frederick William Huels. 6½x9½, pp. 274, illus. Bull. XLV, Wisconsin Geological and Natural History Survey, Madison, Wis.

MINERAL RESOURCES OF ALASKA. Report on Progress of Investigations in 1914. By Alfred H. Brooks and others. Pp. 380, illus. Bull. 622, U. S. Geological Survey, Washington.

ABSTRACTS OF CURRENT DECISIONS ON MINES AND MINING, OCTOBER, 1914, TO APRIL, 1915. By J. W. Thompson. Pp. 138. Bull. 101, U. S. Bureau of Mines, Washington.

REPORT OF THE CHIEF INSPECTOR OF MINES IN INDIA, Under the Indian Mines Act (VIII of 1901) for 1914. By G. F. Adams. 8x13, pp. 81, illus. Department of Mines, Calcutta, India.

BIBLIOGRAPHY OF MINNESOTA MINING AND GEOLOGY. By Winifred Gregory. Pp. 157. Bull. 4, University of Minnesota. Minnesota School of Mines, Experiment Station, Minneapolis.

QUINQUENNIAL REVIEW OF THE MINERAL PRODUCTION OF INDIA. By Sir Thomas H. Holland and L. Leigh Fermor. Pp. 296, illus. Vol. XLVI, Records, Geological Survey of India, Calcutta.

MIXING AND MINE VENTILATION. A Practical Handbook on the Physics and Chemistry of Mining and Mine Ventilation. By Joseph J. Walsh. 5x7½, pp. 180, illus.; $2. D. Van Nostrand Co., New York.

GEOLOGY OF THE VICTORIA AND SAANICH MAP-AREAS, VANCOUVER ISLAND, B. C. By Chas. H. Clapp. Pp. 143, illus. Memoir 36, Canadian Department of Mines, Geological Survey Branch, Ottawa.

THE YUKON-ALASKA INTERNATIONAL BOUNDARY, BETWEEN PORCUPINE AND YUKON RIVERS. By D. D. Cairnes. Pp. 161, illus. Memoir 67, Canada Department of Mines, Geological Survey Branch, Ottawa.

THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE. Report of Operations and Production During 1914. By D. H. Newland. Pp. 88, paper. Museum Bull. 178. University of the State of New York, Albany.

GEOLOGY AND OIL RESOURCES OF THE WEST BORDER OF THE SAN JOAQUIN VALLEY NORTH OF COALINGA, CALIFORNIA. By Robert Anderson and Robert W. Pack. Pp. 220, illus. Bull. 603, U. S. Geological Survey, Washington.

THE CANBELEGO, BUDGERY AND BUDGERYGAR MINES. Part II of the Cobar Copper and Gold-Field. By E. C. Andrews. 6x9½, pp. 121, illus.; 7s. 6d. Mineral Resources No. 18, Geological Survey, Department of Mines, Sydney, N. S. W.

A GEOLOGICAL RECONNAISSANCE BETWEEN GOLDEN AND KAMLOOPS, B. C., ALONG THE CANADIAN PACIFIC RAILWAY. By Reginald Aldworth Daly. Pp. 260, illus. Memoir 68, Canadian Department of Mines, Geological Survey Branch, Ottawa.

THE WORLD'S SUPPLY OF POTASH. 6¼x9¾, pp. 47, paper; 1s. The Imperial Institute, London, S. W. An account of all the more important sources of potash in the world, including the Stassfurt deposits in Germany, which before the war had an almost complete monopoly of the world's supply.

ESTUDIO DE LA FUERZA HIDRAULICA DE LOS RIOS COLORADO, BLANCO Y RIO DE CHIUTA CON ANTEPROYECTOS PARA LA INSTALACION DE CENTRALES HIDRO-ELECTRICAS. By Victor Sintich. 8½x11½, pp. 34, illus., 16 plates. Sociedad Imprenta y Litografia Universo, Valparaiso, Chile.

THE SAMPLING AND CHEMICAL ANALYSIS OF IRON AND STEEL. By O. Bauer and E. Deiss, translation from the German by William T. Hall and Robert S. Williams. 5½x8, pp. 373, illus.; $3. McGraw-Hill Book Co., New York.

This book was originally a compilation of the methods which have been found reliable after several years' use at the Royal Testing Bureau, Gross-Lichterfelde, Germany, but has been amplified by methods tested by the U. S. Bureau of Standards and in the laboratories of the Massachusetts Institute of Technology.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES FOR BUYERS AND SELLERS. 7¾x11½ in., pp. 1503, leather; $10. S. E. Hendricks Co., Inc., New York.

The present volume is the twenty-fourth edition of this work, which is published annually. It has been thoroughly revised, entirely reset and much new matter added, which will increase its usefulness. The binding has been changed from cloth to Du Pont "Fabrikoid," making a more handsome book, and we also note an improvement in the quality of paper used.

THE RARE EARTH INDUSTRY. Including the Manufacture of Incandescent Mantles, Pyrophoric Alloys and Electrical Glow Lamps. By Sydney J. Johnstone. Also a chapter on The Industry of Radioactive Substances. By Alexander S. Russell. 6x9¾, pp. 136, illus. D. Appleton & Co., New York.

This is the second of a series of manuals of chemical technology, and is essentially of a practical nature, treating especially of the industrial applications of the rare earths. The pure chemistry of these substances is dealt with only in so far as is necessary for properly understanding the nature and properties of the materials dealt with. The chapters are: Thorium and cerium, titanium, zirconium, tantalum and niobium, tungsten, the incandescent electric glow-lamp industry, uranium, vanadium and the industry of radioactive substances.

DETERMINATIVE MINERALOGY, With tables for the determination of minerals by means of their chemical and physical characters. By J. Volney Lewis. Second edition revised. 5¼x8, pp. 155, illus.; $1.50. John Wiley & Sons, New York, N. Y.

This book has been designed for the use of students in determinative mineralogy and also to meet the needs of the geologist and the mining engineer. The tables give the physical and chemical properties of 380 minerals (which the author says is 100 to 150 more than the current textbooks), while the arrangement is such that unknown minerals may be determined quickly and easily. In the system of determination, the general plan of the Brush-Penfield tables has been followed in the main, but there is much condensation and simplification of procedure.

THE MINERAL INDUSTRY DURING 1914. Volume XXIII. Edited by G. A. Roush. 6x9, pp. 998, illus; $10. McGraw-Hill Book Co., New York.

The twenty-third volume of "The Mineral Industry" is the same in appearance and general plan as its predecessors have been. Indeed, it is remarkable, and a tribute to the foresight of the originators of this publication, that during 23 years there has been so little change of plan. The twenty-third volume brings forward some new contributors, which add freshness to the volume, but in general they stick to the same lines that the writers on the same subject in the past have followed.

The new volume is rather marred by some carelessness in editing. Some of the bibliographies are sadly incomplete, which excites the suspicion that this failing may be general throughout the book. Also, the references to original sources of information in the footnotes are not well done. Many important references are omitted, while minor ones are included, and citations are made to some sources which are not good authorities. The index to the volume is poor, being only a scant 7½ pages.

These criticisms are not offered in any captious way. The defects that we have remarked are trifling in comparison with the great value of "The Mineral Industry" as a book of reference. For a concise summary of progress in the metallurgic arts, for statistics of production and commerce throughout the world, everybody has acquired the habit of turning to this book and usually is able to find what he wants.

THE THEORY AND PRACTICE OF ORE DRESSING. Edward S. Wiard. 6x9, pp. 426, illus.; $4. McGraw-Hill Book Co., New York.

There have been published a good many books on ore dressing, but nothing previously that is just like this one. The treatises in English, heretofore, have been of the descriptive character. The classic of Prof. Richards was much more than that, being encyclopædic. Wiard's new book differs from its predecessors in not being descriptive to any great extent, but rather advisory. That is to say, it tells mill men how they ought to do things, and gives adequate descriptions of the means how and the reasons why, without wasting any time or space upon machines and methods that have been discarded. In other words, this is a treatise by an experienced mill man, who has written a book just as if he were instructing his own assistants or advising a client. It is about the same thing in the art of ore dressing that Peters' first book was in the art of copper smelting.

Now, this book is by no means perfect. There are many things in it with which other mill men will disagree. There are many things that ought to have been treated, which are omitted or else are mentioned but scantily. When we first turned over the pages we were rather shocked to discover how slight was the attention given to the flotation process, but upon referring to the preface we learned that this omission was intentional. The author said, "It was hoped, also, to present some plans and flow sheets of flotation mills, and a large amount of material was collected; but owing to the litigation on flotation processes this information has been furnished confidentially. For this reason the flotation process has not received the mention that its importance warrants."

Here we have once more the bane of that long-drawn vexatious litigation that casts a shade over technical literature like that of the deadly upas tree.

With our eyes open to these shortcomings, however, we think that most mill men will recognize that Mr. Wiard's book is an important contribution to the literature of ore dressing, and is not only refreshing on account of its novelty, but also is of promise with respect to its practical usefulness both to students and the men who are engaged in the actual practice of the art.

RULES AND REGULATIONS FOR METAL MINES. By W. R. Ingalls, James Douglas, J. R. Finlay, J. Parke Channing and John Hays Hammond. Pp. 296. Bull. 75, United States Bureau of Mines, Washington.

It would be difficult to find in this country five men more thoroughly qualified by knowledge, experience and judgment than the members of this committee for the work of which this bulletin is the result. Originally appointed in 1906 as a committee of the American Mining Congress, they spent in preliminary studies, inquiries, tentative reports and publications the following five years, during which they received valuable suggestions from their professional brethren and were appointed a committee of the American Institute of Mining Engineers and of the Mining and Metallurgical Society of America—of each of which organizations they were already members. A fourth instrument of publicity was the "Engineering and Mining Journal," which threw open its columns to the various reports and discussions furnished or called for by the committee. This noteworthy wide and enthusiastic coöperation in such an inquiry is of course highly creditable to the organizations concerned. But it is also a striking testimony to the committee that inspired it. These were competent judges, free from self-interest or professional prejudice, able to comprehend and weigh both criticism and controversy and not ashamed to yield to reasonable opposition. It was worth while to give facts and views to a committee that treated its witnesses as friendly advisers, neither imposing oaths upon them nor flinging curses after them; and the result of its labors, as compared with those of other so-called investigating commissions planned, manned and steered by politicians, is an object lesson in sociology. The first chapter of the volume before me, in which Mr. Ingalls recounts simply and without comment the history of the committee and its investigations, is full of significance to one who can read between the lines.

It was to a work thus auspiciously inaugurated and superintended that the United States Bureau of Mines lent its grateful approval and powerful assistance in 1911 by appointing the individual members of this committee its consulting engineers, facilitating their further labors and finally publishing and circulating their report as Bulletin 75 of the bureau. Its late distinguished director, Dr. Joseph A. Holmes, wrote me, not long before his death, repeating an assurance often given before, that it was his earnest purpose to conduct the Bureau of Mines so as not to oppress individual enterprise by governmental inquisition, interference or control, and especially to keep the bureau out of politics. This report conspicuously illustrates that declaration.

Chapter II constitutes the general report of the committee and Chapter III is the committee's draft of a proposed law. The latter would naturally be regarded as the more important, but I am inclined to give that rank to the former, which contains the committee's opinion of its own work. The following passages indicate this opinion:

> We consider our work to be especially of educational character rather than anything else. It will be useful in three main ways, we think, as follows: (1) As a basis for state legislation. (2) As a basis for private systems of inspection. (3) As a collection of simple rules for the guidance of everybody engaged in mining. . . .
>
> We consider, however, that the chief usefulness of the code of rules that we have formulated will be to small operators, who frequently engage in unsafe practices without knowing that they are unsafe or without thinking about the matter at all. There is a reasonable hope that our report will be of educational value to all mining operators.

Concerning the first two uses of this code mentioned, the committee can already adduce gratifying instances in the codes of states and the systems adopted by large mining companies. In view of the comprehensiveness, technical thoroughness and wide circulation of the committee's code, it is highly probable, not that any legislature or board of directors will adopt it in full, but that no system will be hereafter adopted without a consideration of this one, and that good reason will have to be shown for any omission, addition or departure exhibited by a new system proposed. Legislators and directors cannot hereafter blunder through lack of warning.

The third, the educational, value of this report is greatly enhanced by the comments interspersed through Chapter III and contained in Chapter V—"Discussions of Certain Matters of Practice." Here the conditions to be met are clearly stated and the reasons are given that influenced the committee's adoption or omission of certain rules. This explanation of omissions is specially useful; for an omission might be simply an oversight; and when a drastic or unwise rule is proposed, it is well to know that such a tribunal has considered and condemned it. Moreover, many things are recommended in these chapters as good, though not codified as obligatory.

In short, the code and comments, taken together, constitute an elementary, practical guidebook that ought to be in the hands of every mine operator. If put into his hands, it will certainly open his eyes and thus get into his head, to the great advantage of his brain! It will teach him to value as well as to frame suitable rules; to welcome gladly suitable laws, to oppose bad ones intelligently. For the book is not dry, but fascinating; not abtruse, but practical; not dogmatic, but suggestive and stimulating.

Indeed, the admirable code of this committee is, to my thinking, far more instructive educationally than efficient administratively. Its weakest part is Section 52, "Penalties," which provides that every violation of this law shall be a misdemeanor, punishable, after conviction in a circuit court, by fine not exceeding $500, or imprisonment in the county jail for not more than six months, or both. The same section makes the owner or operator liable for the damage caused by his own act or neglect, or the act or neglect of any superintendent, foreman or hoisting engineer of any mine. Nothing is said about the legal responsibility of employees for anything whatever, and no penalty is provided for any violation of rules by an employee, except that of an indictment and trial by jury in the county court.

The committee frankly confesses this deficiency in the following paragraph (p. 81):

> The committee has endeavored to place the responsibility for certain conditions and the observance of certain requirements upon those who should clearly be responsible—the operator in some instances, and in others the superintendent or the mine foreman. It is recognized that many accidents are due to the miners themselves, owing to carelessness or recklessness, or willful disregard of safety rules; but it is not practicable to penalize the miners for all of such acts. Of course the miner, as well as the operator or superintendent, is personally liable for the doing of an act expressly made unlawful and the doing of which constitutes a misdemeanor. If a miner persistently violates safety requirements, the operator can terminate his employment, if nothing more; or he may, if desired, report the violation of law to the local prosecuting officer or to the mine inspector. Although the men may not be reached in some instances, it is certainly true that a miner injured by the doing of some prohibited thing—that is, in violating the law—would have no recourse against the operator, which is in itself a penalty of a more or less drastic character.

Bearing in mind that the best code is of no use unless strictly enforced and that such an enforcement means the proper punishment of those violations which do not, as well as those which do, result in injury, we must say that the committee's explanation as to penalties shows the weakness of its code in this particular, beyond the need of argument.

For instance, a miner violates Section 51 by giving an electric shock to a comrade "for fun" or by making connection with an electric current so as to get a spark to light his pipe. No harm actually follows, but just such careless acts should be punished without reference to their results. Yet all that the superintendent can do under this code is to tell the district attorney and the grand jury, and get the miner indicted and tried by jury. True, if he "persistently" does the unlawful thing, the operator may discharge him. And finally, if he gets hurt through his own violation of the law, he certainly cannot get damages from his employer.

I am not so sure of the last two propositions as the committee seems to be. I have known superintendents that did not dare to discharge men under such circumstances for fear of a general strike; I have known many a strike that originated in such a discharge; and I have known boards of directors that rebuked their superintendents for "getting into trouble" by trying to enforce discipline. Finally, as to the "certainty" that a violator of the law cannot recover damages for the direct consequence of his own act, a good many people still remember, as I do, the case of an employee that undertook to destroy a mine building with a dynamite bomb, lost an arm through the premature explosion of the bomb, and got from a terrorized jury a verdict for some $17,000 against the company, for "injuries suffered while in its employ." This verdict was, indeed, afterward set aside as contrary to the evidence, but it served to show the value of a jury trial in such a case, place and time.

Admitting, however, all that the committee says under this head, I must still regard its code as highly deficient in penalties. Yet I can hardly characterize this feature as a fault. The most important work of the committee was to point out dangers and remedies; and the highest function of its report will be to convince even employees that the dangers are real and the remedies wise. After that has been accomplished, both the creation and the enforcement of codes will be easy.

R. W. RAYMOND

Hoover Back to Belgium

Among the passengers sailing for Rotterdam on the Holland-American liner "Nieuw Amsterdam," Nov. 10, says the New York *Times,* was Herbert C. Hoover, chairman of the Commission for Relief in Belgium, who has been in New York for two weeks consulting with his American colleagues on the work to be done during the coming winter. He was accompanied by his wife and his two sons. In an interview just before the steamer sailed, Mr. Hoover said:

We have had to prepare for a year ahead. Belgium has been under occupation and blockade for fifteen months, and there have been no imports and almost complete industrial paralysis and un-mployment among the working classes.

The industrial trades in Belgium were hit the hardest. The agriculturists did not suffer so badly. In Brussels from 30 to 40% of the population is on the bread line. In Liege fully half the population is being supported by the relief commission.

We are faced with the task of obtaining for these people a supply of clothing to tide them over the winter. We want about $5,000,000 worth of clothing or clothing material.

The gratitude of the Belgian people to the United States is pathetic. That is the one country in Europe today where America is popular. The people left in Louvain have renamed a public square the Place des Etats Unis, and several streets in Belgium have been named after President Wilson.

Revision of Mining Laws

The convention of mining men that is to be held in Washington on Dec. 16, 1915, at the invitation of, and under the auspices of, the Mining and Metallurgical Society of America, is exciting a good deal of interest, especially in the West, whence numerous delegations have signified their intention to attend.

The headquarters of the society for this meeting will be in the building of the United States Bureau of Mines, where F. F. Sharpless, secretary of the society, will be present on Dec. 15. A book for the registry of persons attending the convention will be open at that time. The society requests that all visitors will register on that day or the following day.

Report of Ray Consolidated

The report of the Ray Consolidated Copper Co., operating at Ray, Ariz., for the third quarter of the year shows a copper production in concentrates of 14,931,388 lb., divided as follows: July, 4,352,571 lb.; August, 5,581,-731 lb.; September, 4,997,083 lb. In addition to the copper derived from concentrating ores there was a total of 450,966 lb. of copper contained in ores shipped direct to the smelter. The total amount of ore milled for the quarter was 716,241 dry tons averaging 1.659% of copper, as compared with 679,004 dry tons averaging 1.677% for the previous quarter. The milling costs for the quarter were 56.54c. per ton, as compared with 44.53c. for the previous quarter. The average mining and coarse crushing cost of ores milled for the quarter was 70.835c. per ton, of which 4.279c. was the cost of coarse crushing, leaving the net mining cost 66.556c. per ton. The underground development for the quarter was 12,205 ft.

The average cost per pound of copper produced from milling ores for the quarter, after allowing for smelting losses and applying dividends of the Ray & Gila Valley R.R. and revenues from gold and silver produced, but no other miscellaneous income, was 10.264c. The combined cost per pound of net copper produced from milling and direct shipping ore for the quarter was 10.294c. These costs include all operating and general charges, as well as 12½c. per ton of ore milled, which is applied to the retirement of mine-development costs. This latter charge is equal to 0.621c. per lb. of copper produced from concentrating ores for the period.

The financial results for the quarter were as follows: Net operating income, $802,775; miscellaneous income, $14,171; less bond interest, $35,675, and dividends, $547,-802, leaving a net surplus over bond interest and dividend requirements of $233,470.

Costs and earnings were adversely affected during the quarter by labor disturbances. These difficulties were fully and satisfactorily overcome by the middle of July, but the organization did not regain its former efficiency for some time thereafter.

Largest Electric Locomotive in the World

BUTTE CORRESPONDENCE

The first of the electric locomotives for use on the division of the Chicago, Milwaukee & St. Paul lines between Deer Lodge and Three Forks, Mont., arrived in Butte Oct. 25 and was viewed by hundreds of interested spectators. The locomotive is the largest electric railroad engine in the world. It was built by the General Electric Co. and is to be taken to the Coast and exhibited at the principal stations along the route.

The locomotives are 112 ft. long, weigh 284 tons each and are designed to use as high as 3,000-volt direct current. Passenger locomotives are geared to haul 800 tons at 60 mi. per hr., and freight locomotives will haul 2,500 tons trailing, on a 1% grade at a speed of 16 mi. per hr. Each locomotive is driven by 8 motors rated at 375 continuous horsepower each. On down grades the train is controlled by reversing the controller, which changes the motors into generators and sends back to the line about 50% of the energy used in pulling a train up grade. This makes the use of air brakes necessary only in case of emergency. The electrification of the 440 mi. from Harlowtown, Mont., to Avery, Ida., has cost $13,000,-000. The first unit completed and to be put in operation will be from Three Forks to Deer Lodge, running through Butte. On Oct. 25, a dozen officials of the Milwaukee and of the Butte, Anaconda & Pacific, with a few guests, made a very successful trial run from Butte to Anaconda and back over the B. A. & P. line. Tests will soon be made with the new locomotives over the line between Deer Lodge and Three Forks, and trains will be running over that division under electrical power by Jan. 1, 1916.

Japanese Mineral Production in August, 1915

Japanese mineral production during August, 1915, according to the Department of Agriculture and Commerce in Tokyo was as follows: Gold, 742,858 kg.; silver, 11,974,036 kg.; copper, 5,667,780 metric tons; iron, 4,986,645 metric tons; coal, 1,290,722 metric tons; crude oil, 43,226,640 liters; sulphur, 6,648,963 metric tons.

Coal and sulphur show a decrease compared with 1914; all others show increases.

Editorials

The Metal Markets

The middle of November sees all of the metal markets in a blaze of glory. In each case there is a large production, probably a phenomenal production, but the demand is so large that the output is readily absorbed on a scale upward. Verily, this is a bull market in the metals.

In copper the strike at the Nichols refinery, reducing the American production of electrolytic copper by about a million pounds a day, gave the market the fillip it needed. Buyers began to think that no matter how plentiful copper might be next year, when Chuquicamata and Inspiration are expected to be going real good, for a while copper might be scarce, especially in view of the facts that producers were well sold ahead and had no great accumulation of stocks. Their thoughts of this nature prompted them to action, and they bought freely.

Some characteristics of the existing copper market are deserving of comment. Buyers appear to have abandoned the policy of coming into the market together, contracting for huge blocks, and then remaining away for a long time. During the last month there has been good business from day to day, each buyer playing his own hand and contracting for copper as he thought it wise to do. On the other hand, producers have displayed no tendency to dangle copper over the buyers' heads, but have supplied it liberally on a scale upward. Not yet has copper been put to an extravagant price.

Within a month the price for lead has risen from 4½c. to 5¼c., the successive advances following large and satisfactory selling at each previous price. The demand for lead, both for domestic consumption and for export, continues large, but in this metal, as in copper, the producers have followed the policy of making hay while the sun is shining and have deemed it wise to convert lead into money as fast as they could.

The demand for spelter appears to be insatiable, for in spite of the rapidly increasing production prices have risen again. The great mystery is how so much of it is being used, for the domestic galvanizing business for peaceful purposes continues all but paralyzed.

Great Britain's Backwardness in Metallurgy

The handicap under which Great Britain and her colonies labor, owing to their small participation in the metallurgical industries of the world—iron and steel excepted—continues to exercise the British press. In the *Journal* of Nov. 13 were reproduced excerpts from a recent article in the *Statist*, which is more rational and better informed than most of its contemporaries. The complaint particularly expressed in this article is against the sending of raw copper from Great Britain to the United States for refining.

This movement, which is no new thing, has not deprived Great Britain of any needed supplies in her time of war, nor has it advanced the price to her. The copper refining business is highly competitive—American, Japanese, Australian, and other refiners meeting in a free field. All that Great Britain loses is the profits that would accrue to her from doing more of this work at home. The reason that she does not do it at home is that her metallurgists are backward, while the blight of labor inefficiency is over everything. In a previous article on this subject, the *Journal* suggested as a fruitful subject for inquiry the reason why Great Britain has been able to maintain her prestige in iron and steel while falling so far behind in copper, lead and zinc.

Opportunities for Unemployed Mining Engineers

Owing to numerous untoward conditions that have obtained in the mining industry for the last few years, there has been a growing number of competent mining engineers who have been finding great difficulty in obtaining employment. This has been adverted to several times in these columns and has aroused considerable discussion. Although the conditions of unemployment have been ameliorated to a certain extent by the present boom in mining, no permanent solution of the problem has been found, and recurrence of these periods of unemployment for mining engineers is a probability.

The field for the independent consulting mining engineer, which was such an attractive one a few years ago, has narrowed almost to the vanishing point. All of the larger mining concerns, which can afford to pay consulting engineers' fees commensurate with the talent required, maintain their own staffs who are constantly employed with the almost innumerable propositions being put to them every year. There is also in these large companies a growing tendency toward promotion and elevation of their own engineers, so that it is increasingly difficult for an outsider to break into these attractive organizations.

Therefore many competent mining engineers are confronted with the question of where to look or what to do. A striking and interesting illustration of the solution of this problem, in one instance, is at hand and should furnish food for thought for others.

About one year ago ten Colorado mining engineers, who had plenty of idle time, organized themselves into a leasing and mining company, believing that if the advice of a competent experienced engineer is sufficient basis for the expenditure of large sums by experienced eastern mining investors, it ought to be sufficient basis for the investment of the engineer's own money. After much consideration of many offerings, a good lease, which each agreed was one he would recommend to a client, was selected near Denver and work was commenced on a comparatively small scale, financed by the engineers themselves, who of course provided the engineering talent for the proposition. Within a very short time they had

found what they went after, and further developments made a paying proposition of the venture. The work is still going on with good results.

If such a scheme were to be as widely adopted as it should be, there would be a dearth instead of a surplus of unemployed mining engineers. There are plenty of promising opportunities, both in new prospects and in old mines whose ores, formerly too low-grade or too complex to be successfully treated, are now profitable. These opportunities cannot be safely judged except by the trained engineer, and this very fact more often brings them to the notice of the engineer earlier than to the promoter or investor. That the engineers have not taken up this independent work and made themselves producers is partly owing to the fact that, when confronted with unemployment, which from previous experience the engineer may know is likely to be quite long, he hesitates about making the venture. However, in one small district, for example, there are more than forty leasers who are making more than $300 a month each, on average veins of ore, with no capital investment. And there are plenty of localities and prospects where a few thousand dollars judiciously expended would at least give a fair run for the money.

The engineers' lease on the Florence, in Goldfield seven or eight years ago, is another instance where engineers took hold of an abandoned lease with the greatest success, although of course in this case it was enlarged by the fact that they were after and found the rather exceptional picture rock which was common to that section of Goldfield in the early days.

Let the engineers grub-stake themselves by association or secure a grub-stake from an outsider and become producers instead of stragglers or farmers.

There is another field for the mining engineer that has sufficient capital to keep himself going for a little while, say 12 to 18 months. If he is not already acquainted with several mining propositions that are being run very unprofitably, a short trip, which would be within his means, would doubtless reveal to him one or more small mining propositions that were producing, say, in the neighborhood of $100,000 a year, whose operations were being sadly bungled. There are hundreds of mining operations being carried on under the direct supervision of men that are not engineers and that have little executive ability and that are not only not producing results but have very little likelihood of ever being able to do so, although the opportunity is there if the right talent be applied. The unemployed engineer could well afford to make a proposition to undertake the handling of such an operation on a contingent basis—not to receive any salary during the period, but to receive a compensation commensurate with the savings or increased profits which he feels his ability will enable him to make over the present poor methods employed. As a consulting engineer he would be staking his reputation, at least so far as his then clients were concerned, on the advice that he would give them as to the methods for changing or improving their mining and milling methods. He would not be doing more or less than this if he assumed this responsibility himself on a contingent basis.

A working arrangement of this kind would be not only mutually advantageous, but also would be as welcome to one party as to the other. A mine that is producing $100,000 a year and that at a loss, will almost never have an engineering staff, nor will it have a head who will feel justified in incurring the expense of employing a consulting engineer to point out where the flaws are that result in unprofitable operations. A mining proposition cannot go on losing money forever, and the limit is much more quickly reached in a mining operation of the size that we have assumed. Therefore the consulting engineer who would attach himself to the company on a contingent-fee basis would be not only a very welcome acquisition from the standpoint of the controlling interests, but under the conditions would be stimulated to put forth his best and most energetic efforts; and there is no doubt that hundreds of mining operations throughout the country which under present conditions are foredoomed to disaster could thus be turned into profitable money-making properties, to the gratification of both parties to the contract.

If these two methods of turning unemployment into employment were to be adopted by any considerable percentage of the mining engineers looking for openings, there would be another great advantage along broad general lines, but in a distinctly different direction. One or two small mines in a district employing, or having in this manner associated with it, a mining engineer would stimulate the other properties that were on a similar basis, both as to size and quality of operations, to make some such arrangement. The eventual result would be that those mining operations, in general, that are conducted on a moderately small scale would be toned up and we should see far fewer monuments to poor engineering and blasted hopes than are now so common in almost every mining district.

Respirators vs. Water Sprays

The danger from the inhalation of rock dust by miners is becoming more and more recognized. The drawing of fine particles of dust into the lungs is not good for the lungs, no matter what be the kind of dust, although certain kinds are less injurious than others. The worst kind is, without any doubt, that which arises when flint or chert is pulverized, as in drilling upwardly pointed holes. The sharp angular fragments, infinitesimal though they be, produce an affection known as silicosis, the sufferer from which is especially subject to tuberculosis. The men working in the zinc mines of the Joplin district of Missouri and in the gold-quartz mines of California seem to be especially subject to this danger.

There are two principal means for the amelioration of bad conditions resulting from the operation of such mines: One is for the miners to wear respirators, in order to filter the dust from the air they breathe. The other is to lay the dust by directing a water spray upon the mouth of the hole being drilled or to use the hollow steel water-drill.

The compulsory use of respirators has been tried by some enlightened operators in the Joplin district, but without success, for the reason that the miners would not wear them except when the shift boss was looking on. At all other times the free and independent miner preferred to be at liberty to converse with his partner, whistle, chew tobacco and expectorate, or do whatever he pleased, rather than protect himself against a danger whereof the consequences were not, anyhow, immediate, so far as he could see. The same aversion used to be observed in

dry-crushing mills, wherein the dust-laden atmosphere was much worse than it is in any mine. No matter how many respirators might be provided, the men would not use them. Sometimes they would tie a wet sponge over the mouth, but generally they dispensed with all protection and tried to lead a merry life, if a short one.

The California mine operators, on the other hand, appear to be having better success in inducing the men to wear respirators than in persuading them to use water in connection with the drilling. The men claim that the use of water in steeply inclined or vertical raises makes some of them very dangerous by rendering the timber slippery and the ground unsafe. Also, they allege that the men who use water in such raises become wet to the skin in a short time and are troubled by rheumatism. The average California miner dreads rheumatism even more than tuberculosis, and as to the latter he does not realize that breathing rock dust may cause it.

This is one of the evils of the mining occupation that cannot be cured effectually by rules and regulations, no matter how many policemen may be appointed to enforce them. The real remedy is education, making the miners themselves see the dangers so clearly that they will want to protect themselves.

BY THE WAY

Recent news dispatches affirm that after a lapse of about two years the service of Pullman cars from Laredo to Mexico City has been resumed. Well and good. But peace and prosperity will seem more assured when the service of man-pushed ore cars is resumed throughout the Sierra Madre.

⁂

The Ford process for producing castings direct "at one heat," concerning which some extraordinary statements appeared in the daily papers, consists chiefly in the delivery of molten pig iron from the blast furnace to the electric furnace through a mixer in the same way as molten iron is delivered to the openhearth steel furnace.

⁂

"The hottest summer known in Alaska, melting the snow on mountain tops for first time since purchase of the territory from Russia, together with the action of a receding glacier, uncovered and exposed near Valdez within 11 mi. of tidewater what is said to be greatest low-grade copper-ore deposit in Alaska." says the Boston *News Bureau*. "Ore zone is 1,000 ft. wide and 3 mi. long. Traversing it are eight strata of schist and quartzite from 24 to 200 ft. in width, freely impregnated with chalcopyrite, carrying values of from 2% to 9% copper. Also in same belt is found great quantity of malachite ore carrying copper value of $10 a ton." There is a long, cold, hard winter coming, however.

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That all the smelter chemists are not rich is merely because they do not know anything to speak of, which is shown by the following quotation from the Salt Lake *Herald-Republican:* "In the smelter fumes are scores of rare materials which as yet the smelter chemists know nothing about. It is probable that in the smelter fumes there are greater profits than in the metals that are being smelted. Take as an example the Tennessee Copper ores—and there are thousands of tons of ore almost identical in Utah—or at least are treated in the Utah smelters. In making its copper the Tennessee Copper saves sulphuric acid, nitric acid, picric acid, tri-nitro-toluol, and other products which will sell under contract during the year for $11,000,000, on which it is declared there is a profit of at least 50%. Using this as a basis for figuring, Utah could produce at its present rate of making copper, $165,000,000 gross. Then there are all the byproducts from the lead-silver stacks which have not yet been taken into consideration. Figuring profits at 50%, the return would be $82,500,000." Let's all start for Utah and get rich.

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The camp of Eureka, Nev., at the height of its activity had a population close to five figures. Austin at this time was compelled to take a back seat; and Pioche crawled into her shell; for twenty years Eureka was the whole show and rejoiced in her prominence. Everything was as rosy as a Flemish sunset; and though Eureka could not hope to rival Pioche in the matter of "men for breakfast," she had enough to maintain a respectable average. Prosperity filled the cup between 1870 and 1890; but after that adversity took to mixing the drinks for the camp—each one a little bit worse than the one which preceded it, writes Charles E. Van Loan in the *Saturday Evening Post*. For the benefit of those who take their narrative sprinkled with names and dates and vital statistics, Mr. Van Loan gives the following thumbnail history of Nevada's lead camp: In 1864 five prospectors set out from Austin, following the Pony Express route eastward to the mountains. On the western slope of the range they found ore that puzzled them; and as they could learn nothing of it by examination they put fragments of it into their camp fire. The result was an immediate flow of whitish metal. The prospectors argued long over it; those who claimed it was silver were told that it was too soft, and those who thought it was lead were told that it was too hard. Both sides were correct—it was a combination of both metals. The news of the strike created little or no excitement. Nevada, with one eye on the tremendous output of the Comstock Lode, could not be bothered with anything so commonplace as a lead mine with silver trimmings. For several years after discovery the district languished while unsuccessful attempts were made to smelt the silver-lead ore; but in 1869 draft and blast furnaces solved the problem, and the camp of Eureka bounced out on the map of the state as the metropolis of eastern Nevada, greatly to the disgust of Pioche, which was just beginning to sit up and howl, a day's journey to the southeast. Foreign capital became interested in the new district. Two mines on Ruby Hill were sold to the Eureka Consolidated Mining Co., of San Francisco, and an English concern, the Richmond Mining Co., bought adjoining property and, with characteristic British thoroughness, set about developing it. The Eureka Consolidated erected its furnaces at the lower end of Main St., and the Richmond works went up at the other. In 1875 the "Slim Princess" came puffing into town from Palisade, linking Eureka to the outside world, and prosperity came in with a whoop and a yell, bringing the nine graveyards with it. . . . As in Virginia City and elsewhere, nobody doubted the future—good times, they thought, would last forever; but it seems to be true that the more you take out of the ground the less you leave in.

PERSONALS

S. A. Worcester is at Ouray, Colorado.

J. Power Hutchins has been in the Altai region in Siberia.

George A. Denny, recently in Mexico, has gone to the Transvaal.

H. C. Enos has just returned from Central America and will spend several weeks in Utah.

Frank H. Probert left San Francisco Nov. 13 to visit the new gold camp at Oatman, Arizona.

Harold B. Gleeson is manager of the Mawchi mines in Burma, succeeding George Macfarlane.

W. M. Archibald has succeeded J. M. Turnbull as manager of the Consolidated Mining and Smelting Co. at Trail, in British Columbia.

J. D. Galloway, assistant provincial mineralogist, has been examining mining properties in the Big Bend and Slocan districts of British Columbia.

W. Hunnewell, of Wellesley, Mass., and C. W. Hanford, of New York, both connected with the Calumet & Hecla interests, visited the Michigan copper mines this week.

Taylor Allderdice, vice-president of the National Tube Co., Pittsburgh, has been appointed a member of the state board of education of Pennsylvania by Gov. Martin G. Brumbaugh.

Dr. Henry M. Payne was in Petrograd on Oct. 16, and expected to leave there early in November for London, by way of Sweden and Norway. He will sail for America in December.

H. F. Fay, president of the Mayflower and Old Colony properties near Houghton, Mich., accompanied by W. L. Frost, of Brookline, Mass., is in Michigan from Boston, visiting the properties.

R. T. McKeever, former manager of the Copper Range railway, but later connected with the firm of Logan & Bryan in Chicago, is now associated with Hornblower & Weeks in their Chicago office.

George B. Holderer, who recently returned from South America, has been made general manager of the Furlough Development Co., which is developing a copper property near Wickenburg, Arizona.

D. G. Kerr and McGilvary Shiras, of Pittsburgh, Penn., have been in the Lake Superior district for 10 days, looking over the mines of the Oliver Iron Mining Co., in company with the officials of that company.

R. L. Agassiz, president of the Calumet & Hecla and various subsidiaries, has returned to Boston, after an extended visit at the mines in Michigan. He was accompanied by Shaw McKane, of the eastern management.

Albert Sauveur, professor of metallurgy and metallography of Harvard University, presented an illustrated lecture on "The Industrial Importance of Metallography" at the Exchange Club, Boston, Nov. 10, before the NewEngland Foundrymen's Association.

John Saam, who, for the past 12 years has been assistant clerk at the Mohawk mine, resigned last week to become clerk and purchasing agent for the White Pine Extension, one of the Stanton properties recently operating in Ontonagon county, Michigan.

E. W. Maynard, who has been in charge of the Atlas Powder Co.'s plant at Senter, near Houghton, Mich., ever since its erection in 1910, has been promoted to the superintendency of the company's plant near San Francisco. He is succeeded by E. C. Eddy of New Jersey.

Frank M. Leland, manager of the Balaklala, after attending the mining congress and other engineering conventions at San Francisco and visiting the Panama-Pacific Exposition, is devoting some time to the affairs of the Balaklala at Coram, Calif. The mine is shipping ore to the Mammoth smeltery, and keeping up the demand for 250 to 300 tons a day.

John MacGinniss of Butte, George S. Deeks of New York, and Al Frank of the Ohio Copper Co., Bingham, Utah, have just visited their Delaware property at Vernon, Nev., in company with General Manager H. H Hunter of Lovelock. The result of the trip of inspection will be the institution of immediate development work to explore the Delaware veins at depth.

W. C. Ralston is preparing for a return trip to New York, where he has established an office at 25 Broad St. The purpose of the New York office is to attract Eastern men to the advantages of mining investments in California, Nevada and Alaska. Mr. Ralston has learned the futility of attracting California men to the possibilities of their home state in the industry of mining, and realizes that the development of the large mining properties has been the work of Eastern and European men.

OBITUARY

Thomas E. Frakes died at Sutter Creek, Calif., in October, at the age of 82 years. He crossed the plains shortly after the Marshall gold discovery at Coloma, and settled in Amador County, where he engaged in mining. In later years he gave up the mining business and carried on an extensive dairy ranch.

William H. Davis died at Alameda, Calif., on Nov. 7. He was born in Boston in 1831 and crossed the plains to California, settling in Eldorado County in 1852, where he engaged in mining. In 1859 he established the Union Lumber Co. in San Francisco. He was the last surviving charter member of Excelsior Lodge of Masons in San Francisco.

Professor Vivian B. Lewes died Oct. 16, at Mold, England, aed 64 years. He was for many years professor of chemistry at the Royal Naval College and was engaged in many important investigations, such as the chemistry of coal and its combustion, spontaneous combustion, oils, boiler corrosion, etc. He was also for a number of years chief gas examiner for the city of London. He was the author of several books on chemistry and combustion.

Henry Benjamin Smith died at Joliet, Ill., Nov. 7, aged 53 years. He had been in the Joliet Steel Works since he was a boy, entering the service of the old Joliet Steel Co.—later merged in the Illinois Steel Co.—in 1878 and gradually attaining a responsible position. He was one of the first to take up questions of safety work in the plants of the company and in 1893 was appointed supervisor of safety and labor, which position he had held ever since doing notable work in the cause of accident prevention.

Nicholas Treweek, of Salt Lake City, Utah, died in New York Nov. 8, as the result of an operation for throat trouble. He was born in Cornwall, England, and came to the United States when 20 years old. After a few years spent in Pennsylvania he settled in Utah and engaged in mining operations. He was identified with the opening and operation of many mines, notable among them being the Wabash at Park City, several properties in the Big Cottonwood district in Utah, the Lucky Boy in Idaho and several British Columbia mines. He was well known throughout Utah and was prominent as a Mason and a member of other orders. He leaves a widow, two sons and two daughters, all residents of Salt Lake.

Sir Andrew Noble died at Ardkinglas, Scotland, Oct. 22, aged 84 years. He was born in Greenock, was educated at Edinburgh and at Woolwich. He served for 15 years in the Royal Artillery and became an expert in ordnance and ammunition. After leaving the army, he became connected with the Elswick works at Newcastle, with which he continued for over 40 years, being for some time head of the great firm of Armstrong, Whitworth & Co. He was concerned in a number of important investigations, especially one on the products of combustion of powder, which he conducted with the late Sir Frederick Abel. He was a member of many learned societies and had received medals and other honors from a number of them.

INDUSTRIAL NEWS

The Anaconda Copper Mining Co. has ordered three additional 10-ft. by 48-in. Hardinge mills.

Nineteen parcels of land (an entire city block) have just been acquired by The Cleveland Galvanizing Works Co., Cleveland, Ohio, adjacent to its present location which is in the heart of the city.

The American Cyanamid Co. now has its general offices at No. 200 Fifth Avenue, New York. The Nashville and Buffalo offices were discontinued on Oct. 1. A southern office is maintained at 601 Walton Building, Atlanta, Ga.

The Salt Lake office of the Mine and Smelter Supply Co. has received orders for No. 64½ Marcy mills for the following companies: Silver King Coalition Mines Co., Park City, Utah, 2; Duquesne Mining Co., Duquesne, Ariz., 1; Red Banks Mining Co., H. C. Callahan, Bagby, Calif., 1.

TRADE CATALOGS

Newport Rolling Mill Co., Newport, Ky. Circular. Genuine Open Hearth Iron. Illus., 9x15 inches.

Mesta Machine Co., Pittsburgh, Penn. Bulletin R. Mesta Barometric Condensers. 8 pp., illus., 9x6¼ inches.

B. F. Sturtevant Co., Hyde Park, Boston, Mass. Bulletin No. 221. Electric Fans. 24 pp., illus., 6½x9 inches.

The Denver Fire Clay Co., Denver, Colo. Folder. The Case Oil-Fired Tilting Crucible Furnace. Illustrated.

The Colorado Iron Works Co., Denver, Colo. Pamphlet No. 24-B. The Akins Classifier. 16 pp., illus., 9x6 inches.

Stephens-Adamson Mfg. Co., Aurora, Ill. Catalog No. 22. "S-A" Pivoted Bucket Carrier. 84 pp., illus, 6x9 inches.

The Denver Fire Clay Co., Denver, Colo. Bulletin No. 100. Crucibles, Muffles, Scorifiers, etc. 18 pp., illus., 7x10 inches.

The Scranton Pump Co., Scranton, Penn. Bulletin No. 103. Jet Condensers and Vacuum Pumps. 12 pp., illus., 6x9 inches.

Morse Chain Co., Ithaca, N. Y. "Chain of Evidence." Publication No. 14. Large Power Drives. 20 pp., illus., 6x9 inches.

Kingsford Foundry and Machine Works, Oswego, N. Y. Catalog No. 18. Turbine Pumps, Type L. 22 pp., 6x9 inches illus.

Asbestos Protected Metal Co., Pittsburgh, Penn. Bulletin No. 56. "Waugh" Glazing Construction. 20 pp., illus., 8x10½ inches.

A. S. Cameron Steam Pump Works, 11 Broadway, New York. Bulletin No. 154. Centrifugal Pumps. 16 pp., illus., 6x9 inches.

The Texas Co., Lubricating Division, 17 Battery Place, New York, N. Y. Booklet. Lubrication Vol. III, No. 1. 16 pp., illus., 5½x8½ inches.

Wilson-Maeulen Co., Wales Ave. & E. 142d St., New York. Catalog T-15. The "Tapalog"—Recording Pyrometer. 8 pp., illus., 8x10½ inches.

Pitman, César & Co., 25 Victoria St., London, S. W., England. Catalog. Water Turbines and Pelton Wheels. 16 pp., illus., 11x8½ inches.

Edison Storage Battery Co., Orange, N. J. Bulletin No. 1125. Edison Storage Batteries and Some of Their Applications. 24 pp., illus., 6x9 inches.

General Electric Co., Schenectady, N. Y. Bulletin No. 44,005. Line Material and Rail Bonds for Mine and Industrial Haulage. 76 pp., illus., 8x10½ inches.

Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn. Circular No. 1536. Alternating-Current Water-Wheel Generators. 32 pp., illus, 8x10½ inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1432-A. Stamp Mills and Accessory Machinery for Free-milling Gold Ores. 52 pp., illus., 8x10½ inches.

Hauck Mfg. Co., 140 Livingston St., Brooklyn, N. Y. Bulletin No. 60. Application of Hauck Oil Burners and Torches in Different Shops. 16 pp., illus., 6x9 inches.

Ingersoll-Rand Co., 11 Broadway, New York. Catalog No. 76. "Water Lifted by Compressed Air." 80 pp., illus., 6x9 in. Form No. 9201. Calyx Core Drills. 128 pp., illus., 6x9 inches.

Alberger Pump & Condenser Co., 140 Cedar St., New York. Bulletin No. 21. Alberger Centrifugal Boiler-Feed Pumps, Alberger-Curtis Steam Turbines. 28 pp., illus., 6x9 inches.

Oliver Continuous Filter Co., San Francisco, Calif. Pamphlet. "Oil Flotation—Oliver Filtration." Description and list of installations of Oliver continuous filters. 6 pp., illus., 6x9 inches.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Booklet No. 213. Simplate Flat Disc Valves. 10 pp., illus., 3½x6 inches. Bulletin No. 126. "Hummer" Self-Rotating Hammer Drills. 28 pp., illus., 6x9 inches.

The Williams Patent Crusher and Pulverizer Co., St. Louis, Mo. Bulletin No. 107. Durability of Williams Crushers and Pulverizers. 8 pp., illus, 12x9½ in. Bulletin No. 112. Conglomerate Ore. 8 pp., illus., 12x9½ inches.

A. M. Byers Co., Pittsburgh, Penn. Bulletin 26. Byers Genuine Wrought Iron Pipe. 24 pp., illus., 11x8½ inches.

This bulletin contains useful information about Byers pipe, such as its resistance to corrosion, fabricating and welding qualities, etc. Complete tables showing dimensions, areas and hydrostatic tests are given.

NEW PATENTS

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

ANNEALING FURNACE. John E. White, Tarentum, Penn., assignor to West Penn Steel Co., Brackenridge, Penn. (U. S. No. 1,158,760; Nov. 2, 1915.)

CARS—Safety Device for Mining Cars. William Kowalski, Chicago, Ill. (U. S. No. 1,159,050; Nov. 2, 1915.)

CHARGING CAR. Frank D. Carney and Richard V. McKay, Steelton, Penn. (U. S. No. 1,158,982; Nov. 2, 1915.)

CONCENTRATOR HEAD MOTION. William H. Reagan, Jr., and John R. McMurray, Miami, Ariz. (U. S. No. 1,159,272; Nov. 2, 1915.)

CONVEYING, SORTING AND SCREENING SYSTEM. Gilbert Tollefson, Bagley, Minn. (U. S. No. 1,159,134; Nov. 2, 1915.)

CYANIDING—Treatment of Ores by the Cyanide Process. Hugh M. Leslie, Glasgow, Scotland. (U. S. No. 1,158,513; Nov. 2, 1915.)

DRILL—Rock-Drill Attachment. Harry H. Hughes, Poultney, Vt. (U. S. No. 1,159,034; Nov. 2, 1915.)

DRILL-SHARPENING APPARATUS. Arthur H. Skaer, Denver, Colo., assignor to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,159,722; Nov. 9, 1915.)

DRILLS—Improvements in Power-Driven Rock Drills. M. Kellow, Penrhyndeudraeth, N. Wales. (Brit. No. 13,067 of 1914.)

ELECTRIC FURNACE. Percy A. Boeck, Worcester, Mass., assignor to Norton Co., Worcester, Mass. (U. S. No. 1,158,971; and 1,158,972; Nov. 2, 1915.)

FLOTATION—Separation of Minerals by Flotation. Lewis G. Rowand, Brooklyn, N. Y., assignor to New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,159,718; Nov. 9, 1915.)

FULLER'S EARTH—Earth-Treating Process and Product. Michael J. Welsh, Philadelphia, Penn., assignor to The Atlantic Refining Co., Philadelphia, Penn. (U. S. No. 1,159,450; Nov. 9, 1915.)

FURNACE and Allied Structure. Utley Wedge, Ardmore, Penn. (U. S. No. 1,159,141; Nov. 2, 1915.)

FURNACE-DOOR LINING—Edward S. Cline and Edward C. Meier, Phoenixville, Penn. (U. S. No. 1,159,898; Nov. 9, 1915.)

FURNACE LINING. Albert P. Meyer, Aspinwall, Penn., assignor to Allen S. Davison Company, Pittsburgh, Penn. (U. S. No. 1,160,085; Nov. 9, 1915.)

JIG. Walter S. Tower and Peter D. Camphuis, Wallace, Idaho. (U. S. No. 1,159,295; Nov. 2, 1915.)

LEAD ALLOYS Containing a Plurality of the Metals of the Alkaline Earths. Francis C. Frary, Minneapolis, and Sterling N. Temple, St. Paul, Minn.; said Temple assignor of one-sixth of the whole right to said Frary. (U. S. No. 1,158,672; Nov. 2, 1915.)

METAL-MELTING FURNACE. Oro J. Warman, Cincinnati, Ohio, assignor, by mesne assignments, to Buckeye Products Co., Cincinnati, Ohio. (U. S. No. 1,158,873; Nov. 2, 1915.)

MINE-CAR LUBRICATOR. Charles Goyn, Gorham, Colo. (U. S. No. 1,160,067; Nov. 9, 1915.)

NITROGEN COMPOUNDS—Process of Producing Nitrogen Compounds of Aluminum and Alkali or Alkaline-Earth Metals. Dmitry Alexandrowitch Peniakoff, Brussels, Belgium. (U. S. No. 1,159,989; Nov. 9, 1915.)

POTASH—Process of Recovering Potash from Potassium-Iron Silicates. Harry P. Bassett, Catonsville, Md., assignor to The Spar Chemical Co., Baltimore, Md. (U. S. No. 1,159,464; Nov. 9, 1915.)

REFRACTORY MATERIAL — Highly Refractory Material and Process for Making It. August Pfaff, Freiberg, Germany. (U. S. No. 1,159,264; Nov. 2, 1915.)

SCREEN—Shaking Screen. Paul M. Kuehn, Baltimore, Md., assignor to Bartlett Hayward Co., Baltimore, Md. (U. S. No. 1,159,317; Nov. 2, 1915.)

SCREENING APPARATUS. Paul M. Kuehn, Baltimore, Md., assignor to Bartlett Hayward Co., Baltimore, Md. (U. S. No. 1,159,318; Nov. 2, 1915.)

SEPARATION—An Improvement in the Magnetic Separation of Ores. Graf Botho Schwerin, Frankfort-on-the-Main, Germany. (Brit. No. 19,313 of 1914.)

SULPHATING—Method of Sulphating Materials. Henry B. Hovland, Duluth, and George B. Frankforter, Minneapolis, Minn.; said Frankforter assignor to said Hovland. (U. S. No. 1,159,032 and 33; Nov. 2, 1915.)

SULPHIDE ORES—Imported Method for the Recovery of Cuprous Sulphide from Ores and the Like. Metals Research Co., New York City. (Brit. No. 143 of 1915.)

SULPHIDIZING—Method of Sulphidizing Metals. Henry B. Hovland, Duluth, Minn. (U. S. No. 1,159,942; Nov. 9, 1915.)

TRANSIT. Adolph Lietz, San Rafael, Calif. (U. S. No. 1,159,510; Nov. 9, 1915.)

ZINC—Device for Removing Residue from Retorts. Nicholas L. Heinz, La Salle, Ill. (U. S. No. 1,160,077; Nov. 9, 1915.)

ZINC—Method for the Treatment of Zinc Ore or Zinc-Bearing Material. Sewall Truax, Canon City, Colo., assignor to Granadena Mining Co. (U. S. No. 1,155,625; Oct. 5, 1915.)

ZIRCONIUM OXIDE—Method of Producing White Zirconium Oxide Free of Iron. Paul Askenasy, Karlsruhe, Germany, assignor to Chemisch Metallurgische Industrie-gesellschaft mit beschränkter Haftung, Berlin, Germany. (U. S. No. 1,158,769; Nov. 2, 1915.)

Editorial Correspondence

SAN FRANCISCO—Nov. 10

California Metal Producers' Association—At the recent annual meeting at San Francisco the following officers were elected: President, Albert Burch; vice-presidents, G. W. Metcalfe, E. C. Hutchinson; secretary-treasurer, R. I. Kerr; executive committee, G. W. Starr, C. E. Knox, N. Cleaveland, S. W. Mudd.

The Comstock Mines are shaking off the ghostly raiment with which a recent magazine story invested the town of Virginia City. In the last half of October and the first quarter of November, Union Consolidated and Sierra Nevada explored high-grade orebodies on the 2,500 level. The ore in the Comstock north-side mines has been running at from $8 to $12 per ton, with an occasional shoot of higher grade. Recent disclosures have increased the value to a probable average of $40 per ton. As early as the week ended Oct. 16, Union Consolidated saved 83 cars average $49 per ton and 35 cars which averaged $63 per ton. In the same week Sierra Nevada ran into ore worth $11 per ton and in the week ended Oct. 23 the face of the north drift of the 2,500-ft. level showed ore running as high as $130 per ton; with an encouraging outlook for a large high-grade orebody in this neighborhood. In the same week the north end of No. 1 stope of the Union 2,500 level was in ore averaging $79 per ton. At another point samples showed $89 per ton. The ore saved from this stope averaged $26.90 per ton. Six feet of $50 ore was found in No. 3 stope of the Union in the week ended Oct. 30, and in the same week Sierra Nevada extended the north drift 10 ft. into ore averaging $32.34 per ton, while the face was in $85 rock. In the first week in November, Sierra Nevada saved ore averaging $33 per ton and Union Consolidated found various grades running $13.72, $24.60 and $45.16. Herman Zadig, of San Francisco, one of the directors, returning from Virginia City after a visit to the north-end mines, stated that the recent development in the Sierra Nevada proved the contention of himself and other directors that the Comstock was not dead. He considered this disclosure of high-grade ore of great importance, because it was in the Sierra Nevada in 1878 that the bonanza people thought they had found another orebody similar to the one that was then being worked in Consolidated Virginia. Mr. Zadig and Mr. Slosson and Mr. Ralston have been sanguine that large orebodies would be found in the 2,500 and 2,700 levels. In their opinion the work now being done on 2,500 level proves to a certainty that there is a chance of extensive orebodies at this point. It seems reasonable that if the early-day management had believed in 1878 that ore persisted in large bodies to the 2,700 level, they would have mined it because silver was then worth $1.29. However; without assuming to disagree with these opinions it may be taken as indisputable that Fair and Flood and Mackay did, and left undone, many things which were incomprehensible to mining men of that day. The past performances of the past-masters of Comstock mining are not of such great interest to the present-day management as the fact that the Comstock ghost has begun to walk again.

DENVER—Nov. 11

The Phenomenal Demand for Tungsten has created conditions in Boulder County that, for a brief time, threatened the organization of a miners' union. The idea, it is believed, was thwarted at its inception by prompt action of the leading mine operators in establishing a new and uniform wage scale for miners at 45c. per hour. The regular wage has been $3 for eight hours. The "boom" continues unabated at Nederland.

The American Metals Producing Co., controlled by E. S. Moulton and G. Whitney Adams, is attracting attention by its activities at Black Hawk. Mr. Moulton has, for years, owned the Rocky Mountain concentrator, a fair-sized crushing and jigging plant formerly operating on custom ores. This mill occupies the exact site of the first smeltery in the state—the Hill furnace, materials for the construction of which were hauled by ox-teams from St. Joseph, Mo. While this mill has lain idle for several years, these men have been experimenting along hydro-metallurgical lines and they believe they possess a wet process for recovering the precious and the several base metals in Gilpin county ores. The secret process is known to include roasting and lixiviation followed by selective precipitation. Two carloads of machinery have been delivered to be erected on foundations now being laid in the remodeled building.

BUTTE—Nov. 10

In the Districts Tributary to Helena, former Senator W. A. Clark has bought Monte Cristo mine, situated 2 mi. north of Rimini, and work will be begun immediately. Purchase price said to be $100,000. Syndicate which recently acquired "Head" mine on Scratch Gravel has been formally incorporated as Scratch Gravel Gold Mining Co. for $1,000,000. W. E. Cullen, of Spokane, Wash., is president of company. Last month was first month ore was hoisted and profits aggregated $24,000. The Monarch mine near Elliston, has been leased and bonded to a group of Helena mining men. Development work will be started at once. Property lies on north slope of Bison Mountain, 9 mi. south of Elliston, and 6 mi. south of Rimini. Property is developed by shaft and tunnel, where body of commercial galena ore has been opened up. Several carloads of high-grade ore have been shipped and thousands of tons of low-grade ore are on dump awaiting treatment. Property is one of most promising in district. Helena Mining Bureau has leased and bonded Little Wonder mine and stamp mill, at head of Nelson gulch, and work will be commenced as soon as necessary improvements are made.

SALT LAKE CITY—Nov. 11

The Ore Production of Bingham at present is in the neighborhood of 945,000 tons of ore per month. The Utah Copper is producing 27,500 tons of ore daily, and the Utah Consolidated, United States Smelting, Bingham-New Haven, Utah Apex, Bingham Mines, Utah Metal and Tunnel, 2,000 tons more, which with 2,000 tons being mined and milled at the Ohio Copper makes a total daily output of approximately 31,500 tons, or 945,000 a month.

The Strike at the Silver King Coalition mine in Park City ended Nov. 9, when a miners' meeting was held, and it was voted to return to work. Notices had been posted by the company to the effect that the miners would be taken back in their old standing, if they signed the compensation agreement and returned to work before 6 o'clock, Nov. 10. Exception was made of some of the shift bosses who had struck, and a certain number of men deemed agitators. Of the 210 former employees, who applied for work on Nov. 9, 149 were signed up. Some work was done on the night shift Nov. 9, and a full shift was worked Nov. 10. Things at the mine will soon be in normal running order. Up to 6 o'clock on Nov. 10, 230 men, out of the 370 who walked out, had signed the compensation and insurance contracts over which they struck two weeks ago. The strike has been characterized by freedom from violence or other demonstration, and the men have conducted themselves in an orderly manner throughout the time they were on strike.

In the New Zinc Camp, Lakeview mining district on Promontory Point, Box Elder County, there are now eighteen incorporated companies, and about 150 men are employed. The Lakeview Mining Co. declared another dividend of 2¼c. a share Nov. 6. This calls for the distribution of $11,250. In October a similar amount was paid, making $22,500 in two months. In June, July and August seven mills a share was distributed each month. Altogether approximately 7c. a share has been paid on the 500,000 shares, making total dividends of about $35,000. To date shipments have amounted to 67 cars of zinc ore containing 3,149 tons, which averaged 32.75% zinc. The prices received varied from $27 to $55 a ton. This ore at an average price of $40 per ton brought approximately $124,960. In addition to the above, five cars have been shipped by lessees. Three thousand feet of tunnel work has been done; a new compressor was installed and placed in operation Nov. 6, and a new lower tunnel is being started to prove the ore at greater depth. It is reported that an option has been taken on this company's property by the A. S. & R., which is doing development.

FARGO, N. D.—Nov. 13

Dakota Lignite for heating will hereafter be used by all state institutions of North Dakota. In most cases however it is necessary to mix with some bituminous coal, owing to the high moisture content of lignite.

OURAY, COLO.—Nov. 10

The Wanakah Mining Co., operating claims adjoining the American Nettie ground, north of Ouray, and in control of the Ouray smelting works, is planning to conduct extensive explorations and to expand the smelting operations so as to treat custom ore. The control of the company has recently been changed and G. W. Barnhart, of Ouray, formerly manager of the Mountain Top mine, at Telluride, has succeeded John T. Roberts, Jr., in the management of the property. George H. Beebe, of Syracuse, is the new president. The mine is connected with the mill by an aërial cable and the ore is hauled from the mill to the smeltery 2 mi. by railroad. The ore is mostly heavy iron sulphide with from 2 to 8% copper and some precious metals. Some of the ore is amenable to milling but owing to the large loss of copper in the mill, practically all of the output now goes to the smeltery. The smeltery, which was improved and enlarged last summer has a capacity of 250 tons a day, but this has been reduced to 150 tons by a fire-brick partition in the furnace chamber. Semi-pyritic smelting is practiced with a consumption of about 10% coke. A two-unit Greenwalt sintering equipment is installed. The matte is shipped to Garfield, Utah. The company has heretofore largely depended upon its own mine for smelting ore but is now planning to treat custom ore, particularly siliceous ores, a policy which has already had its effect of stimulating operations in the district. The Wanakah mine in the last four years has produced nearly a million dollars gross.

The American Nettie Property now belongs to the American Gold Mining Co., of St. Louis, Mo., W. C. Wisberg president. The company drove a tunnel to the Wanakah ore horizon and several other operations are under way to explore for deposits of the Wanakah type in the sedimentary cliffs north and east of Ouray. The Two Kids property has opened up an orebody and is building a small mill. This operation is financed at Delta, Colorado. On Black Silver Mountain to the north of the American Nettie, limited operations are under way on the Black Girl, the Scotsman and the Cutler Creek properties.

The Results of the Development at Wanakah have aroused interest in the possibilities of the sedimentary areas in the vicinity of Ouray, which occur extensively north and west of the town and which are cut by numerous dikes. The important mineralization so far has been found on the east side of the cañon only and its extent is still to be determined.

In Poughkeepsie Gulch, Uncompagre Cañon, the Old Lout mine, now owned by the Onetal company, 10 Wall St., New York, is being equipped with an electric compressor and drills for extensive development. This vein has been opened on the surface for about 600 ft. in depth and has a record of about $800,000 production of rich bismuth-silver ore. The tunnel cuts the vein at about 1,000 ft. in depth and a drift on the vein has opened three oreshoots, showing sulphide ore, with copper, lead, zinc and silver. The company has a lease on the Mickey Breene mill and is to introduce flotation. It is expected that some shipping ore will be extracted this winter. Frank M. Jackson is in charge. This property was last worked by an English company in the early nineties.

The Maid of the Mist adjoins the Old Lout on the north and will probably be developed from the Lout tunnel. The Poughkeepsie mine, at the head of the Gulch, has suspended developments but will resume in the spring. The Benock, on the north extension of the Lout is being operated on a lease by John T. Roberts, Jr.

No Work Has Been Done during the past season on the San Juan Chief, the Huff or the North Star properties, all of which lie east of the Lout. The Ben Butler is under option to W. M. Waybright and some work has been done on it. The ore in the Ben Butler is zinc with gold. W. J. Rattles, of Cleveland, Ohio, is in charge of work on the Vermilion mine, about half a mile south of the Ben Butler. The Columbus tunnel, in this vicinity, is being extended to cut the Columbus vein. On Red Mountain the National Belle is under lease to Messrs Roberts, Wood and Forest, of Ouray, and is shipping, regularly, high-grade copper ore. When the mine was opened recently it was found that the rails, tools and nails of the old equipment were entirely replaced by copper.

WALLACE, IDAHO—Nov. 10

American Institute of Mining Engineers—The fifth annual meeting of the Columbia Section will be held at Wallace, Idaho, Nov. 19-20. A special train leaving Spokane at 8:30 a.m. will arrive in Wallace at 12:50 p.m. At 3:00 a technical session will be held in the public library, at which D. W. Buckby will present a paper on "Progress in Ore Dressing" and J. E. Chapman one on "Mine Accounting." At the evening session W. E. Henry will discuss "Zinc Smelting and Smelter Rates." The following day will be given over to a trip to the Interstate-Callahan, Tamarack and Success mines on Ninemile; a business session and banquet will be held in the evening. A special invitation has been extended to members of the Montana section of the Institute.

PHILADELPHIA—Nov. 15

Pennsylvania State College—The new mining building of the School of Mines was dedicated on Nov. 5. Dr. H. M. Chance, of Philadelphia, the speaker of the day, took as his subject "The Conservation of Mineral Resources." There was a large gathering of people, among whom were many prominent mining men from both the bituminous and anthracite fields The museum of the school, one of the best in the United States, is being installed in the new quarters, which together with the added facilities for classroom and laboratory work, will contribute materially to the increased usefulness of the school. The School of Mines was established in 1884 and has graduated a large number of men now prominent in mining in Pennsylvania as well as in many other states.

IRONWOOD, MICH.—Nov. 13

Shipments from the Gogebic Range for 1915 will exceed 5,000,000 tons. To Oct. 25, the Chicago & Northwestern Ry. Co. had hauled 3,600,000 tons of Gogebic ore to the Ashland docks. The most the company has ever handled in a single year was 3,760,000. The Soo line will take out about 1,000,000 tons this year.

HOUGHTON, MICH.—Nov. 13

A Million a Month in Wages Was the Slogan when the copper country of Michigan hoped, some day, to reach total monthly pay roll of a million. At the present time that slogan is out of date. A million and a half a month is more nearly correct. Each Saturday pay day the mining corporations distribute to employees at least $700,000. This is for half a month's work. One mining corporation alone pays out over $230,000 in cash.

BRAINERD, MINN.—Nov. 11

Indian Commissioner Sells ordered closed on Nov. 1 all saloons in Chisholm, Hibbing, Taconite and several smaller Mesabi Range towns. Entire Cuyuna Range has been "dry" for some time, and the commissioner's action now makes large part of Mesabi Range dry as a desert. Mine operators in general favor the drys.

TWO HARBORS, MINN.—Nov. 10

Duluth & Iron Range Ry., announces according to W. A. Clark, chief engineer, that it will expend $1,635,000 for dockage facilities at Two Harbors. A steel and concrete dock, costing $1,500,000, will be built, and Dock No. 6 will be remodeled. The new, or No. 2 Dock, will be 80 ft. high, with 228 pockets.

At Two Harbors Dock, 10,098 carloads came from the Biwabik District in October, being a nominal decrease from September. The Biwabik and Bangor mines are the leading shippers, with 1,286 and 1,416 cars respectively to their credit. The total ore tonnage for October via Duluth-Superior and Two Harbors docks was 1,800,000 tons in excess of October, 1914, all roads participating in the increase except the Great Northern which had a decrease of 150,000 tons. At Ashland, Wis., all iron ore shipping records have been broken, and indications point to still greater figures for next season. To Nov. 1 the C. & N. W., and Soo Line docks had a combined tonnage of 4,754,397 with several weeks yet to operate, while the best previous season (1912) totaled but 4,797,101 tons.

VICTORIA, B. C.—Nov. 8

The Leona, carrying a heavy cargo of ore from the Britannia mines on Howe Sound to the Tacoma smeltery, turned turtle and foundered due to the shifting of her cargo during a heavy gale when nearing Active Pass on the night of Oct. 31. Seven out of the crew of 14 were drowned.

TORONTO—Nov. 13

The First Run of Manganese Steel ever manufactured in Canada was turned out on Nov. 6 by the Wabi Iron Works, of New Liskeard in Northern Ontario. It is produced by electric process in a furnace of the Heroult type having a capacity of 5 tons per day.

Part of the famous "silver sidewalk" that contributed to so much of the excitement in the early days of Cobalt has been purchased by the Department of Mines and is being removed. The Department does not wish to allow such a remarkable specimen to be lost, and as there is little probability of such a showing ever again being discovered, it will be kept for the museum.

The Mining News

ALASKA

ALASKA GOLD (Juneau)—In October treated 154,500 tons of ore, compared with 132,000 tons in September. Total cost per ton is now under 60c., and tailings are running under 19c. Plant is regularly treating 6,000 tons per day, which is approximate limit of present power capacity at Salmon Creek. New power plant at Annex Creek should be in commission in December, when operations will be brought up to 10,000 tons capacity.

ARIZONA

Gila County

KEYSTONE COPPER (Miami)—At special meeting of stockholdders it was voted to dissolve company and distribute assets to stockholders. Meeeting of directors to be held immediately to arrange distributon.

ARIZONA ASBESTOS ASSOCIATION (Globe)—Has opened up a large deposit of chrysotile asbestos of the finest quality at Ash Creek Cañon. Output is sold some time in advance and is being used by most exacting manufacturers of asbestos textiles.

INSPIRATION CONSOLIDATED (Miami)—Is operating 9 out of 18 sections of mill and is handling 7,000 tons of ore daily; extraction of 82% being secured on average of all ore handled; recovery on sulphide ore alone is about 93%. During October produced about 4,000,000 lb. of copper. November output expected to be greater.

Greenlee County

ARIZONA COPPER (Clifton)—Company's Clifton concentrators Nos. 2 and 3, instead of No. 4 as reported, together with 300 ft. of big ore bins and conveyor belt leading from the mill to the leaching plant, burned Nov. 5. Fire started about 8 o'clock and lasted greater part of night, and but for work of fire fighters, company's store, leaching plant and other property would have been destroyed. Deputies and pickets state that conflagration started near top of old mill, and Sheriff Cash, in whose care property has been since managers left district, claims it was due to defective wiring. Men who are familiar with plant, however, are positive that fire could not have been caused by loose wires in the locality where it originated. Property that burned was not being used when strike was called, Sept. 11, but was being extensively remodeled, and new and modern machinery was being installed. The loss is estimated at $100,000 to $150,000. Destruction of property would not preclude an early resumption of work should managers and strikers come to an agreement.

Mohave County

LEVIATHAN MINES (Oatman)—Recently encountered ledge of ore in its mines averaging more than 50% copper.

UNITED STATES SMELTING (Kingman)—Has taken option on Antelope and Democrat claims, situated in Wallapai Mountains, from their owners, W. H. Murphy and W. F. Dunlap.

ARIZONA TELLURIUM CO. (Kingman)—Is preparing to install hoist, compressor and other machinery at its mines in Wallapai Mountains, 16 miles east of Kingman. The ore runs high in gold and silver.

COLORADO RIVER PLACERS (Oatman)—D. P. Mitchell and associates are negotiating with syndicate of Eastern men for sale of about 2,000 acres of placer ground, situated along lower course of the Colorado River. Mineral bearing bars are 35 to 45 ft. deep.

Pinal County

MAGMA COPPER (Superior)—For quarter ended Sept. 30 company produced 1,973,960 lb. copper, at an average cost of 5.72c. per lb., compared with 1,302,199 lb. at 6.19c. per lb. for preceding quarter. Operating profit for third quarter was $238,490, compared with $186,057 for preceding quarter.

Yavapai County

TELSORI MINING (Cherry Creek)—Company is erecting new stamp mill at its Nelson mine. Has large amount of ore blocked out.

DEVELOPMENT CO. OF AMERICA (Congress)—Is reported to be negotiating for sale of its Congress gold mine, including old tailings dump, which contains about 1,200,000 tons of ore, valued at $2 per ton.

PORTLAND-ARIZONA (Copper Basin)—O. W. Bickenstaff and associates have sold their group of 28 Portland-Arizona copper claims to D. M. Louey, of St. Louis, Mo., and associates. The new owners will conduct extensive development operations.

CALIFORNIA

Amador County

EAST EUREKA (Sutter Creek)—Cleaning out and repairing north shaft, which was caved about 20 years ago. Recent development has been through south shaft, which proved that greater possibilities of developing pay orebodies lie to north.

Calaveras County

UTICA (Angels Camp)—Repairs in progress at Stickle mill and Cross shaft, preparatory to resuming operation when water supply is sufficient.

CALAVERAS COPPER (Copperopolis)—Forty men reported to have been laid off because of lack of bin capacity for ore extracted, which is in excess of mill capacity. Reported that additional concentrating installation is contemplated.

Eldorado County

WAGNER (Lotus)—High-grade ore reported disclosed in 37-ft. drift from 54-ft. shaft. New machinery will be installed before proceeding with further development. Ore contains large percentage of copper and some gold.

COX & MASSA (Placerville)—Work started in 600-ft. tunnel. Reported that rich gravel has been disclosed. Large body of deep gravel opened on Coffin & Reed property adjoining.

STILLWAGON (Placerville)—Los Angeles men have leased this property at forks of Cosumnes River, 2 mi. south of Caldo R.R. Present operators are extending 800-ft. tunnel about 100 ft. in belief that oreshoot will be tapped at vertical depth of 500 ft. Mine is equipped with stamp mill and electric generating plant, both operated by water power.

Inyo County

WILSHIRE-BISHOP CREEK (Bishop)—Arthur Joslin was killed Oct. 22 by falling of an ore car into shaft, car striking cage in which Joslin and three other men had descended.

CERRO GORDO (Keeler)—Contract reported signed by F. J. Hambley and A. L. Dornberger on behalf of company and Southern Sierras Power Co., for electric current for mine for lighting, drilling, hoisting and all other operations.

Kern County

HOPE (Randsburg)—Philadelphia men reported to be negotiating for control. Deepening of 250-ft. shaft to 500 ft. contemplated. Large shoot of ore disclosed at 250 ft. Recent shipment of ore averaging $80 per ton.

Merced County

SAN JOAQUIN LIGHT AND POWER (Merced Falls)—Work begun on construction of new $65,000 plant for generating electric power.

Modoc County

SEITZ (Cedarville)—Copper claims on Neasham Mountain have been bonded to T. G. Elgie. Development work has disclosed good copper-bearing ore in 5-ft. ledge.

Nevada County

SPENCEVILLE MINERAL (Spenceville)—All buildings and surface plant destroyed by fire night of Oct. 30. Suspected incendiary origin. Copper revival had induced preparations for operating on much more extensive scale.

BLACK BEAR (Rough and Ready)—Directors have retained William Buchholz as managing director; William Gans is superintendent. Company was recently reorganized and sufficiently financed to deepen shaft and install machinery for development work.

MOHAWK (Graniteville)—Antimony ore reported to be found in sufficient quantity and quality to justify reopening of this mine on Moores Flat, owned by William McLean of Graniteville and Charles Scheunert of Sacramento. Old tunnel is being cleaned out and placed in condition, and driving on the vein will be resumed.

WILLOW VALLEY (Nevada City)—New electric pump with capacity of 500 gal. per min. is being installed. This will permit development to depth of 1,200 ft. Montana shaft now down to 830 ft. Both properties have records as producers and it is believed that they will again be put in producing class.

Placer County

GREEN EMIGRANT (Forest Hill)—R. A. Nicol has bonded this mine on Bald Hill to E. W. Drumond and Joe Delmue. Reopening and development will begin immediately.

Sierra County

ANDY FITZ (Alleghany)—Permit issued by Commissioner of Corporations to sell 75,000 shares stock at 25c. to finance exploration and development of quartz ledge.

KLONDIKE (Sierra City)—Machinery and winter supplies being taken in for continuing tunnel to tap gravel channel, expected within 100 ft. more. W. W. Tiner in charge.

Siskiyou County

MANGANESE claims have been located near Black Bear mine in Salmon River district. Ore said to contain high percentage of manganese. Surface crosscut has been run 144 ft. Ledge is almost vertical; walls are porphyry and diorite. Reported that New York men have taken a bond and will develop property.

SISKIYOU MINING (Etna)—The 15-mi. flume is being lengthened 1½ mi. to cover Muck-a-Muck flats which embrace about 400 acres of gravel. Property is owned by Dr. Harback and Mr. Gardner of New York. Mr. Payne is superintendent.

Trinity County

TRINITY ASBESTOS (Cinnabar)—Closed down for winter. Work will be resumed as soon as weather will permit in the spring.

BONANZA KING (Trinity Center)—Has abandoned old 3-mi. tramway, and has erected bunk houses, cook house and mill at mine, and will operate now during winter as well as summer.

CRAIG (Dedrick)—R. W. Hamilton, of Weaverville, and H. C. Stofer, of Dedrick, have taken a five-year lease on this property owned by Globe Consolidated Mining Co. Development work will be carried on throughout winter.

GLOBE CONSOLIDATED LEASE (Dedrick)—Began operating the Globe Consolidated Co.'s mill and properties at Dedrick, Oct. 1. About 40 men are at work developing orebodies on Bailey and also on two levels of Globe. Archie Burnett is new manager.

BELLI (Coffee Creek)—Property shut down for the winter after successful and steady run since July 4. Ore put through mill averaged $30 per ton. New wagon bridge is being constructed across Trinity River while water is low.

BONANZA KING (Weaverville)—Large orebody reported in lower tunnel driven 1,500 ft. into hill. Milling plant being moved to mouth of tunnel which will save transportation of ore over a mile of tramway. Tramway is in heavy snow belt and is difficult to keep in order.

Tuolumne County

REPUBLICAN (Sonora)—Purchase bond covering five mining claims and 20-stamp mill delivered to F. W. Page, manager Royal Consolidated mine at Hodson, Calaveras County. Mr. Page represented Eastern men in this deal. Shaft is 700 ft. deep. Price said to be $65,000.

COLORADO

Gilpin County

EAST NOTAWAY (Russell Gulch)—In the "Journal" of Oct. 23 was published an item in this column stating that the mine after being closed for a year by litigation, had been finally secured by opposing litigant, Colomo Mining Co., and was to be reopened. We have various communications from parties to the two sides of the litigation relative to the item and to each other. We hold our honorable correspondents in equal esteem, and considering our distance from the clouded issue, we are disinclined to judge the evidence.

San Miguel County

TOMBOY (Telluride)—At recent meeting in London it was announced that Sidney White Cloud group of claims, situated to north of Bushwhacker claim, and carrying extension of Montana vein, has been acquired for consideration of $75,000, to be paid in cash instalments before June 15, 1916. During October mill ran 29 days; crushed 13,000 tons of ore. Bullion and concentrates shipped totaled $88,400; expenses, $60,600; operating profit, $27,800.

IDAHO

Shoshone County

INTERSTATE-CALLAHAN (Wallace)—Shipments during October were heaviest in history of mine, totaling 6,500 tons of crude ore and concentrate.

AMERICAN-COMMANDER (Wallace)—This company is building blacksmith shop at tunnel portal and otherwise preparing for winter work. Has 400 ft. of crosscut yet to drive to reach vein.

ALAMEDA (Wallace)—Is suing Success, alleging illegal extraction of ore to value of $30,000 from its ground; Success admits extraction of ore but claims title to ore under apex law. Rumored that properties will be consolidated and action dismissed.

CASTLE ROCK (Wallace)—Idaho-Nevada Exploration Co., has resumed work on Castle Rock situated on Placer Creek. Operations delayed by lack of water for power. Crosscut from 200-ft. level of shaft has penetrated vein 20 ft.; 12 ft. of ore assaying 4 to 5% copper reported; small stringer assaying 3% zinc and 3% lead on footwall.

BERNICE (Kellogg)—Capital stock of this company increased from 200,000 to 1,500,000; 250,000 shares of new stock to be transferred to Wardner Mining and Milling Co., in exchange for its holdings. Bernice company owns 8 claims east of Caledonia, on which two veins have been located; will drive crosscut to cut veins at intersection.

MARSH (Burke)—Reported strike of 18 in. of shipping ore in crosscut from 900 level. As soon as oreshoot is explored sufficiently to prove persistence, sinking will be continued to 1,200 level. Large pump ordered; first summer will be installed temporarily at 900 level but will be removed later to 1,200. Remodeling of mill on Ninemile completed, increasing capacity from 150 to 225 tons daily.

GALENA GROUP (Wallace)—Coeur d'Alene M. & S. Co., plans to develop Galena group, lying west of Success on Ninemile. Two tunnels previously run and winze sunk 60 ft. from upper; good showing of carbonate ore, but work was suspended on account of water. Crosscut tunnel driven 900 ft. tapped vein at depth of 500 ft.; 400 ft. of driving on vein necessary to get under ore in shaft.

PORTLAND (Sunset)—D. L. McGrath, manager for the Ray-Jefferson company, has taken option on Portland claims on Sunset Peak, situated between Sunset Group, owned by W. A. Clark, of Montana, and Tuscumbia group. Claims have been idle since death of Georg B. Markle, organizer of Portland company. Two tunnels each about 500 ft. long have good showing but maximum depth obtained was only 100 ft. Owing to elevation of mine and heavy snowfall development will not be started till spring.

MICHIGAN

Copper

HOUGHTON (Houghton)—Sinking continues in good commercial rock.

NEW ARCADIAN (Houghton)—Third test of copper rock satisfactory, 1,500 tons being handled.

WOLVERINE (Kearsarge)—Rock running close to 18 lbs. to ton. Rock keeps two stamp heads running to capacity.

BALTIC (Painesdale)—Richest copper-bearing ground yet located in this mine is now proven to extend from 14th to 22nd level. Increase in rock tonnage expected soon.

COPPER RANGE CONS. (Painesville)—Announcement made of 10% bonus for November and December for 3,000 or more men working at mines and mills of Copper Range company.

SOUTH LAKE (Houghton)—New steel shaft-rock house will be built within four months. Foundations now being laid. Both 3 and 4 lodes in commercial ore. Expected that 10,000 shares new stock will be subscribed by present share owners.

BALTIC (Painesdale)—Transmission line, from Redridge mill plant is under construction to mine over right of way of Atlantic railway, to utilize excess turbine power at Baltic mine, a subsidiary of Copper Range. W. A. Rankin, chief electrical engineer of Copper Range is in charge.

CHEROKEE (Houghton)—Operations suspended for winter. Work economically conducted under direction of W. A. Hodgson and results in three exploration pits showed good prospects. Small exploration shafts will be put down in most promising pits next summer.

VICTORIA (Victoria)—Conditions continue to improve. It will be several months before new hoist is in running order and new shaft ready for work. That will mean larger tonnage and closer selection, so that 13 lbs. per ton can be maintained. This can be operated profitably by Victoria even if output is sold on 13c. basis, because of low power costs.

WHITE PINE (Ontonagan)—Railway connection now is established and within week regular train service will be in operation. St. Paul end of line was finished week ago and connection made with portion built by Smith, Byers & Sparks on contract for Calumet & Hecla. This will mean enormous savings for White Pine. At present 90 men are employed cutting wood for fuel for the boilers. There is large accumulation of mineral on hand waiting to go to smelter at Hubbell.

Iron

DOBER (Iron River)—Oliver Iron Mining Co. is to sink another shaft here. Work will be started soon after Jan. 1.

CLEVELAND-CLIFFS IRON (Ishpeming)—Has only about 45,000 tons more to ship this season. L. S. & I. road expects to be through handling iron ore by Nov. 20.

BUCKEYE (Commonwealth)—This property has been abandoned by Oglebay-Norton & Co. Sulphur content of ore is too high. Is one of oldest mines on Menominee Range.

OLIVER IRON MINING (Ironwood)—Night shifts have been added at mines that have not been working with two forces. Pabst has had two crews for some time. About 400 more men will be given employment.

MASS (Negaunee)—A Halby loading machine is being tried out underground. It is working successfully but has not been in operation long enough to give data. The Lake Shore Engine Works is building 10 of the machines. Most of them will be shipped West. The Copper Queen Mining Co. has ordered one shipped to Bisbee, Ariz.

MINNESOTA

Duluth

MINNESOTA IRON DEVELOPMENT (Duluth)—Has obtained fee to 8,697 acres of mineral lands in St. Louis, Crow Wing and Aitkin Counties. Options are held on 591 acres additional. Properties are located on Mesabi, Vermilion and Cuyuna Ranges. Exploring is to be started immediately. E. J. W. Donahue, formerly of Cuyuna-Mille Lacs and Cuyuna-Duluth companies, is one of directors.

Cuyuna Range

CUYUNA-MILLE LACS (Ironton)—Shipping 10 cars daily of its manganiferous product.

Mesabi Range

TIOGA (Chisholm)—Shaft now down 103 ft., and working in wet ground.

DEAN (Buhl)—All shipping has ceased and mine was shut down Nov. 6.

MYERS (Chisholm)—All ore in stock is to be shipped this fall. This will be last of Oliver piles to be moved.

TIOGA (Chisholm)—Excavating is completed in engine house for engine bed. Work on new change house is progressing satisfactorily.

HAWKINS (Nashwauk)—Mine was closed down Nov. 4. No more ore will be shipped this season. Averaged about 70 cars a day during last two months.

EUCLID (Chisholm)—M. A. Hanna Co. is to ship ore in stock here. Mine is near lake and could not be kept open. Water kept coming in until workings flooded.

ALEXANDRIA (Chisholm)—All of dwelling houses for men have been completed. Drifting is going on from bottom of main shaft. Timber shaft is going down steadily.

OLIVER IRON MINING (Eveleth)—Stated that Fayal and Genoa mines will be operated all winter. About 650 men will be kept employed at two properties. Company has shipped 1,100,000 tons from Eveleth district this season.

Vermilion Range

CHANDLER (Ely)—Both the North and South Chandler mines have raised miners' pay 30c. a day. They have heretofore paid $2.10 to $2.40, and raise is to meet wages of $2.40 to $2.80 paid by the Steel Corporation mines in district. It has been many years since an increase in wages has been made in fall of year.

MONTANA

MONTANA-CANADIAN OIL (Sweet Grass)—Fine flow of gas obtained Nov. 10 in company's well. Is taken as sure indication of presence of oil. Gas will be used from now on for firing boilers that supply power for drilling, thus saving $1,000 a month in operating expenses. Company's well is now down 1,500 ft. Nearest adjoining well struck oil at 1,735 ft.

Fergus County

BARNES KING DEVELOPMENT (Kendall)—During October 4,128 tons of ore, averaging $8.84 a ton, were mined and milled at North Moccasin mine. Total includes 873 tons of ore requiring roasting which averaged $1.42 a ton. Bullion estimated at $33,000. At Piegan-Gloster property near Marysville, 2,437 tons of ore were mined and milled averaging $7.51 a ton. Bullion estimated at $11,000.

Silver Bow County

ALICE (Butte)—No offers having been made at public sale held Nov. 10 in front of federal building at Butte, under terms of court's decree property reverts to Anaconda.

EAST BUTTE (Butte)—Net earnings of company for quarter ended Sept. 30 were $423,000. September net was $170,000, largest for any month on record, but exceeding July figure by only $6,000.

NORTH BUTTE (Butte)—According to report for quarter ended Sept. 30, company shipped 115,796 wet tons of ore and 27½ wet tons of precipitates. It treated 113,002 dry tons of ore and 19.6 dry tons of precipitates. Of ore, 12% was first-class and 88% second-class. Ore and precipitates produced 5,672,890 lb. of copper, 265,855 oz. of silver and 305 oz. of gold.

NEVADA

Esmeralda County

ATLANTA MINES (Goldfield)—Stoping has been started on 1,550 and 1,626 levels and shipments are to be resumed at once. Expect to maintain grade of $35 per ton.

GOLDFIELD CONSOLIDATED (Goldfield)—Preliminary estimate for October shows production of 36,500 tons of gross value of $256,000; with profit of $101,000. Red Top claim and adjoining north-end ground has again become large producer on company account from territory largely given over to leasers for last two years.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Produced $60,000 in October; banner month in history of mine. The next nearest approach was December, 1914. Between 1,200 and 1,300 levels, shoot 1 to 3 ft. wide and bringing returns of $300 to $1,000 a ton discovered.

ROCHESTER MINES (Rochester)—By reason of delays in transportation of ores necessitating closing down of mill for several days, output for October was only $40,000. With discovery of rich orebodies of unusual extent in deep levels and improvement of hauling facilities on Nevada Short Line railroad, there is every reason to anticipate production of $2,000 per day for November.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 6 amounted to 10,343 tons valued at $212,134 compared with 9,891 tons week previous. Producers were: Tonopah Belmont, 2,990 tons; Tonopah Mining, 3,230; Tonopah Extension, 1,850; West End, 904; Jim Butler, 1,100; Halifax, 50; and miscellaneous leasers, 219 tons.

TONOPAH EXTENSION (Tonopah)—Installation of 20-drill compressor at No. 2 shaft about completed. Additional equipment being installed at mill expected to increase capacity materially. September profits amounted to $52,000. Developments during October showed steady improvement in general mine conditions, with mill products for latter half of month valued at about $80,000.

Storey County

ANDES (Virginia)—Saved 14 cars of ore from stope above 170 level.

OPHIR (Virginia)—Saved 343 cars of ore from north drift on 250 level, Central tunnel; milled 280 tons.

MEXICAN (Virginia)—Exploration work continued on 2,500 and 2,700 level. Mill crushed 252 tons of custom ore, average assay value $18.56 per ton.

CROWN POINT-BELCHER (Gold Hill)—Reopening north drift 1,600 level, leading to stopes. Water held 65 ft. below 1,600 level. Mill rock taken from 1,300 and 1,400 levels. Mill received 976 tons dump rock and shipped one bar bullion.

UNION CON. (Virginia)—Extracted 59 tons of ore averaging $24.60 per ton from No. 1 stope, 2,500 level; 181 cars sampling $13.72 per ton from No. 3 stope. West crosscut in No. 1 raise in low-grade ore, selected samples north side assayed $24.05 per ton, and from top $45.16 per ton.

SIERRA NEVADA (Virginia)—Northwest drift on 2,500 level advanced to 20-ft. point; face in ore averaging $31 per ton; saved 40 cars of ore averaging $33 per ton. Jointly with Union, raise to 2,450-ft. level continued and into quartz of low assay value.

NEW MEXICO

Grant County

DARK THUNDER MOUNTAIN (Twin Peaks)—Paul Crowley, of Duncan, Ariz., claims to have discovered enormous deposit of low-grade zinc ore on Dark Thunder Mountain.

CARLISLE GROUP (Silver City)—Announced by George Utter that he has sold Carlisle group to an Eastern syndicate for $300,000. Purchasers are represented here by W. B. Duvall, who will soon place order for mill, machinery and other equipment. Construction of branch railroad to mines is contemplated.

Lincoln County

RITA MINING (White Oaks)—Rita Mining Co. is negotiating for sale of its rich mineral holdings to W. M. McDonald, of El Paso, and associates. Its group of claims embraces 60 acres.

MINING TUNGSTEN ORES (White Oaks)—Richard Wightman and syndicate of New York men have just closed deal for purchase of Old Abe, North and South Homestake and Wilson mines from John Y. Hewitt and associates. New owners have began mining operations on large scale and it is their object to develop tungsten ores which are known to exist in North and South Homestake mines. Plans being made for modern mill and cyanide plant for treating gold ores.

SOUTH DAKOTA

Custer County

OLD MIKE (Custer)—J. W. McBride has taken over this mica property and has commenced development. A shaft is being sunk and hoisting apparatus and compressor being added

UTAH

Box Elder County

WEST CENTURY (Park Valley)—Lease has been taken on this property by A. Allred. Development consists of tunnel 500 ft. long. Low-grade gold ore has been cut. It is expected to mill some of this at small mill on adjoining property.

Juab County

TINTIC ORE PRODUCTION for October amounted to 643 carloads, estimated at 32,150 tons valued at $800,000, compared with 506 cars in September, 648 in August, 817 in July and 2,790 for the first half of 1915. There were 25 shippers as follows: Chief Consolidated, 126 cars; Iron Blossom, 115; Centennial-Eureka, 88; Mammoth, 81; Eagle & Blue Bell, 72; Gemini, 35; Grand Central, 27; Yankee, 18; Gold Chain, 14; May Day, 13; Dragon Consolidated, 12; Beck Tunnel, 8; Lower Mammoth, 7; Victoria, 5; Colorado, 4; Uncle Sam, 3; Utah Miner Co., 3; Bullion Beck, 3; Carisa Lease, 2; Eureka Hill, 1; Godiva, 1; Ridge & Valley, 1; Sioux mill dump, 1; Minnie Moore lease, 1; Cliff lease, 1 car.

TINTIC MILLING (Silver City)—Steel work is being erected at leaching section of this mill.

BECK TUNNEL (Eureka)—This company is developing ground on the 1,100. Leasers are working in various parts of the mine as usual.

IRON BLOSSOM (Silver City)—Preparations are being made for stoping ore opened on the 900 level, from the winze below the 600. The ore carries up to 8 and 12% copper.

IRON BLOSSOM (Silver City)—Copper ore has been opened on 900 level of No. 3 workings. This is reached by winze from 600, reported to have passed through 14 ft. of ore.

CHIEF CONSOLIDATED (Eureka)—Shipments for the first 10 months of 1915 amounted to 831 cars or about 41,500 tons. Arrangements for electrifying the compressor will soon be completed.

RIDGE & VALLEY (Eureka)—Value of ore mined on 1650 is increasing, returns now being over $1,200 per car, instead of $1,000 as heretofore. Principal contents are lead and silver.

EAGLE & BLUE BELL (Eureka)—Work has been started on power line between substation, owned jointly with Chief Consolidated, and new Eagle & Blue Bell 300-hp. hoist. Work is being done by Utah Power and Light Co.

YANKEE CONSOLIDATED (Eureka)—Connections have been completed between raise and winze, which allows ore to be sent out from new strike. Prospecting is being done on east side of property in search of Beck Tunnel ore channel.

Salt Lake County

A FOOT OF SNOW FELL at Alta Nov. 10; 8 in. fell in south fork of Big Cottonwood, and 2 ft. at Brighton. This will not interfere materially with ore hauling.

MICHIGAN-UTAH (Alta)—Nine bids have been received for proposed extension work in this company's lower tunnel. These varied from $9 to $13 a foot.

EMMA (Alta)—Men were started to clean out tunnels Nov. 6, preparatory to beginning work at this property. A. O. Jacobson and associates have made arrangements to operate.

SOUTH HECLA (Alta)—Shipments of 40 tons of ore daily are being maintained from the Wedge workings. Development is being done on 200 level, where vein reaches 25 ft. in width. This ore has been opened up for 185 ft. Lessees on Kate Hayes fissure have recently shipped 15 tons.

EMMA COPPER (Alta)—Development is in progress at this property, adjoining the old Emma. Several contracts for work have been let recently, and operations will be continued during winter. Drift from north crosscut is in mineralized ground, on contact of white and gray limestone.

OHIO COPPER (Bingham)—An experimental flotation plant using Field process is to be tried at this company's mill at Lark. Capacity will be 25 tons per day. Experimental work will probably be done on Ohio Copper tailings, as well as on low-grade ore at present being treated.

Summit County

PARK CITY ORE PRODUCTION for October amounted to 9,762 tons, valued at $390,000 compared to 8,000 tons in September. The producers were: Silver King Coalition, 2,742 tons; Daly-Judge, 2,724; Silver King Consolidated, 1,687; Daly West, 1,074; D. W. Quincy, 35; Daly, 120; Big Four Exploration, 1,000; miscellaneous, 380 tons.

CANADA

Ontario

CANADIAN COPPER (Sudbury)—In October sank new main shaft 165 ft.; shaft is 30x10 ft. in clear.

BRUCE MINES (Sault Ste. Marie)—Have been purchased by Mond Nickel Co. Ore, high in silica, carries from 3 to 4% of copper.

PLENAURUM (Porcupine)—This mine shaft, 200 ft. deep, is being pumped out for sampling on behalf of La Rose which may purchase property.

DOME (Porcupine)—Bullion production during October was highest on record, being $150,500, from 28,750 tons of ore; average $5.24 per ton.

CHENEY COPPER (Sault Ste. Marie)—Is under option to the Timmins-McMartin syndicate. Tenders have been asked for diamond drilling but no contract has as yet been let.

TECK HUGHES (Kirkland Lake)—Foundation for cyanide mill completed. Work on power plant delayed pending decision as to whether it will be possible to obtain electric power.

MINING CORPORATION OF CANADA (Cobalt)—This company which controls Cobalt Townsite, City of Cobalt and Cobalt Lake mines, has discharged all Austrians and Germans in its employ. Order, which came from head office in England, affects about 50 men.

The Market Report

Metal Markets

NEW YORK—Nov. 17

All of the principal metal markets experienced sharp advances during the last week which were scored in the transaction of large volumes of business. In copper especially the week was rather spectacular.

Copper, Tin, Lead and Zinc

Copper—On Nov. 11 the market had become well established at 18¼c., regular terms, for domestic deliveries, especially prompt deliveries, but forward business was taken at small concessions, as was also some foreign busines when figured out to the cash equivalent, f.o.b., New York. The volume of business continued to swell, and increased day by day, the price rising with it. On Nov. 15 the advance began to be rather violent. At the opening of that day copper was sold at about 18.45c., regular terms. By the end of the day, 18¾c. was realized in some cases, although the market did not become firmly established at that figure. On Nov. 16, business was done at 18⅝c., regular terms, and even a shade lower, early in the day, but later sales of million-pound lots were made at 19c. It was expected that there would be a rush of buying on Wednesday, but instead thereof the market became rather quiet, with the price firm at 19c. regular terms, equivalent to 18.75@18.80c. cash, New York.

The aggregate of business transacted during the week was very large, the estimates in several quarters agreeing upon something like 50 to 70 million pounds. Sales to domestic consumers predominated and it was especially noteworthy that some very large business was done with the wire drawers.

Certain sellers of copper are now adopting the policy of doing their business with France only in terms of dollars per ton.

The strike at the Nichols refinery was settled on Nov. 16.

Shipments from Baltimore for the week included 7,847,765 lb. copper to France.

Copper Sheets, base price is 23½c. per lb. for hot rolled and 24½c. for cold rolled, with usual extras. Copper wire is 19@19½c. per lb., carload lots at mill.

Copper Exports from the United States week ended Oct. 30 are reported by the Department of Commerce at 13,657,586 lb. The larger items were 5,551,235 lb. to Franee, 2,930,833 lb. to Russia; 1,996,644 lb. to Sweden, 1,301,411 lb. to England; 1,121,329 lb. to Italy. Imports for the week were 8,498,268 lb. metal and 824,444 lb. in ore and matte; 9,322,712 lb. in all. The chief imports were from Peru, Canada and Chile.

Tin—In this market there was a sharp advance, caused by an urgent demand and the shortage of supply for near-by deliveries. Rumors respecting the Suez Canal also played a part. When it was learned that the canal was open and had not been closed at all, the market receded from its highest point.

Tin production of Federated Malay States nine months ended Sept. 30 is reported at 36,692 long tons in 1914, and 34,840 tons in 1915; deerease, 1,852 tons.

Corrected statement of tin exports from the Straits eight months ended Aug. 31: United States, 19,313; Great Britain, 18,234; other Europe, 6,651; China, 58; India, 862; total, 45,118 long tons, an increase of 1,457 tons over last year.

Lead—Following the advance to 5.15c., New York, independent producers tried to see if they could get a little more and found that they could. The demand for lead was ,indeed, so good, and the transactions so large, that the A. S. & R. Co. felt itself warranted in advancing the price to 5.25c. on Nov. 15. The aggregate of business transacted during the week was very large.

The Chinese Lead Markets are reported badly demoralized by lack of supplies. This has resulted from the order of the Australian Government prohibiting lead exports.

Spelter—A pretty good volume of business was transacted up to and inclusive of Nov. 15. Some sales for export were made and also some considerable sales to important domestic consumers, including certain galvanizers. The bulk of the business was for January-March delivery, and the nature of the demand was sufficient to produce a considerable advance in price. Since Monday the market has been dull and quiet, and a shade weaker in tone.

The Donora plant of the United States Steel Corporation is now producing spelter regularly, and its output will increase month by month, but it will probably not be running at full capacity before next April.

Zinc Sheets were advanced 1c. per lb. on Nov. 13, to $18 per 100 lb. On Nov. 17 the price was again advanced 1c., making it $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Nov	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts per Lb.	Tin Spot, Cts. per Lb.	Lead New York, Cts. per Lb.	Lead St Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
11	4 6525	50¼	17 90	38¾			14 25
			@18 05		5 15	5 07½	@15 75
12	4 6538	50¼	18 05	41	5 15	5 07½	14 25
			@18 15		@5 17½	@5 10	@15 75
13	4 6500	50¼	18 15	44	5 15	5 07½	14 50
			@18 30		@5 20	@5 10	@16 00
15	4 6525	50⅝	18 20	45	5 25	5 17½	15 50
			@18 55				@17 25
16	4 6550	50⅝	18 40	42	5 25	5 17½	15 50
			@18 80				@17 00
17	4 6663	51	18 75	42	5 25	5 17½	15 50
			@18 80		@5 20	@5 20	@17 00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies, and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St Louis is given as the basing point St Louis and New York are normally quoted 0 17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St Louis being the basing market We quote the New York price at 17c per 100 lb. above the St Louis price.

Silver quotations are in cents per troy ounce of fine silver

Some current freight rates on metals per 100 lb. are: St Louis-New York 17c.; St Louis-Chicago, 6.3c.; St Louis-Pittsburgh, 13.1c.

LONDON

Nov	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos.	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts per Lb.
11	24 7/16	75½	75½	91	18 88	67	166½	25¼	5 21	85½	17.74
12	24 7/16	77½	77½	91½	18 98	172	171½	26¼	5 42	87	18 05
13	24 7/16										
15	24½	78½	78¾	91½	18 97	176¼	175	26½	5 57	86	17.84
16	24½	78¾	78	92	19 09	172¾	171½	27¼	5 63	86	17.85
17	24¾	79¾	79¾	92	19 13	174½	173¼	27	5 61	86	17.88

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Nov. 17

Aluminum—Supplies for early delivery continue scarce. Prices are fully maintained and even stiffened, 57@59c. having been paid for No. 1 ingots for spot delivery.

Antimony—The market is very firm. Stocks here are low and metal for immediate shipment is hard to get. Quotations for Chinese and other ordinary brands are 37½@38½c. per lb. Cookson's is held at 45c. per lb. nominally.

Antimony ore is only offered in very small quantities, at $2.25@2.35 per unit.

Quicksilver—The market is strong and stocks are small. New York price is $105 per flask of 75 lb. for large lots; $105 @110 for smaller orders. San Francisco reports by telegraph $100 per flask, with the market very firm. London price is £16 10s. per flask, with no discount from second hands.

Nickel—There is no change reported. Ordinary forms are nominally 45@50c. per lb. according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium** metal, 75c. per lb., New York.—**Cobalt** metal, 97% pure, is sold at $2 per lb.—**Magnesium**, pure, has gone to a high price, $6 per lb. being asked.

EXPORTS AND IMPORTS

Exports and Imports of Copper in September are reported by the Department of Commerce as below, in pounds:

	Imports	Exports
Ore, copper content	10,503,225	315,651
Matte, copper content	1,706,689	.....
Unrefined, blister copper, etc.	25,529,234	2,168
Refined	786,560	49,441,194
Old scrap, etc.	663,658	10,625
Total	39,189,366	49,769,638

In addition to the quantities given, manufactures of copper valued at $631,258 were exported; quantities not being given. This makes the exports of copper for the nine months ended Sept. 30 a total of 216,260 long tons; imports, 106,371 tons.

Imports of Lead in September are reported by the Department of Commerce as below, in pounds:

Lead in ore	1,095,649
Lead in base bullion	10,728,927
Lead, metallic	27,944
Total	11,852,520

The total imports for the nine months ended Sept. 30 were 37,572 short tons. The base bullion was nearly all from Mexico.

Imports and Exports of Zinc in September are reported by the Department of Commerce as below, in pounds:

	Imports	Exports
Zinc contents of ore	8,826,329	1,218,500
Zinc, metallic	225,689	20,332,761
Total	9,052,018	21,551,261
Zinc dust	267,774	78,220
Zinc dross	.....	886,778

Total weight of ore imported was 15,753 tons; 5,112 tons being from Mexico, 5,023 from Australia, 4,743 from Spain, 874 from Canada, and 1 ton from Japan. For the nine months ended Sept. 30 the total exports were 90,696 short tons; imports, 32,416 tons, nearly all in ore.

Exports and Imports of the Principal Metals, other than iron and steel, eight months ended Aug. 31, copper and tin in long tons, lead and zinc in short tons:

	Exports		Imports	
	1914	1915	1914	1915
Copper	284,910	194,041	104,789	87,626
Tin	486	502	28,939	33,576
Lead	46,395	86,059	15,635	34,646
Zinc	4,455	79,920	760	607
Ores:				
Zinc	8,490	605	12,483	77,468
Zinc ore, contents			4,503	31,809

Exports include reexports of foreign material. Copper includes contents of ore and matte; lead, contents of ore and base bullion.

Shipments of tin from the Straits 10 months ended Oct. 31—estimating October—were 51,127 long tons, in 1914, and 54,060 in 1915; increase, 2,933 tons.

Gold, Silver and Platinum

NEW YORK—Nov. 17

Gold is still coming here from London. A further shipment of $3,800,000 was made on Nov. 12, and more is reported this week.

Platinum continues high, with supplies scarce and the future uncertain. Sales are small, and prices continue rather nominal at $55@60 per oz. for refined platinum; $60@63 per oz. for hard metal.

Our Russian correspondent writes under date of Oct. 22 that the market is very firm and advancing. The demand both for the domestic market and for export has increased enormously, and the offers of metal are not up to the needs of the market. On Oct. 16 a total of five poods was sold at 52,000 rubles per pood. The quotations at Ekaterinburg are 13@13.25 rubles per zolotnik; at Petrograd, 52,000@53,000 rubles per pood, for crude metal, 83% platinum. These prices are equal to $49.35 and $51.45 per oz., average.

Silver has shown a rising tendency the past week, owing to a more active London demand and reduction in the stocks held in that city. The advance in English exchange has also contributed to an improvement in the New York equivalent price of the London official.

Zinc and Lead Ore Markets

JOPLIN, MO.—Nov. 13

Blende, high price $112.50; base per ton 60% zinc, premium ore, $110; medium, $109@100; lower grades down to $90; calamine, base per ton 40% zinc, $60@70; average selling price, all grades of zinc, $97.49 per ton. Lead, high selling price, $62.50, bids today as high as $64 base per ton of 80% metal content; average selling price, all grades of lead, $60.55 per ton.

SHIPMENTS WEEK ENDED NOV. 13

	Blende	Calamine	Lead	Values
Totals this week.	14,307,340	714,090	2,066,750	$794,790
Totals this year.	506,481,690	36,423,080	78,789,770	22,647,380

Blende value, the week, $711,750; 46 weeks, $19,692,000.

Calamine value, the week, $20,490; 46 weeks, $880,230.

Lead value, the week, $62,550; 46 weeks, $2,074,150.

Sellers are very well satisfied with the market for both zinc and lead. Zinc was advanced another $10 this week and lead was advanced $4 per ton today for next week's delivery. The enormous shipment is largely attributable to the United States Smelting, Refining and Mining Co.'s heavy purchases the past three weeks. This week this company was practically out of the market, but this was not known until late in the week by the agents of other smelting companies. Today blende of 62% zinc and no lead was being offered at $105 base, a grade of ore purchased yesterday at $110 base.

PLATTEVILLE, WIS.—Nov. 13

The base price paid this week for 60% grades of zinc ore advanced from $88 to $100 per ton at week end. The base price paid for 80% lead ore was $58 per ton.

SHIPMENTS, WEEK ENDED, NOV. 13

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,738,400	.....	1,790,100
Year	178,771,750	6,028,540	24,862,690

Shipped during week to separating plants, 4,872,000 lb. zinc ore.

Iron Trade Review

NEW YORK—Nov. 17

The iron and steel trades continue extremely active, with both foreign and domestic demand strong and prices inclined to advance still further.

The following statement has been issued: "The United States Steel Products Co. has recalled, temporarily, quotations in French markets, except as to pipe, tinplate, and some specialties that involve a small tonnage, for the reason that steel products for delivery in the near future are sold well up to maximum capacity. Until the general questions of supply and demand are carefully considered it is impossible to tell how much surplus we shall have for sale in France for the present."

The new works of the Steel Corporation at Duluth, Minn., are almost ready to start and will probably be making steel ingots and billets next week.

The United States Steel Corporation announces that two blast furnaces and several openhearth furnaces are to be added to the equipment of the Gary works, and some other improvements.

It appears that the control of the Cambria Steel Co. is not yet decided. We noted last week the sale of 112,000 shares by the Pennsylvania R.R. Co. to W. H. Downer, now president of the Cambria. This week a further sale of 250,000 shares was made to a syndicate represented by J. L. Replogle, formerly vice-president of the Cambria and now president of the Vanadium Steel Co. With him are associated some prominent Philadelphia and Pittsburgh steel men. Neither party now holds a majority of the stock. Reports as to the sale of the Pennsylvania Steel Co. have been current, but have not been confirmed.

Alabama pig-iron production for the 10 months ended Oct. 31 was 1,600,712 tons. The make of iron is now at the rate of about 200,000 tons a month.

The United States Steel Corporation reports unfilled orders on its books Oct. 31 at 6,165,452 tons of material; an increase of 847,834 tons over Sept. 30, and the highest monthly report made since May, 1913, over two years ago.

Exports and Imports of those articles of iron and steel for which tonnages are given in the Commerce reports were as follows for September and the nine months ended Sept. 30, in long tons; values of exports of machinery are added:

	September		Nine Months	
	1914	1915	1914	1915
Imports, iron and steel	38,420	31,814	234,282	183,997
Exports, iron and steel	96,482	381,317	1,142,979	2,461,198
Exports, machinery, values	$5,295,167	$12,377,389	$72,617,657	$91,673,678

Exports of mining machinery, including oil-well machinery for the nine months were valued at $5,934,748 in 1914, and $4,950,076 this year.

FOREIGN IRON

Pig Iron Production in Germany in September was 1,033,078 metric tons, being 17,532 tons less than in August, and 452,991 tons more than in September, 1914. For the nine months ended Sept. 31 the total production this year was: Foundry, 1,776,034; forge, 218,964; steel pig, 1,244,275; bessemer pig, 135,162; Thomas (basic) pig, 5,291,093; total, 8,665,528 tons. The total in 1915 was 12,016,888 tons, showing a decrease of 3,351,360 tons, or 27.7%, this year.

Exports of Iron Ore from Sweden in the six months ended June 30 were 2,027,000 tons, a decrease of 501,000 tons from last year. Imports of coal were 2,243,000 tons, an increase of 108,000 tons from last year.

Imports of Iron and Steel into Italy for the six months ended June 30 were 336,164 tons. Imports of coal were 4,119,110 tons, being 1,285,360 tons less than last year.

British Foreign Trade in Iron and Steel and in manufactures thereof for the nine months ended Sept. 30 are valued by the Board of Trade returns as follows:

	Exports	Imports	Excess
Iron and steel	£28,794,063	£7,844,353	Exp. £20,949,710
Machinery, hardware, etc.	21,842,751	11,377,041	Exp. 10,465,710
Totals	£50,636,814	£19,221,394	Exp. £31,415,420
Totals, 1914	73,204,394	20,526,543	Exp. 52,677,851

Quantities of iron and steel exported were 3,179,726 long tons in 1914, and 2,333,529 tons in 1915. Quantities imported were 1,467,412 tons in 1914, and 901,032 tons this year.

PITTSBURGH—Nov. 16

The October increase of 847,834 tons in the unfilled obligations of the Steel Corporation show the pace at which steel buying has proceeded, for the bookings, although so large, were chiefly of specific orders, there being an unusually small amount of contract tonnage. Only in two months in the past, December, 1911, and October, 1912, was there a larger increase, and in those months the business accepted was chiefly in the form of open contracts, subject to specification later.

This week witnesses a reduction in the pressure to buy steel products, the rush to get under cover having spent part of its force, while it meets increased reserve on the part of the steel mills as to selling. Some are practically out of the market. Very few will accept contract obligations and the trend is strongly toward a condition in which nothing marketwise will be done except by way of specific orders. Specifying against existing contracts shows no abatement. With these specifications and the specific orders placed the mills will enter the new year with from two to four months of actual work on books, according to the description of material, and even very light buying in the first six months of next year will not enable the mills to catch up by July 1. Steel prices continue to show an advancing tendency. The average price of finished steel products is now within $3 a ton of the highest level reached in 1907, and higher than at any high point since then.

The most important new business in sight is in freight cars. The Pennsylvania system is now opening bids on 9,000 cars but is expected to buy a larger number, as many as 25,000 being predicted in some quarters. There are many inquiries for relatively small lots. The railroads are disagreeably surprised at the strength of the steel market, finding that full market prices have to be paid for car material, while the mills will give options for only a few days at a time.

Pig Iron—The sharply advancing tendency in pig iron has been arrested and in bessemer there has been what amounts to a reaction from the higher prices reported a week ago. We quote: Bessemer, $16.50; basic, $16; foundry and malleable, $15.50@16; gray forge, $15@15.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There continues to be buying of billets [illegible] t bars by mills that ordinarily make steel for their own consumption, the object being to release openhearth capacity to make forging and war billets. The latest buying of this sort has been by the Pittsburgh Steel Co., which has taken about 40,000 tons of bessemer billets from Youngstown and Wheeling mills, to use in its wire department, releasing so much openhearth steel-making capacity for other purposes. Current prices are approximately as follows: Bessemer billets, $25.50@26.50; sheet bars, $26@26.50; openhearth billets, $26.50@27.50; sheet bars, $27@27.50, at maker's mill, Pittsburgh or Youngstown; forging billets, $42@45; rods, $35 at mill.

IRON ORE

Shipments to furnaces from Lake Erie docks have been large, and the stock on docks is being drawn down rather low. Some furnaces which have been looking for additional tonnage this year have not been able to get it.

Of the October shipments of Lake Superior ore a total of 5,741,176 tons, or 80.3%, were delivered to Lake Erie docks.

Imports at Baltimore for the past week included 23,958 tons manganese ore from Brazil.

Imports at Baltimore included 35,775 tons iron ore, of which 5,785 tons were from Algeria and 29,990 tons from Cuba.

OTHER ORES

Molybdenum and Tungsten ores mined in Australia are now all taken by the Commonwealth government under an agreement with the British government. No exports of these ores will be allowed except through the government agents, Dalgety & Co., Ltd. The arrangement is for one year from Sept. 9, 1916. The prices fixed by the government are: Molydenite, 90% MoS_2, 105s.—$25.20—per unit; Wolframite, 65% WO_3, or scheelite, same grade, 55s.—$13.20—per unit.

Prices here are a decided contrast to these. We noted last week a sale of **Tungsten** ore at $38 per unit, and have since heard of sale of ore, 60% WO_3 at $45 per unit.

NEW CALEDONIA ORES

Shipments of chrome ore from New Caledonia in August were 11,195 metric tons, all to the United States. For the eight months ended Aug. 31 shipments were 40,024 tons chrome ore and 39,216 tons nickel ore. Shipments of nickel matte were 2,710 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 424,162 short tons; shipments, 426,093 tons. Shipments of Greensburg and Upper Connellsville districts, 45,022 tons.

Connellsville—The market for prompt furnace coke is decidedly softer, with fair offerings at $2.25 and little demand. Corrigan, McKinney & Co. are understood to have closed for at least half their requirements for 1916 with the Rainey interest. The Youngstown Sheet and Tube Co. is reported to have renewed its contracts, involving a total of about 75,000 tons a month, with Hillman and Producers, for the first three months of 1916 at about $2.50, this carrying the company to the time when its new byproduct plant is expected to be operating. Foundry coke is quotable at $3@3.25 for both prompt and first-half contracts.

Chemicals

NEW YORK—Nov. 17

The general markets show little change from our last report. The chief business now is in contracts for next year's delivery of heavy chemicals.

Arsenic—Only a moderate business is forward. Prices are steady and unchanged at $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is good for the season and the market is steady. Current quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is rather active and sales are steady. Quotations are firm at $2.90 per 100 lb. for spot and December; and $2.85 per 100 lb. for January and later deliveries.

Imports and Exports of Raw Materials for chemical manufacture in the United States eight months ended Aug. 31, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Sulphur	14,583	17,736	95,176	9,414
Pyrites	667,036	600,558		150
Chrome ore	48,081	30,089		
Magnesite	90,522	19,287	1,196	412

Exports include reexports of foreign material. Estimating sulphur contents of pyrites, the total imports of sulphur in 1915 were 257,958 tons.

Assessments

Company	Delinqt	Sale	Amt.
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0 01
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0 002
Columbus Ext., Utah	Dec. 11	Jan. 3	0 02
Cons. Imperial, Nev	Nov. 30	Dec. 24	0 01
Copper Mt. M. & D., Ida	Oct. 28	Dec. 1	0 002
Danley-Lloyd, Utah	Nov. 14	Nov. 30	0 0025
Darby M. & M., Ida	Nov. 16	Dec. 16	0 00125
Dry Canon Cons., Utah	Dec. 18	Jan. 17	0 001
Eastern Star, Ida	Oct. 29	ov. 29	0 002
Emerald Oil, Utah	Nov. 27	Dec. 16	0 06
Eureka M. & M., Ida	Nov. 26	Dec. 27	0 001
Great Western, Nev	Nov. 15	Dec. 7	0 001
Hancock Cons., Mich	Jan. 3	.	1 00
Hector, Ida	Nov. 18	Dec. 10	0 005
Idaho & Los Angeles, Ida	Nov. 26	Dec. 27	0 005
Idaho-Nevada Exp., Ida	Nov. 1	Dec. 1	0 002
Ivanhoe, Ida	Nov. 8	Dec. 9	0 0025
Jack Waite, Ida	Nov. 20	Dec. 20	0 01
Leonora M. & M., Utah	Nov. 27	Dec. 17	0 005
Lewis & Clark, Ida	Nov. 15	Dec. 15	0 001
Lucky Swede, Ida	Nov. 11	Dec. 11	0 002
Military M. & M., Ida	Oct. 28	Nov. 29	0 0065
Missoula Copper, Ida	Nov. 15	Dec. 15	0 002
Montana Standard	Nov. 15	Dec. 15	0 005
National Copper, Ida	Nov. 20	Dec. 18	0 01
National Lead, Ida	Nov. 16	Dec. 15	0 001
Nevada-Douglas, Nev	Nov. 30	Dec. 31	0.10
New Arcadian, Mich	Dec. 1	.	0.50
New Baltic, Mich	Jan. 15	.	0 50
Northern Light, Ida	Nov. 2	Dec. 2	0 004
O. K. Ex. M. & R., Utah	Nov. 20	Dec. 15	0 005
Old Vetearn, Ida	Nov. 1	Nov. 27	0 002
Osm Pail Con., Ida	Nov. 15	Dec. 6	0 01
Oriental, Nev	Nov. 6	Dec. 7	0 003
Original, Nev	Nov. 6	Dec. 7	0 003
Pacific M. & M., Ida	Nov. 10	Nov. 30	0 0005
Phedora, Ida (post.).	.	Nov. 20	0 0005
Phoenix, Mich	Jan. 1	.	1 00
Pioche Metals, Nev	Oct. 20	Nov. 20	0 004
Rainbow, Ida	Oct. 15	Nov. 20	0 002
Seg. Belcher & Midas, Nev	Dec. 12	Jan. 6	0 02
Silver Cliff, Ida	Nov. 8	Dec. 6	0 0025
Silver Pick Cons., Nev	Oct. 16	Nov. 23	0 01
Sonora M. & M., Ida	Nov. 4	Dec. 17	0 003
Sunset M. & D., Nev	Oct. 18	Nov. 22	0 02
Ten. Gipsy Queen, Nev	Oct. 29	Dec. 6	0 01
Umatilla Ton., Nev.	Nov. 8	Dec. 13	0 005
Wolf Mountain, Utah	Nov. 12	Dec. 14	0 0025

Stock Quotations

The copper and lead stocks have advanced sensationally this week, and apparently the end is not in sight. Coppers always look best with the metal at 20c. per lb.

COLO SPRINGS	Nov. 16	SALT LAKE	Nov. 16
Name of Comp.	Bid	Name of Comp.	Bid
Acacia	02½	Beck Tunnel	05½
Cripple Cr'k Con.	008	Black Jack	.05
C. K & N	‡ 02	Colorado Mining	06
Doctor Jack Pot	09½	Crown Point	01
Elkton Con	30	Daly-Judge	7 10
El Paso	77	Emma Co	.21½
Findlay	03½	Gen'l Chain	10
Gold Dollar	02½	Grand Central	46
Gold Sovereign	05½	Iron Blossom	82
Golden Cycle	1 81	Lower Mammoth	05½
Isabella	18½	May Day	18½
Jack Pot	06½	Opohonco	002
Jerry Johnson	05½	Prince Con	77
Lexington	‡ 005	Seven Troughs	01½
Mary McKinney	44	Silver King Coal'n	3 25
Pharmacist	‡ 008	Silver King Con	2 10
Portland	1 70	Sioux Con	02
Raven B. H	03½	Uncle Sam	07½
Vindicator	1 65	Yankee	09½

TORONTO	Nov. 16		
Bailey	04½	Dome Exten	28
Chambers Ferland	16	Dome Mines	24 87½
Comstock	‡ 09	Foley O'Brien	50
Peterson Lake	26½	Hollinger	26 50
Right of Way	‡ 04	Imperial	04½
Seneca Superior	65	Jupiter	11½
Silver Queen	‡ 01	McIntyre	90
T. & Hudson Bay	20 06	Pearl Lake	‡ 002
Thinkamingo	44	Porcu Crown	78
Trethewey	.13	Preston E. D	04½
Wettlaufer-Lor	07	Vipond	74

SAN FRANCISCO	Nov. 16		
Alta	04	Belmont	3 70
Andes	09	Jim Butler	90
Best & Belcher	06	Lone Star	03
Caledonia	52	MacNamara	02
Challenge Con.	06	Midway	11
Chollar	02	Mont.-Tonopah	29
Confidence	16	North Star	12 00
Con. Virginia	23	Rescue Eula	06
Gould & Curry	03	West End Con.	66
Hale & Norcross	04	Atlanta	22
Jacket-Cr. Pt.	17	Blue Bell	02
Julia	02	Booth	36
Mexican	39	C. O. D. Con	04
Occidental	75	Comb. Frac	07
Ophir	30	D'field Daisy	‡ 03
Overman	09	Jumbo Extension	1 27½
Potosi	02	Pitts.-Silver Peak	‡ 06
Savage	05	Round Mountain	41
Sierra Nevada	50	Sandstorm Kendall	02½
Union Con	51	Silver Pick	07
Utah Con	03	Central Eureka	08

N. Y. EXCH.	Nov. 16
Name of Comp.	Clg.
Alaska Juneau	12
Am.Sm.&Ref.,com	100
Am. Sm. & Ref., pf.	111½
Am. Sm. Sec., pf. A	90½
Am. Sm. Sec., pf. B	84½
Anaconda	91½
Batopilas Min	1½
Bethlehem Steel	45¾
Bethlehem Steel, pf.	60½
Chino	53½
Colo. Fuel & Iron	54½
Crucible Steel	75½
Federal M. & S., pf.	53½
Great Nor., ore, ctf.	50½
Greene Cananea	42½
Guggen. Exp	78½
Homestake	121
Inspiration Con	46½
International Nickel	104
Miami Copper	35½
Nat'l Lead, com	66½
National Lead, pf	114
Nev. Consol	16½
Ontario Min	1½
Quicksilver	4½
Ray Con	27½
Republic I&S, com	52½
Republic I&S, pf	107½
Slossh'eff'd, com	59
Tennessee Copper	50½
Utah Copper	79
U. S. Smelt. com	86½
U. S. Steel, pf.	115½

N. Y. CURB	Nov. 16
Alta Con	12
Beaver Con	30
Big Four	05
Braden Copper	16½
Buffalo Mines	.30
Can. Cop. Corpn	2 3/16
Cashboy	.05
Cerrode Pasco	39½
Chile Cop	25½
Con. Ariz Sm.	1½
Con. Coppermines	1½
Con. Cop.-Utah	1/16
Dia. Black B	03
Florence	42
Goldfield Con	1 5/16
Goldfield Merger	20
Howe Sound	3½
Kennecott Cop	58½
Kerr Lake	3½
La Rose	75
Magma	15½
McKinley-Dar-Sa	35
Mines of Am	2½
Mother Lode	.34
Nevada Hills	18
New Utah Bingham	3
Nipissing Mines	7½
Oro	06
St. Joseph Lead	14½
South Utah	.30
Stand'd Oil of N.J.	495
Standard S. L	1½
Stewart	.50
Success	.62
Tonopah	5½
Tonopah Ex	3
Tonopah Merger	.42
Trihill Con	75
Yukon Gold	4½

LONDON	Nov. 4
Alaska Tre'dwell	£6 17s 6d
Burma Corp	1 8 9
Cam & Motor	0 13 6
Camp Bird	0 8 0
El Oro	0 10 6
Esperanza	0 12 0
Mexico Mines	4 5 0
Nechi, pfd.	0 13 0
Oroville	0 14 3
Santa Gert'dis	0 10 6
Tomboy	1 3 0
Tough Oakes	0 7 0

BOSTON EXCH	Nov. 16
Name of Comp.	Clg.
Adventure	2
Ahmeek	397
Alaska Gold M	29
Algomah	1½
Allouez	59
Am. Zinc	70
Ariz. Com., ctfs.	7½
Bonanza	.30
Butte-Balaklava	3
Butte & Superior	71½
Calumet & Ariz.	69½
Calumet & Hecla	563
Centennial	18
Copper Range	62½
Daly West	2½
East Butte	15½
Franklin	10½
Granby	85
Hancock	17
Hedley	28
Helvetia	40
Indiana	5½
Island Cr'k, com	43
Island Cr'k, pfd.	89
Isle Royale	28½
Keweenaw	2½
Lake	13½
La Salle	6
Mason Valley	1½
Mass	13
Mayflower	4½
Michigan	2½
Mohawk	87½
New Arcadian	11½
North Butte	32½
North Lake	1½
Ojibway	1½
Old Colony	3½
Old Dominion	58½
Osceola	87
Quincy	89½
Santa Fe	4
Shannon	8½
Shattuck-Ariz	37½
Superior	28½
Superior & Bost	2½
Tamarack	56
Trinity	11½
Tuolumne	35
U. S. Smelting	47½
U. S. Smelt'g, pf.	47½
Utah Apex	3½
Utah Con	13½
Victoria	2½
Winona	3½
Wolverine	60
Wyandot	1½

BOSTON CURB	Nov. 16
Bingham Mines	8
Boston Ely	.21
Butte & Lon'n Dev.	.01
Calaveras	1½
Calumet-Corbin	.03
Chief Con	.96
Cortez	.45
Crown Reserve	.55
Davis-Daly	1 9/16
Eagle & Blue Bell	1 15/16
First Nat. Cop	5½
Honghton Copper	3
Iron Cap Cop., pf	7
Majestic	.75
Mexican Metals	.37
Nevada-Douglas	61
New Baltic	3½
New Cornelia	24½
Ohio Copper	.15
Oneco	1
Raven Copper	.10
Rex Cons	.45
Smokey Dev	.15
Stone Lake	5½
Tonopah Victor	.30
United Verde Ext	5½
Utah Metal	9½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57 572	48.855	28 983	26 553	22.731
February	61 642	57 506	48.427	28 357	26 573	22.753
March	57 870	58 067	50.241	26 660	26 788	23.708
April	59 490	58.519	50 250	27 416	26 958	23 709
May	60 361	58 175	49.915	27 825	26 704	23 570
June	58 990	56 471	49.634	27 199	25 948	23.267
July	58 721	54 678	47.519	27 074	25.219	22 597
August	59 293	54 344	47.163	27 335	25.029	22.780
September	60 640	53 290	48.688	27 986	24 260	23 501
October	60 793	50.654	49.385	28 083	23 199	23 925
November	58 995	49 082	.	27.263	22 703	.
December	57 760	49.375	.	26 720	22 900	.
Year	59 791	54 811	.	27 576	25 314	.

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14 223	13.641	64 304	60.756	69.488	65.719
February	14 491	14 394	65 259	63 394	70 188	*
March	14 131	14 787	64 276	66 152	69 170	*
April	14 211	16 811	64 747	75 096	69 313	*
May	13 996	18 506	63 182	77 600	67 786	*
June	13 603	19 477	61 336	82 574	66 274	95 333
July	13 223	18 796	60 540	76 911	64 955	91 499
August	*	16 941	‡	68 673	‡	82 333
September	*	17 502	‡	68 915	‡	85 250
October	*	17 686	‡	72 601	‡	88 000
November	11 739	.	53 227	.	.	.
December	12 801	.	56 841	.	*	.
Year	.	.	.	.	.	.

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 779	34 260	171 905	156.550
February	39 830	37 415	181 656	176 925
March	38 038	48 426	173 619	180 141
April	36 154	47 884	163 963	166 225
May	33 360	38 790	150 702	162 675
June	30 577	40 288	138 321	167 636
July	31 707	37 423	142 517	167 080
August	*	34 389	‡	151 440
September	32 675	33 125	‡	152 625
October	30 284	33 080	‡	151 554
November	33 304	.	139 391	.
December	33 601	.	147 102	.
Av. year	34 301	.	.	.

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4 111	3.729	4 011	3.548	19.665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3.970	4.053	3.850	3.997	19.661	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3 715	4.520	‡	21.946
September	3.828	4.610	3 658	4.490	‡	23.151
October	3.528	4 600	3.384	4.499	‡	23.994
November	3.683	.	3.585	.	18.500	.
December	3.800	.	3.662	.	19.097	.
Year	3 862	.	3.737	.	.	.

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6 211	21.533	30.844
February	5 377	8.436	5.228	8.255	21 413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5 113	10.012	4.963	9.837	21.569	49.888
May	5 074	14.781	4.924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.036	21.345	100.614
July	4 929	19.026	4 779	18.856	21.568	97.250
August	5 568	12.781	5 418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4 909	12.800	4 750	12 596	‡	66.536
November	5.112	.	4 962	.	25.016	.
December	5.502	.	5 430	.	27.369	.
Year	5.213	.	5.060	.	.	.

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.59	$13 23	$13.43	$13.99	$13.90
February	15 06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13 91	13.45	14.10	13.95
April	14.90	14.55	13 90	13.43	14.13	13.95
May	14 90	14.61	13 90	13.60	14 27	13.83
June	14 90	14.70	13.90	13.67	13.96	13.77
July	14 90	14.94	13.90	13.91	13 90	13.68
August	14 90	16.01	13.90	15.31	14.08	14.75
September	14 90	16.86	13 90	15 95	14.03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59	.	13.43	.	13.83	.
December	14.70	.	13.45	.	13 83	.
Year	$14 88	.	$13.78	.	$14.01	.

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Building the Tough-Oakes Mill—I

By John A. Baker*

SYNOPSIS—In building the Tough-Oakes mill, a 100-ton cyanide plant, arrangements were made for keeping a detailed chronological record and a segregated cost account. Cost of ground clearing, concreting for foundations, building construction, and general costs are given with extreme clarity, the time factor also being definitely determined.

The property of the Tough-Oakes Gold Mines is in the Kirkland Lake gold area, in the district of Timiskaming, Ont., Can. This district is about 50 mi. north of Cobalt, and the Tough-Oakes mine, at present the sole producer, is in the eastern portion of the area, between Kirkland and Gull lakes. A good wagon road, built by the Ontario government, connects the mine with the village of Swastika, about seven miles away, on the main line of the Temiskaming & Northern Ontario Ry. The area is just south of the Height of Land, separating the waters of the St. Lawrence from those of Hudson Bay. Crushing at the newly constructed 100-ton cyanide plant of this company was begun on Mar. 15, 1915, slightly over three years from the date of discovery of gold on the property and 29 months from the inception of mining operations there.

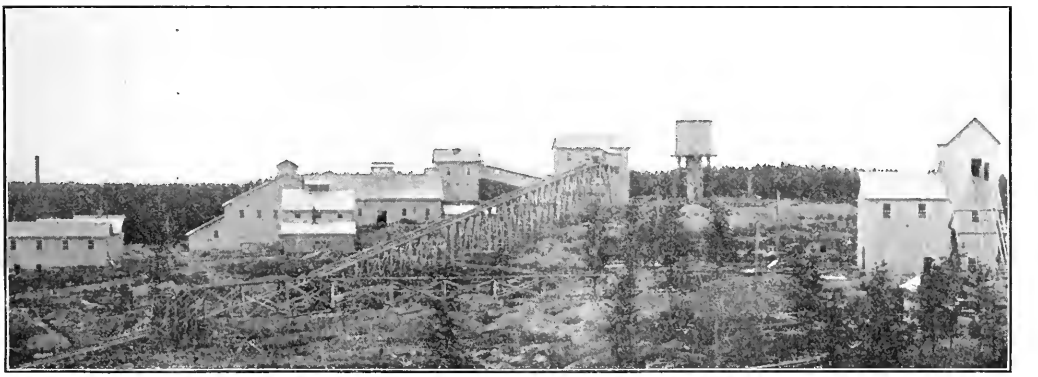
Development of the Tough-Oakes property progressed through the ordinary steps usual in such cases, including the construction of a small amalgamating mill; but the prospective value of the mine increased so rapidly that the present mill was decided upon and construction begun in a much shorter period than is usual with mines of the kind. The customary cyanide experiments and grinding tests were made. These, together with the quick-setting properties of the ore, indicated that the continuous counter current decantation process was applicable. Ball-mill crushing was looked upon with favor on account of the low first cost and the success of some similar mills at Porcupine. In view of guarantees given by manufacturers it was decided to install Hardinge ball mill instead of stamps.

The Butters-Johnston Engineering Syndicate was engaged as consulting engineers and metallurgists.

The necessity for having the mill in operation at the earliest possible moment led Mr. James Johnston to accept the opinion already arrived at as regards process and machinery, this opinion being later corroborated by the experimental tests made by his company.

While the utmost economy was aimed at in all that pertained to the designs and their execution, quality in machinery and material was never sacrificed to cheapness where any advantage or efficiency in operation was to be gained by the former.

Since the doubling of the mill was considered a not remote possibility, provision was made in the organic design and in power line, transformer station and pipe lines for this contingency. Particular care was taken with the estimate, and a detailed cost-keeping system was installed. A construction schedule was drawn up, and shipments of machinery were planned in accordance with it. By this means it was possible to estimate the monthly



SURFACE PLANT OF THE TOUGH-OAKES MINE, KIRKLAND LAKE, ONT., SHOWING THE SHAFT HOUSE, MILL BUILDINGS, TRESTLES AND BOILER PLANT

*Formerly Construction Engineer, Tough-Oakes Gold Mines, Ltd.

expenditures considerably in advance, thus aiding financial arrangements. A careful daily diary, or log, of all events taking place at the mill site was written up each day. This record enabled the construction engineer to look back and visualize the state of progress at any time, and from that intelligently to predict future progress. It contains the starting and finishing date for every portion of the work, record of arrival and supplies of machinery, had many valuable data, particularly regarding the time factor, which in the rush of construction work is usually lost unless its systematic recording is insisted upon.

General Description of Site and Mill

The mill is on a rocky gently sloping hillside about 1,000 ft. north of the main shaft. From this shaft the ore is delivered along an inclined trestle by a self-dumping skip. An intermediate pocket permits handling ore from No. 3 shaft over the same trestle. The crusher station occupies a separate building connected with the cyanide plant by an overhead conveyor. The cyanide plant is built in the shape of a letter L, the eastern wing comprising the fine-ore bin, ball mill, tube mills and plates and is referred to as the fine-grinding department. The main building houses the tanks, pumps and accessory apparatus.

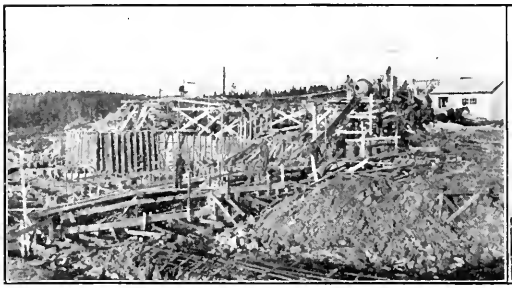
In the crusher station run-of-mine ore is reduced to 1¼-in. ring by two jaw crushers, with intermediate elevating and screening. The crushed ore is delivered by belt conveyor to the fines-storage bin at the end of the fine-grinding department. From it push feeders deliver to a short conveyor feeding the ball mill. The ball-mill product is split between two duplex Dorr classifiers, each operating in closed circuit with a 5x20-ft. tube mill. An elevator and copper plates are provided, so arranged that the plates may be interposed between either tube-mill discharge and its classifier. The classifier overflow runs by gravity into a 30x10-ft. Dorr thickener. The overflow of this machine, constituting the pregnant solution, gravitates to a box containing canvas leaves for clarifying. From this a vacuum pump delivers the clear solution to a sump, from which it is drawn for precipitation. The zinc-dust system is used.

Thickened pulp from the bottom of the 30x10-ft. collector thickener is transferred by diaphragm pumps to three 16x12-ft. agitators operating continuously in series. The pulp from the third agitator gravitates to the first of four 28x10-ft. Dorr thickeners, operating on the continuous counter-current decantation principle. Each tank is 24 in. higher than the preceding one. The overflow runs by gravity, while the thickened-pulp transfers are effected by diaphragm pumps. From the final tank the thickened pulp is discharged by spigot into a launder, whence it runs through a mechanical sampling device and then to waste.

Below and to the west of the cyanide plant are the heating boiler, transformer house and the carpenter and machine shops. Next to the crusher station are the office and storehouses, water tank and lime bin. All these auxiliary buildings, together with the water-service pipe, 2,200-volt mill-feeder line and trestle are included under the general heading of mill construction in the original estimate. The refinery and oilhouse were added later when the financial situation had improved.

Clearing and Excavating for Foundations

Clearing of stumps and removing of soil was commenced on July 27, 1914, with a gang of 12 laborers and one team. Under about 6 in. of top soil a tough boulder clay was encountered. Work was found to progress most satisfactorily when using two teams and about a dozen men. The soil was deposited about 100 ft. outside the lines of the building, where it could be recovered handily for filling purposes. On portions of the work wheelbarrow runways were employed instead of teams, to dispose of material. Frequent boulders and the uneven nature of the ground prevented the use of scrapers or similar devices. The average depth of the overburden over the whole area cleared was 2 ft., giving a total of 1,278 cu.yd. The cost of the work was: Labor, $820.19; material, $99.60; total, $919.79; or 72c. per cu.yd. Laborers were paid at the rate of $2.25 per day.



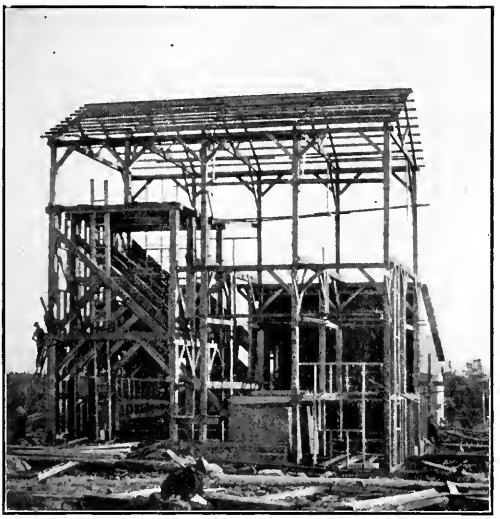
POURING THE CONCRETE MILL FOUNDATIONS THROUGH A CHUTE FROM THE MIXER

CONSTRUCTION OF TANK ROOM, CRUSHER STATION IN THE BACKGROUND

Work on rock excavation was begun immediately, using hopper drills of the hand-rotated type. After Sept. 1, air was supplied from the original small steam plant, so that its cost per machine per shift was higher than when the large electric compressor was running, the exact figure being $3.50. There was no cut more than 6 ft. deep, but it was necessary to cut down from 1 to 2 ft. over nearly 60% of the area of the cyanide plant. A total of 125 machine shifts was necessary, and the complete work of rock excavating was not finished until Oct. 1, making an average of three machine shifts per day. Owing to the great irregularity of the rock surface, no close estimate of rock removed, based on cross-sections, can be given. The figures given herewith are believed to approach accuracy to within 15%: Total yardage, 547; labor and material, $3,001; cost per yard, $5.52. The rock was nearly all conglomerate.

On Sept. 20, while the drills were still working on the lower floor of the cyanide plant, carpenters commenced work on the crusher-station forms. Since the topography of the mill site is something over which the construction engineer had no control, the actual work of the mill construction may be said to start from this date.

One-inch rough lumber costing $24 per M laid down at the mill site was used in the forms. On walls up to 4 ft. high, 2x4-in. scantling on 18-in. centers was used. On walls 4 ft. to 10 ft. high, 2x6-in., 16-in. centers, securely tied together with concrete wire, was employed. On the main retaining wall between the fine-grinding department and the cyanide plant 2x8-in. timbers on 16-in. centers were found necessary to make the forms secure. This wall is 12 to 14 ft. in height. The uprights were tied from back to front in three places with soft-iron concrete wire. A rough reinforcement consisting of strands of old cable was fastened to these tie wires. This



THE CRUSHER STATION IN CONSTRUCTION STAGE

wall was given a batter of 1 in. per ft. The other walls, which varied in thickness from 6 to 12 in., were built with vertical sides.

All tanks are supported on packed rock and earth fill held in place by small retaining walls. Since all the tanks are on different elevations and since it is necessary to have a channel to the center of each thickener, the foundation plan presents a rather complicated appearance. This method, however, is much more economical than that using individual piers with timber beams and joists. The center channels are run obliquely, so that there will be only one elbow in the diaphragm-pump suction line.

All concrete was mixed in a Smith mixer of ⅓-cu.yd. capacity. The mixer was driven by steam from a 20-hp. locomotive boiler temporarily erected for construction purposes. The total for all walls, floors and piers was 445 cu.yd., divided among the several buildings as follows: Crushing station, 70; fine-grinding department, 135; cyanide plant, 215; water tank, 5; heating plant, 20; total, 445 cu.yd. Four different set-ups of the mixer were necessary. All the main walls and piers were spouted direct from the machine through wooden launders lined with galvanized iron. Some of the smaller walls were filled by wheelbarrow. A modern spouting equipment with steel chutes, hoist and tower, would have saved $200 in the placing of the concrete—not more. This, however, would have involved either a large outlay for equipment or the letting of the work by contract, which was for many reasons undesirable.

The mixture desired was 1 part cement, 3 of sand and 5 of rock. Large piers and walls were given as much additional coarse clean rock as they would stand. The rock used was from the main waste dump about 400 yd. away. It was hauled by team to the mill site and used without crushing or screening. The problem of securing suitable sand was not so simple. Two sources of supply were available and screen tests showed the results given in the accompanying table.

COMPARISON OF SANDS AVAILABLE FOR CONCRETE

	No. 1—Lake Sand, %	No. 2—Trench Sand, %
On 10-mesh	13 9	5 9
On 20-mesh	21 1	6 3
On 40-mesh	21 7	11 3
On 60-mesh	25 7	20 4
On 80-mesh	8 2	27 7
On 100-mesh	3 0	4 2
Through 100-mesh	6 2	22 7

No. 1 sand was two miles from the mill, was coarse and of a reddish color and seemingly the best. No. 2 sand was half a mile from the mill and was almost pure white. Despite the large proportion of —100-mesh it settled quickly in a glass of water, showing little or no colloidal matter. Test bricks were made from both sands without coarse aggregate, and that made with No. 2 appeared considerably the sounder of the two. It was finally decided to mix them in the proportion of 25% of No. 1 to 75% of No. 2. The resulting concrete was sound in every instance.

All floors were laid after the completion of the building and the installation of the heating system. As this was during January and February, hand mixing inside the building was resorted to. Floors were laid 5 in. thick in the usual proportion and then a surface coat ½ in. thick, of 1 of cement to 2 of screened sand, was floated on.

DATA ON CEMENT USED IN CONCRETE WORK

Total cement used	2,736 bags
Total cost of cement	$2,042.85
Cost per bag	0.74
Bags per yard	6.1
Total cost labor, $4,350.33; material, $2,870.31	$7,220.64
Total yardage including floors	445 cu.yd.
Cost per yard	$16.23

In this total cost of concrete no proportion of office, consulting, or general supervision expense was added and no credit is taken for the lumber rescued from the forms and used later in the building.

Sequence Planning for Rapid Construction

Returning now to the chronological description of the work, Sept. 25 saw the completion of the crusher-station forms and a start on those of the cyanide plant. Concrete pouring began on Oct. 2, and as soon as the crusher station was completed the mixer was shifted down to the next set-up and the forms filled as fast as finished. Form building was completed on Oct. 14 and the concrete on Oct. 15.

On Oct. 2, the same day on which concrete pouring was commenced, the framing of the crusher station was begun with a gang of six carpenters. On Oct. 12 the work of erection was commenced. The design of the building

permitted assembling the various members of the structure into frames or bents. The latter were then hoisted into their proper position with a gin pole and small hoist. On Oct. 20 the frame was up and sheeting had commenced.

The posts under the ore bin and the members of the ore-bin frame are 10x10-in. timbers. All other posts are 8x8-in. Mortise-and-tenon construction is employed throughout except on knee braces and roof trusses. In these the members are halved and bolted. All horizontal splices are ship splices, bolted with four ⅝-in. bolts and tightened with tapered hardwood wedges. All vertical splices are plain halved joints 24 in. long. The main plant consists of three buildings—the tankroom, fine-grinding department and the fine-ore storage bin. The main building, or tankroom, consists of a main span of 62 ft. with a shed addition 18 ft. wide along the western side, making a total width of 80 ft. It is 114 ft. in length. The fine-grinding department is 52 ft. long, with a span of 50 ft. The building has a general "L" shape, with limbs of 114x155 ft.

Working from both ends of the "L" with separate gangs of carpenters, the process of erection went forward rapidly. The completion of the crusher station was held in abeyance and every effort made to finish the cyanide-plant building so that the work of tank erection might be

TABLE 1. CYANIDE-PLANT AND CRUSHER-STATION COSTS

Building	Nature of Work	Labor	Material	Total	Supervision	Insurance	Heating	Total
Crusher station.	Clearing, excavations and foundations	$1,098.56	$1,065.29	$2,163.85				
	Building and erection	1,773.16	1,732.96	3,506.12				
	Machinery and equipment	1,792.24	5,786.73	7,578.97				
	Electrical equipment	65.60	856.68	922.28				
	Heating system	109.77	248.48	358.25				
	Crusher station, total	$4,839.33	$9,690.14	$14,529.47	$1,159.65	$43.52	$311.31	$16,043.95
Cyanide plant	Clearing, excavations and foundations	$6,832.11	$2,297.28	$9,129.39				
	Building and erection	4,624.97	4,815.65	9,440.62				
	Tanks	2,866.56	5,100.00	7,966.56				
	Machinery and equipment	7,316.44	35,287.77	42,604.21				
	Heating system	731.45	2,800.95	3,532.40				
	Electrical equipment	559.09	5,789.03	6,348.12				
	Cyanide plant, total	$22,930.62	$56,090.68	$79,021.30	$3,865.98	$145.07	$1,037.74	$84,070.09
	Combined total	27,769.95	65,780.82	93,550.77	5,025.63	188.59	1,349.05	100,114.04

Labor cost was 33% and material cost 67% of the total. Dividing into classes, the cost of supervision and insurance was 5.1%; clearing excavations and foundations, 11.3%; building and erection, 12.9%; tanks 8%; electrical equipment, 7.3%; heating during construction, 1.3%; heating system 3.9%; machinery and equipment, 50.2%.

TABLE 2. CONSTRUCTION COSTS

Building	Nature of Work	Labor	Material	Total	Supervision	Insurance	Heating	Total
Office	Building, furniture and fixtures	$253.05	$580.75	$833.80				
	Heating system	14.58	43.44	58.02				
	Total				$60.00	$4.85	$69.18	$1,025.85
Storehouse	Building and fixtures	177.98	372.86	550.84				
	Heating system	6.03	20.00	26.03				
	Total				50.00	4.85	69.18	700.90
Transf'rm'r sta.	Building and erection	192.08	367.03	559.11				
	Electrical equipment	171.17	3,508.15	3,679.32				
	Total				250.00	14.51		4,502.94
Lime bin	Building and erection	268.08	176.87	444.95	50.00	4.85		499.80
Water tank	Foundations and substructure	537.12	434.50	971.62				
	Tank and piping	191.60	608.18	799.78	120.00	4.83	34.10	
	Total							1,930.33
Carpenter shop	Building and erection	198.83	355.82	554.65				
	Heating system	25.59	46.03	71.62				
	Total				50.00	4.83	86.97	768.07
Machine shop	Building and erection	259.02	464.91	723.93				
	Equipment	183.27	1,256.33	1,439.60				
	Heating system	53.98	107.37	161.35				
	Total				168.53	4.83	86.97	2,585.21
Power line	Erection and material	420.16	712.00	1,132.16	80.00			1,212.16
Trestle	Erection and material	1,505.52	1,038.17	2,543.69	200.00	4.83		2,748.52
Water line	Excavation and pipe laying	1,414.89	876.69	2,291.58	180.00			2,471.58
Heating plant	Clearing and foundations	222.60	93.81	316.41				
	Building and erection	265.45	358.30	623.75				
	Boiler setting, boiler piping	759.09	1,313.70	2,072.79				
	Total				208.95	4.83	34.09	3,260.82
Combined totals		$7,120.09	$12,734.91	$19,855.00	$1,117.48	$53.21	$380.49	$21,706.18

roof-truss members are 4x8 in., and the roof has a ¼ pitch. Splices in truss members are fishplated, using 3x½-in. iron. Studding and purlins are of 2x6-in. timber on 24-in. centers. The sheeting of 1-in. rough lumber is put on diagonally to increase the stiffness. Floors are of double thickness—a layer of 1-in. boards being overlaid with another of 2-in. rough planks. The cornice is boxed in with ⅞-in. dressed lumber. A carefully made cornice is essential to economical heating, with the winter conditions obtaining in northern Ontario. Roof and walls are first covered with 16-oz. tar felt and then with No. 28 gage corrugated galvanized iron.

Erection work on the cyanide-plant frame was commenced on Oct. 22. The roof truss for the main 62-ft. span was completely framed on the ground and then lifted into position. Each truss weighs 2,200 lb. The main members are 4x10 in., but in all other respects the construction details are similar to those of the crusher station. From a structural point of view the cyanide started. The last roof truss was put in place on Nov. 4, and by Nov. 10, sheeting was finished so that the steel-tank erection could be commenced.

On Nov. 24 ventilators, windows and doors were in place and cornice and corrugated-iron work was completed. The time elapsed since starting on crusher-

TABLE 3. TOTAL CONSTRUCTION COSTS

Month	Direct Labor Cost	Total Cost
July	$165.02	$243.80
August	1,332.06	3,297.33
September	2,217.52	5,470.11
October	5,327.84	11,389.53
November	4,942.72	31,728.66
December	3,695.97	30,139.72
January	5,169.64	19,696.79
February	5,283.05	15,834.11
March	2,789.33	3,098.93
April	358.86	921.24
	$31,282.01	$121,820.22

station forms was 65 days. Time required to erect cyanide-plant and crusher-station buildings on completed foundations was 33 days. The cost of erecting these build-

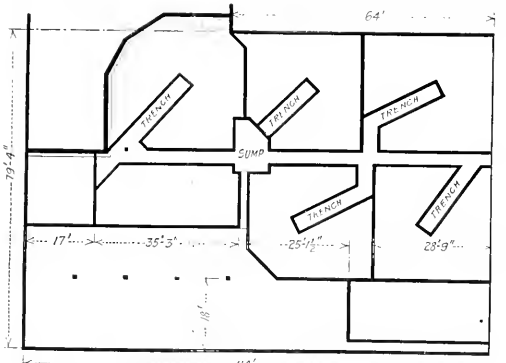
ings is shown on the table of summarized cost of the mill construction, but is repeated here with additional data.

TABLE 4. COST OF BUILDING ERECTION

	Board Measure, Ft.	Labor, $	Material, $	Total, $	Per Cent. Labor in Cost	Volume, Cu.Ft.	Cost per 1,000 Cu.Ft.
Crusher station	45,000	1,773 16	1,732.96	3,506.12	50 5	43,500	$80 00
Cyanide plant	192,000	4,624.97	4,815.65	9,440 62	49 0	257,000	36 00

The great difference in cost is due to the fact that the crusher station has two wooden floors above the basement, the upper one of which has to carry a heavy load. On this account center posts, beams and heavy joists are provided. Also the trussed conveyor bridge and the scalehouse addition (also trussed) are included in the crusher-station cost. As they involve a larger amount of material and labor in proportion to their volume than straight building construction, they have operated to raise the cost per unit of volume. Again, the ore bin comprises a larger proportion of the crusher station than does the ore bin in the cyanide plant.

While the work on the crusher station was just as efficiently done as in the larger buildings, as indicated by labor-material ratio, the figure $80 per 1,000 cu.ft. of volume will hardly have a wide application to other construc-



TANK-FOUNDATION PLAN AT TOUGH-OAKES MILL

tion operations, owing to the peculiar conditions at Tough-Oakes. On the other hand, the figure $36 per 1,000 cu.ft. is one which probably can be used as a basis for estimating on similar construction. The basic prices are: Lumber, $24 per M; galvanized iron, $3.50 per square; carpenters, $3.25 per 9-hr. day. Since labor and material are roughly half and half, any marked variation in either commodity can be easily allowed for in estimating. It is assumed, of course, that the lightest design consistent with strength and rigidity will be employed.

Small buildings cannot be estimated on the same basis as the more pretentious ones, as is shown by Table 5. These buildings are all of the balloon-frame type except the machine shop, which has a light truss of 6x6-in. lumber. Floors are double thickness, and all studs and rafters are 2x6 in. Buildings made of 2x4-in. material are found to depreciate rapidly after the first year.

TABLE 5. COST OF SMALL BUILDINGS

Building	Labor, $	Material, $	Total, $	Per Cent. Labor in Cost	Volume, Cu.Ft.	Cost per 1,000 Cu.Ft.
Transformer station	192 08	367.03	559.11	32	7,800	$72
Machine shop	259 02	404.91	723.93	36	12,500	58
Carpenter shop	198.83	355.82	554.65	35	8,000	69
Heating plant	265.45	358.30	623.75	42	9,800	64
Total	915.38	1,546.06	2,461.44	37	38,100	$65

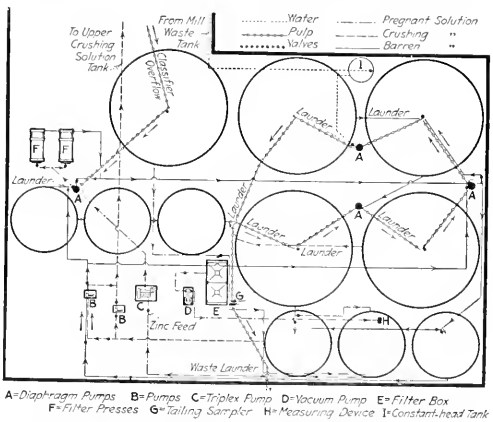
The percentage for labor is in all cases smaller than for the main buildings.

The erection of the steel tanks was begun on Nov. 12. The buildings were closed but not heated, and the weather continued mild. The complete list of tanks is shown in the accompanying table.

LIST OF TANKS IN CYANIDE PLANT

1—30x10-ft. steel tank with overflow ring.
4—28x10-ft. steel tanks with overflow ring.
3—16x12-ft. plain steel tanks.
3—16x10-ft. plain steel tanks.
1—20x10-ft. plain steel tank.

The total number of rivets came to 35,000, and the estimated weights varied from 140,010 lb. to 129,935, with different manufacturers. The price at which the contract was let called for the laying down of the material at Swastika station, 400 mi. north of Toronto at 3.13c. per lb., and erection an additional 1.5c. per lb. In this contract the purchaser was called upon to supply and erect such scaffolding as was necessary, as well as to provide compressed air for pneumatic tools. All tools, forges,



TANK ARRANGEMENT AT THE TOUGH-OAKES MILL

chain-blocks and labor of erection were provided by the contractor.

The complete cost of the tanks erected on the foundations amounted to 5.3c. per lb., made up as follows:

COST OF TANKS ERECTED

Tank material f.o.b. station	$4,390
Cartage to mill site	240
Riveting and erection contract	2,100
Power, labor and material, supplied by the company on erection contract	766
Total	$7,496

The erecting gang at first consisted of the boss erector and three men, using one riveter. It was soon found that progress was too slow and another four men, using another riveter and a calking machine, were added. These men subcontracted a portion of the work at the rate of 1⅛c. per rivet for ⅝ rivets, and 1¼c. per rivet for ½-in. rivets. On this character of work 600 rivets per day for a gang consisting of heater, riveter and bucker-up was found to be good work.

The bottoms of all tanks were calked on the inside and tested with about 4 in. of cold water. All joints are metal to metal, no tar paper or other filler being used. Any leak which showed over 1 drop in 20 sec. had to be remedied before the tank was accepted and lowered into position. The rivets in the side plates and the calking were passed on by inspection, as sufficient water for filling

a tank was not available. The bottom plates of the tank rest on 2x8-in. planks spaced 6 in. apart on packed-earth fill. The work was completed on Jan. 7, a total of 54 working days. A rectangular steel box with hopper bottom for holding clarifying-filter leaves was also erected during this period.

The tabulated construction costs are shown in Tables 1 and 2. Both direct labor and cost by months is shown in Table 3. Actual labor is slightly higher, owing to some distributed charges. Material was charged to mill construction on arrival at mill site. The total cost of the entire mill construction was $121,820.22, against an estimated cost of $124,840. Regular operations began Mar. 15, about two weeks ahead of the construction schedule at first adopted. No mechanical difficulties or other troubles were encountered, and the mill went smoothly into operation.

(To be concluded)

Mining Operations of the Granby Consolidated

For the year ending June 30, 1915, according to the company's annual report only recently published, the shipments from Phœnix and Grand Forks, B.C., amounted to 611,000 tons. The output from the Phœnix mines was curtailed considerably owing to the war. The mining cost was 85c. per ton of ore shipped, which was about 5c. higher per ton than the average for the previous five years. This was due partly to the shutdown last fall and the subsequent starting of operations in the winter, but it also reflects the increasing expense of extraction attending decreasing ore reserves. The reserve tonnage in these mines at the end of the fiscal year amounted to 4,232,405 tons.

From the Hidden Creek mine at Anyox, B. C., the shipments for the year amounted to 477,435 tons. The cost of mining per ton of ore shipped was $1.03. The ore reserve, which assayed 2.2% copper, was, at the end of the year, 9,205,837 tons. There was a further reserve of low-grade copper ore, averaging 0.63% copper, amounting to 8,628,000 tons.

At the Bonanza mine, about two miles up Bonanza Creek, south of the smeltery, nothing was done during the year either in the way of development or in preparation for shipping ore. The ore roughly blocked out by the work previously done on the property, averaging 2.6% copper, amounts to 414,775 tons. There is in addition 489,580 tons of low-grade ore that averages 0.7% copper. The company owns the Mamie and Dean mines on the Kasaan Peninsula of Prince of Wales Island, southeastern Alaska, and has an option to purchase the Ii mine adjoining the Dean. Work was resumed on these properties in April, 1915, after having been discontinued since the beginning of the European War.

Following the characteristics of the known copper mines in this vicinity, these mines are comparatively small. However, the results of the work on them has given sufficient encouragement to warrant the continuation of prospecting for, and seeking the extension and enlargement of, the known orebodies. From these mines there was shipped during the fiscal year 15,000 tons of ore averaging 1.5% copper. The reserve showings are 130,000 tons, with a fair prospect of developing treble this tonnage by future work.

At the Midas mine, Valdez, southwestern Alaska, work was started in April, 1915, to complete the aërial tramway, the mine terminal of this tramway, a few buildings at the mine, and to fill in about the pile foundation of the wharf shipping bins—to prevent destruction by teredos. This work is about completed, and with the little development work that has been done in the mine during the year, this property will be ready to make shipments as soon as arrangements are made for securing power to operate the air compressor.

The Origin of the Bingham Disseminated Ores

In a paper entitled "The Disseminated Copper Ores of Bingham Cañon, Utah," to be presented at the New York meeting of the A. I. M. E., February, 1916, by J. J. Beeson, the conclusions drawn as to the formation of the important sulphides in the disseminated ores are:

Pyrite, chalcopyrite, and probably a minor amount of bornite are the primary copper minerals. The primary sulphides do not occur in these ores as magmatic sulphides, but owe their present distribution to the magnetite which was a magmatic mineral.

Covellite is the most abundant secondary copper mineral, forming by a replacement of chalcopyrite in slightly acid to neutral solutions. Chalcocite is the most important secondary copper mineral, formed under slightly acid to alkaline conditions.

Secondary chalcopyrite may be an indeterminate mineral between pyrite and chalcocite, and bornite may be formed as an indeterminate product between chalcopyrite and chalcocite.

Secondary chalcopyrite and bornite may also be formed by the replacement of the copper in chalcocite, or covellite by the iron of the ferrous sulphate. The concentration of the ferrous sulphate in the descending solution is probably an important factor in secondary enrichment.

Le Pas District in Manitoba

TORONTO CORRESPONDENCE

The Le Pas mineral area in northern Manitoba which has lately attracted some attention is about 74 mi. north of Le Pas, commencing near the Manitoba-Saskatchewan boundary and extending eastward for about 125 mi. toward James Bay, and is about 50 mi. in width. The formation is Huronian, largely conglomerate and Keewatin schist and lies between limestone strata on the south and granite to the north. The deposits contain iron, zinc, copper, lead, gold and silver.

The most noteworthy discoveries have been made in a sulphide area about 25 mi. from Beaver Lake, the western extremity of the belt, where a surface outcrop of 1,000 by 200 ft. has so far been traced, the ores containing in addition to good gold and silver showings, zinc, lead, copper and iron. A large portion of this area has been staked by J. E. Hammill, W. J. Currie, Alexander Fasken and other prospectors. The Beaver Lake Mining Co.'s location is at the extreme west end of the belt, and 50 mi. east of the sulphide area. The Island Lake group of prospects have been located by Sam Otisse and M. J. Hackett. The new Hudson Bay Ry. will run close to the Le Pas mineral belt.

Notes on Shrinkage Stoping

By E. H. Dickenson and H. J. Volker*

SYNOPSIS—Details of methods for mining large deposits whose walls need support other than floor pillars and those whose walls need only floor pillars for support. At these mines under observation where rock was hard, speed of drilling with hammer drills was not equal to piston machines.

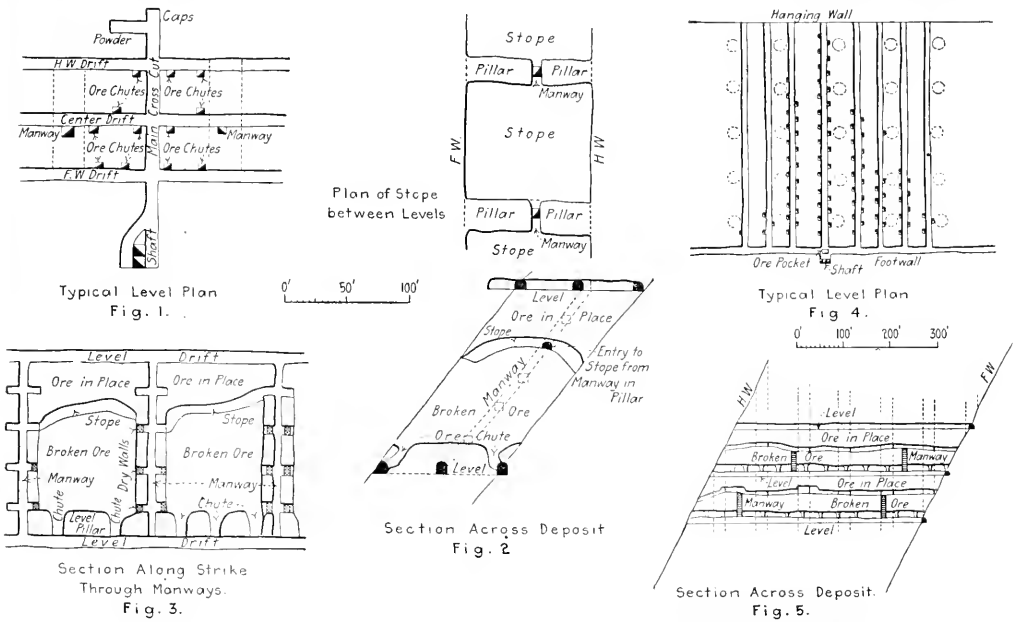
In shrinkage stoping the miner stands on the broken ore, enough of which is left in the stope to keep the back within easy reach of his machine. This means that after work is fairly started, only the excess in volume of broken ore over ore in place is drawn. The unavoidable accumulation of broken ore in the stope is one of the disadvantages of the system. Where the dip is sufficient, however, to permit a ready flow of the broken ore on the foot wall, where the wall rock does not slough off unduly and where the distribution of mineral is such that only negligible quantities of waste are likely to be mixed with the ore, the mining of the orebody may be accomplished by this method. While practically any width of deposit may be so attacked, deposits of the "narrow" vein type are not usually mined by this method, since such veins are often spotty and too high-grade to allow the broken ore to remain idle in the stope with economy. There is no physical reason why the method cannot be used even here. This article, however, has to do mainly with large low-grade deposits.

The dominating feature governing the details of the methods observed is the strength of the wall rock. A fair amount of strength of back is always essential. The haulageways may be run either across or along the orebody, but in each instance they must be close enough together to permit even drawing of the ore.

This discussion is divided into two parts: (A) Mining large deposits whose walls need support other than floor pillars. (B) Mining large deposits whose walls need only floor pillars for support. Only brief mention will be made of other types.

Development of Class A

Such a type may be represented by a deposit 100 ft. wide dipping at 50° and suited, both in grade and distribution of mineral, to be attacked by this method. Figs. 1 and 2 show a suitable arrangement of drifts, ore chutes and crosscuts in which the main haulageways are run parallel to the strike. The ore is drawn from the stopes into three drifts, which feed into a main crosscut and thence to the shaft. Ore chutes are put up about 20 ft. from the floor of the drift and are 15 to 30 ft. apart, depending on the ease with which the ore flows in the stopes. At intervals of 100 ft. along the center drift, raises are put up to the next level at the same inclination as the dip. These are used for manways, steel and timber passes and for ventilation. These manways are in the center of a pillar, rectangular in cross-section, which extends from foot to hanging and continues in



FIGS. 1 TO 5. SHRINKAGE STOPING METHODS FOR LARGE DEPOSITS BETWEEN WALLS NEEDING FLOOR PILLARS AND OTHER MEANS OF SUPPORT

*18 Lorne Apartments, Lorne Crescent, Montreal, P. Q.

depth with the mine workings. These pillars are the distinctive feature of this method of handling shrinkage stoping. They furnish the support needed by the walls and incidentally help support the back. They may be about 25 ft. thick. The manway in the pillar has drifts about 10 ft. long in either direction along the strike at intervals of about 30 ft. vertically. These give the men access to the stope as it ascends. A floor pillar of about 20 ft. is also left at each level. A longitudinal section through the center drift in the plane of the vein is shown in Fig. 3.

Another method of development for a deposit of this type is to carry the manways out through the back of the stope and have no raises in the pillars. This method gives better ventilation, but weakens the back and is usually less safe and convenient.

The distance apart of the levels depends upon many considerations. In one instance 150 ft. was the greatest distance that the vertical pillars would stand without crushing before the stope could be conveniently worked out. Sometimes leaving ore too long in the stope causes oxidation that may interfere with milling. Besides these, there are the more common influences that are discussed in any textbook on the subject. This completes the development of the class A type of deposit.

Development of Class B

This type will be represented by a deposit 500 ft. wide, dipping at 75° and similar to the previous deposit in all else except that its wall rock will stand only when supported by floor pillars. Figs. 4 and 5 show one arrangement of drifts, ore chutes and crosscuts. In this instance the haulageways are mainly across the strike. A hanging-wall drift may connect the crosscuts to facilitate haulage. The ore is drawn from the stopes into the crosscuts, thence to the main drift and ore pocket at the shaft station. The chutes are put up as before, 20 ft. above the floor. Pillars are left 85 ft. apart. They are vertical and cylindrical and center one under the other as the mine deepens, until they find the foot wall. In most of these, manways are put up from level to level with short drifts at intervals, to give access to the stope, but sometimes manways are formed by cribbing one of the ore passes. The latter is a cheaper method, but some manways must be maintained from level to level for ventilation. A floor pillar about 25 ft. thick is left as before. In this case special pillars are left for the support of the back, but only floor pillars support the walls. When such a stope is worked out and drawn, it has the appearance of an enormous colonnade 500 ft. wide and of indefinite length, the stope not having the dividing pillars of the first class.

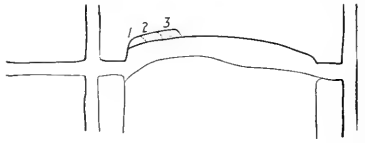
The distance apart of the levels in this case will depend more upon the decision of the mining economist than upon any physical reason, since the determining factor is the interest on the money value of the idle ore versus the cost of extra levels.

The two cases given may be considered briefly as to both wider and narrower deposits. No change occurs in either method as width increases. As width decreases, case A must maintain all its pillars, while as soon as the width is about 75 ft., there is no need of vertical pillars in case B. In narrower veins the floor pillars may disappear in either case, stulls or other timbering furnishing support for the broken ore.

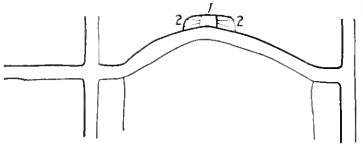
Stoping is started from a short drift either from the top of one of the ore chutes or from the end of the lowest drifts in the manways. This is wall-stoping and is carried on with piston machines. In the first example wall-stoping would be limited to the space outlined by the pillars and walls. In the second example any length could be opened up.

Having enlarged the stope to a suitable size, back-stoping is commenced. The quality of the back will again regulate the details of procedure. Assuming, in case A, a rather treacherous back with horizontal slips, it will be seen that working under overhanging ground would be dangerous. Fig. 6 represents a safe method of procedure. A cut is taken from foot to hanging across the deposit, and piston machines work away from this cut. A more rapid, but not quite so safe, method may be used, as in Fig. 7. The cut in this case is taken across the middle of the stope, and the machines work away in opposite directions. A third method to attack this particular kind of ground is to make a cut across the stope at each end and leave the stope until the intervening slab caves, plugger drills being then used to break it into smaller pieces.

It will be observed that the use of hammer drills is not advisable in a deposit of the peculiarities mentioned,



Side Cut.
Fig. 6.



Center Cut.
Fig. 7.

FIGS. 6 AND 7. METHODS OF BACK-STOPING

for with horizontal slips, vertical or even steeply inclined holes shatter the back and render it unfit to work under.

In class B, let us assume that there are no horizontal slips and that the ore stands well. Back-stoping may go on much less carefully. Any number of circular cuts can be made in the stope and machines work away from these points in circles; or the first two schemes given may be used. The stoper drill may be advantageously used drilling up into the overhanging ground. The drill runner, however, need not always stand directly under the overhang, though his machine may be working there.

The barring or "scaling" down in mines worked by this method is another point of great importance. In cases where the back is bad, it is wise to have the stope boss carefully inspect the stope before permitting the men to enter. In some cases a man is kept barring down all the time, and if the mine is not worked on Sundays, an especially careful inspection is made on that day, extension ladders being used at inaccessible points.

One of the most baffling problems to solve satisfactorily is that of chute gates. In mines of this class large boulders or slabs render the simple arc gate or the common double-sliding boards unsatisfactory.

Finger gates are successfully used in some mines. A bulldozing chute was described in the Oct. 18, 1913, issue of the *Journal*, and a chute using pole lagging for a gate was also recently described therein. All these are to cope with the large boulder problem. Of the three, the finger chute seems the most complicated mechanically. The bulldozing chute described by G. J. Jackson is very ingenious and, though requiring a lot of headroom, time and work to construct, it has but little to get out of order. It would seem, however, that if ore passes were numerous the expense of such a gate would be rather high. The chute of pole lagging is simple and cheap, but when this is used, it is difficult to prevent rushes of ore into the drift after a boulder has passed through. There are other schemes for handling large boulders in chutes, but those mentioned appear to be the most successful.

The foregoing discussion leaves little place for the stoper drill. Piston machines have been used to put up raises, and in one mine at least they are used to put up the ore passes. Piston machines use larger steel, making fewer holes necessary, and they can put in deeper holes. This is not intended to discount the ability of the hammer drill, but in very hard ground—in which most of the foregoing observations were made—the much-lauded speed of the hammer drill does not obtain.

Possible Source of Potash

Following Secretary Lane's instructions to put special effort into its potash investigations, the Geological Survey is publishing the suggestion that a possible source of potash may exist in the tailings piled up at the concentrating mills of the big copper mines in the West. The "porphyry" ores which are being mined by the millions of tons annually contain several times as much potash as copper, and this remains in the tailings at the mills, material already finely ground and in condition for treatment, as well as easily accessible for shipment. This potash, however, is locked up in the form of silicate minerals, and the commercial extraction of potash from silicates has been for several years the subject of earnest study by industrial chemists. If this problem can be solved, it would appear that a large tonnage of potash-bearing material is available in the Western states.

A brief report by the Geological Survey (Bulletin 620-J) contains typical analyses of these "porphyry" ores from the largest copper camps in a half-dozen states, as well as tonnage estimates of the ore reserves and ore already mined and treated. A few check analyses of tailings are also published.

Suggestion of a possible potash reserve in these tailings originated with B. S. Butler, the geologist in charge of the Survey's statistical study of copper, who has based this short paper upon the published analyses of specimens collected by the government geologists in their investigations of the mining districts.

The significant fact regarding this possible source of potash is that in quantity it is more than adequate to meet all the needs of the country as measured by presen consumption.

Plucking the Goose as Town Policy

To the average onlooker, who associates the terms "taxation and representation" somewhat vaguely with the Boston tea party and lets it go at that, there was nothing about the Harrison bill, recently defeated by a determined filibuster in the Minnesota Legislature, to catch his attention or warrant the fight it raised, says *The Survey*, Oct. 16, 1915. It is proposed to restrict tax levies for municipal purposes (exclusive of the support of schools) in towns of the third and fourth class, to $25 per capita. The average per capita rate throughout the state is about one-fifth of that amount.

In the background is a story of absentee ownership with a new problem on its hands, of charges and counter-charges of looting and oppression, in which the United States Steel Corporation and other mine owners appear as plaintiffs, and five towns on the Mesabi Iron Range in Minnesota play the rôle of hold-up men, of specialists in town improvement or of thrifty taxpayers holding rich corporations to proper account—all according to the point of view.

How Do Your Taxes Grow?

In 1914 the average per capita tax for local purposes in 140 Minnesota cities and villages was $5.35. In Duluth, St. Paul and Minneapolis, cities of the first class, the per capita taxes were $11.01, $11.20 and $12.52 respectively. The per capita tax in Hibbing was $85.35. Nor is Hibbing a millionaire colony. It is a mining village of some 10,000 population, the principal industry of which at present seems to be taxgathering.

During the past decade, the taxes have increased 27 times as fast as the population. And the story of Hibbing is in essentials the story also of Chisholm, Buhl, Keewatin and Mountain Iron.

The explanation is simple. The voters levy the taxes. The nonvoting mining corporations own about 98% of the taxable property. Somebody who wanted a new sidewalk or an extra town pump woke up to the possibilities of the situation. Soon the town pockets were bulging with gold, which seemed to burn the traditional holes in them. As the *Mesaba Ore*, of Hibbing, remarked editorially (Mar. 27):

> We should not overlook the opportunity presented to us, and you'll notice we are not overlooking it.

While Hibbing took a leading part, it did not play the game alone. For some years the five towns carried on rival village-improvement bees enlivened by an exhibit of how much open-handed communities can spend when money comes easily.

Hibbing Installs a Great White Way

Before long, Hibbing had more street lights on its "Great White Way" than Cincinnati, a city of 400,000. Eight ornamental lamp-posts, each carrying five incandescent lights, now illumine the principal street intersections. It spent $374,000 for paving in 1914. Its payroll for that year was roughly, $446,000, which provided for a monthly average of 894 men, although there were but 1,318 voters at the last state election. The only state officers that received a larger yearly income last year than Hibbing's treasurer were the governor and the justices of the supreme court.

The expenditure, in a single year (1914) was $1,204,742. Only $620,434 of the warrants issued for this were met with cash, and the outstanding current indebtedness at the end of the year amounted to $1,252,597.

Chisholm, which had 733 voters at the last election, had a monthly average of 538 men on her payroll. An attempt at economy on the part of some of the more timorous members of the council was scathingly dealt with in the *Tribune-Herald* of Mar. 26 last:

> By its action Wednesday the Chisholm council put a crimp in the local baseball team, many of the men that had been given jobs all winter in an effort to keep them here for the coming season being laid off. This is in striking contrast to the action of the Hibbing council, which this year has imported men from the best leagues possible in order that the village of Hibbing might have a first-class ball team.

After a defeat by one of the other towns, the council sought to remedy the error referred to by voting $1,000 to the team.

When a municipal well was sunk in Keewatin, it was a ceremonious occasion. It took five inspectors and a superintendent to supervise the work, in addition to a city engineer. The tax levies had been high for years, but took spectacular jumps in 1913 and 1914. Hibbing's rose gradually from $60,985 in 1904 to $276,490 in 1912, to $753,800 in 1914, and $1,693,933 in 1915. The levy in Mountain Iron for 1913 was 435% greater than the year before.

There was apparently no malice behind these increases —only an awakening to good business opportunities long neglected. And when the mining companies found their protests unavailing and sought legislative protection by the introduction of the Harrison bill previously referred to, indignation rose high in the five towns.

A Sacred Duty to Put On All Possible Taxes

Their main contentions were that they had a perfect right to levy extraordinarily large taxes on the mines, because the mines were exhausting the ore beds and would soon leave the towns with practically no taxable property; second, that the bill was a special-privilege bill fostered by big corporations in the interest of Eastern capitalists to the detriment of local communities; and third, that the expenses of government in mining towns are necessarily higher than in ordinary towns. As the *Mesaba Ore* put it:

> The "Ore" believes that every cent possible should be collected from the mining companies while they are with us, to the end that we may retain unto ourselves a share of the wealth that, once removed, will never return. . . . We do not believe in waste or extravagance in municipal management or anywhere else, but we shall hold that the village of Hibbing should collect every year the one and one-half million dollars due it from the mining companies.

And on Mar. 27 the same paper charged the city councils of the iron range with being

> remiss in their duty to the people of these communities because they do not levy the full amount allowed by law and spend it every year, whether it be extravagance or not. We owe it to ourselves to collect every cent available from the taxation of these mines and use it to beautify our towns because it belongs to us. Hibbing surely receives no thanks for handing over a million dollars a year of its own money to Eastern mine owners, and we will be just as well treated if we collect and spend all that is due us.

The mining companies in reply maintained that the ore deposits will not be exhausted for a long time to come, and such feverish taxation is therefore unnecessary; that if it were true that the ore would soon be exhausted, that fact in itself would be the best kind of a reason why the towns should not expend such vast sums in public improvements, because as soon as the mines were closed most of the population would leave the villages and there would be no one to enjoy the extensive public improvements provided.

The Harrison bill passed the Senate by a vote of 41 to 7, but was defeated in the House by a filibuster which lasted four weeks, although the bill had the support of most of the towns on the eastern end of the range. As the Virginia *Daily Enterprise* of Apr. 12 said, severely:

> If the "Mesaba Ore" (Hibbing) is of the opinion that its town has any considerable portion of the range behind it in the fight on the Harrison per capita tax bill it is mistaken. It has not. Hibbing is now in the position of the small boy who ate all the pie at the party. It has the bellyache and scant sympathy from the erstwhile guests.

Late dispatches state that almost all the mining companies have refused to pay their assessed taxes in Hibbing and will fight collection in the courts.

Basic Principles of Mining Cost*

I shall be able to call your attention to only a few simple matters, the influence of which on the cost of mining is, however, frequently overlooked even by experienced engineers.

The total cost of operating a mine can be divided into at least three independent items—labor, power and supplies. It is important to make this classification for two reasons: First, because the three items do not enter in the same proportions into the cost of operation at all mines; and second, because the variation in the cost for one item, from place to place, may not be in the same ratio as for another of the three items.

Geographical Situation Greatly Influences Costs

In general, the cost of mining in a given locality will vary with the expense and facilities for obtaining labor, power and supplies. Of all the mining regions in North America, I believe that the most favorably situated is found in western Pennsylvania. Between Pittsburgh and Lake Erie is a vast fertile country capable of supporting a large population; food is abundant, climate is excellent, and sociologic conditions are favorable. Hence labor is cheap and, what is of even greater advantage, can be carefully selected with a view to fitness. For power, the immense bituminous-coal fields and the areas yielding both oil and gas are close at hand. Finally, the district is surrounded and dotted with great manufacturing centers, whence mining supplies are available in great variety and at small expense of transportation.

When we seek to compare mining costs in so favorably situated a district with those prevailing in another part of the country—for example, Alaska or the desert parts of Nevada—strict allowance must be made for the changed environment. In both the localities just mentioned, and in many others as well, labor must be imported and it is not so easy to exercise discrimination in its selection. Furthermore, in a remote locality food is often poor and usually expensive and many of the ordinary comforts of civilized life, sometimes even the decencies, are wanting. These hardships must naturally be compensated in the form of higher wages. The cost of power is likewise gener-

*A lecture by J. R. Finlay before a class of mining-engineering students in the Columbia School of Mines, May 4, 1915, and published in the Columbia "School of Mines Quarterly" for April, 1915.

ally higher because of the expense for transportation of fuel. In some favored localities the supply of wood may suffice for a while, and in others hydro-electric power may be available, but the great majority of mines rely upon coal, and in many cases it will be found that the cost of transport exceeds that of mining. Thus coal which sells at Pittsburgh for, say, $1 per ton will cost $2.50 in the Lake Superior district, $4.50 in the Rocky Mountains and $7 or above in more remote districts. The same holds true of supplies, to the original price of which must be added cost of transportation by boat, rail, wagon or mule-back. Since steel and dynamite, the two most used materials, are relatively high-priced, the added cost of transportation is proportionately less than in the case of coal.

Situation Often Settles Payability

As a concrete example of the preceding remarks, let us compare a mine in southeast Missouri with one in Nevada, in both of which districts I have recently been so fortunate as to gain first-hand experience. In both cases we shall estimate that the output is at the rate of 4 tons per man per day. In southeast Missouri labor (at $2.60 per day) costs 65c. per ton of ore mined and milled; power (coal selling at $2.25 per ton) costs 25c. per ton of ore; and supplies cost 15c. per ton of ore; total, $1.05 per ton. Profit on this ore would then be about $1 per ton, out of which to deduct various general and interest charges. At a mine of the same character in Nevada, labor (at $4 per day) would cost $1; power (coal at $6.75 per ton), 75c.; supplies (estimated at 20% higher than in Missouri), 18c.; total, $1.93 per ton of ore, or $0.88 more than in Missouri. If the ore had the same market value, the profit would be only $0.12 as against $1, and this difference would very probably be the deciding factor in determining whether or not to begin operations in the more remote district. In short, the extreme variability of operating conditions at different mines and in different districts must never be overlooked.

It has been said that mining engineers do not know how to figure costs as a contractor would figure them. This is not exactly true, because all successful engineers really do know how to do it, and the wider their knowledge of operating factors the less liable they are to make mistakes. As a rule careless or ignorant computations result in underestimates. An excellent practice is for an engineer to put himself in the position of a contractor, personally responsible, for a loss; cost estimates then cease to be academic questions.

Overhead Must Not Be Disregarded

The most fertile source of mistake in cost estimates is to assume that the data relating to a short period, possibly during a stage of most advantageous operation, are a true average over the whole life of an undertaking. It should be remembered that the cost of an enterprise includes everything that has to be done, from start to finish. To illustrate, suppose a shaft has to be sunk in New York City. If a practical miner were asked how much it would cost, he would first inquire how hard the rock is, and would then figure the cost merely as a job of rock breaking, at so many feet per shift. A contractor, on the other hand, would include in his estimate the necessity for installing hoists, compressors, shops and headgear, entailing maintenance, depreciation and interest on the cost of equipment during the whole period of operation.

In comparing one mine with another, the physical characters of the ore deposits are no less important than their geographical situations, a feature of the problem that is sometimes carelessly overlooked by those who ought to know better, and often purposely disguised by those who have some nefarious purpose in view. How often have we heard promoters calmly assert that a gold-bearing vein in Georgia, for example, could be mined at the same cost per ton as at the Homestake or the Alaska Treadwell?

The importance of careful comparison of geologic conditions was forcibly impressed upon me about three years ago when I had occasion to examine a silver mine in New Mexico, at which the cost of mining and milling was $8 per ton. The mine was controlled by residents of the Lake Superior district, who, reasoning from their immediate experience, thought that the cost ought to be reduced to $3 per ton and wished to be informed why not. The reason is that a silver lode in New Mexico is not like a bed of copper rock or a basin of hematite in the Lake Superior region, and cannot be mined in the same way. Actually, the Camp Bird mine, of Colorado, offers a much clearer analogy, in width of vein, character of mineralization and occurrence of oreshoots, the latter constituting only 25 to 30% of the whole vein and compelling a relatively great amount of exploration and development. The cost of Camp Bird is from $7 to $8 per ton. My Lake Superior friends failed to be impressed by my reasoning and proceeded to capitalize and equip their mine on the assumption of $3 costs; they are now sorry they did so.

While a careless reasoning from analogy may lead to disastrous failure, as in the case just noted, on the other hand, if geologic conditions and working environment at a new locality be reasonably similar to those at an older and established mine, this fact offers a quick and serviceable means of estimating the probable working cost at the mine about to be developed. In fact, a simple comparison, provided that all conditions are closely parallel or provided that allowance is made for divergent conditions, is much more useful and accurate than any amount of independent figuring.

Hamilton Smith's Rule a Wise One

In this connection, it is often possible to make use of certain formulas and standards of comparison that are not so well known as they deserve to be. Hamilton Smith, a distinguished engineer about 30 years ago, suggested the advantage of comparing mines on the basis of yield per unit of stoping area, and gave as his opinion that, with gold ore of good quality, no mine would be profitable which yielded less than $3 per sq.ft. of stoping area, equivalent to $130,000 per acre. Applying this formula recently to a fairly profitable gold mine in Nevada, having a vein 1 ft. thick, of ore averaging $40 per ton, I was interested to observe, allowing 13 cu.ft. per ton, that the yield of that mine was almost exactly $3 per square foot of stoping area. Actual stoping width was about 4 ft., and profits were about 20% of the gross yield.

Smith's factor is important to bear in mind, regardless of other estimates of cost obtained by calculation, comparison or otherwise, especially for checking overestimates of net profits. A mine alleged to yield net profits of 75% of the gross output should be approached cautiously, because such mines are very rare. The Goldfield Consolidated, for example, for considerable periods

yields at the rate of $20 per sq.ft. of the whole area of vein explored—not merely shoot or stoped area; yet the net profits of this mine for the past five years have averaged only 58% of the gross yield, under particularly competent management. On the whole, Smith's rule is a wise one to follow.

Cost Per Ton Often No Criterion

Some people are inclined to attach too much importance to cost per ton, as though this unit possessed some sacred functions. It may often happen that some other unit, as Smith's yield per unit of stoping area, is more serviceable and relevant. Cost per ton is merely the value of the work that has been done on that ton and may bear a very indefinite relation to the profitableness of the operation. As an extreme case, 1 ton of gold worth $600,000 might be mined for $450,000, or 75% of its value, yielding a profit of $150,000. A ton of silver worth $15,000 is mined at Cobalt for $6,000, or at $600 per ton of ore, assuming it to contain 10% silver; yet, rightly considered, this should not be called expensive mining. At Grass Valley, Calif., it costs about $5 to mine and mill 1 ton of ore; at the Michigan copper mines it costs only $1.25; yet applying Smith's unit, we find that the cost per acre of stoping area is nearly alike in these two places—$100,000 at Grass Valley and $70,000 to $120,000 in the copper country. In southeast Missouri the cost is almost exactly $100,000 per acre for mining and milling. We thus see that the really important factor is not how many tons are mined, but how much area must be excavated.

Type of Orebody Influences Cost

Finally, before making comparisons of cost it is important to note the relative difficulties arising from different positions of an orebody; it makes a great difference whether a deposit is horizontal, vertical or inclined. A horizontal deposit is always the cheapest to mine, because when the shaft is sunk there is only one level, one shaft, one pump station. A vertical deposit requires many levels, each exploited separately, each requiring a shaft station and sometimes an independent pump station. Inclined deposits, if not steep enough for broken ore to slide, involve all the disadvantages of a vertical vein, with the added expense of handling ore in stopes.

Your professors have of course discussed the engineering aspects of this matter; I intended only, in conclusion, to emphasize the importance of careful scrutiny before attempting a comparison of working costs.

Anaconda's Community Experiment

One year has elapsed since the Anaconda Copper Mining Co. completed its plan for providing farm homes for its employees. In that time 40 families have established themselves at "Opportunity," the new community six miles east of Anaconda. Eighty children are attending the new Beaver Dam school in Opportunity. Street-car service meeting all shifts has been established, and for a 5c. fare the employees are carried to and from the Washoe Reduction Works at Anaconda.

By way of review it might be mentioned that this enterprise is an outgrowth of the smoke litigation of some years ago. At that time the territory embraced in the new community was practically a swamp. Profitable agriculture was impossible owing to increased wetness of these bottom lands from irrigation of higher lands. Originally the bottom of an old glacial lake, later a beaver-dam bottom where wild duck, muskrats and beaver made their homes, this land in its drier portions was supporting an indifferent agriculture where wire grass and slough grass were the principal crops and the prosecution of smoke claims the main occupation of the landholders.

WHEAT—FIRST CROP AFTER RECLAMATION—1915

BARLEY—FIRST CROP AFTER RECLAMATION—1915

No place in America in the same length of time has had a more revolutionary change take place than that which has been effected in this community—swamp and slough have been replaced by garden and grain field. Land that was so boggy that portions were fenced to prevent loss of livestock from miring is traversed daily by street cars and automobiles, while all over the area comfortable little homes are springing up, the nucleus of a better set of living conditions and a better citizenship.

About 4,000 acres of land has been reclaimed, of which 1,000 has been opened for settlement. This reclamation has been effected by tile drainage in which parallel lines of 12-in. tile have been placed 1,000 ft. apart along the line of greatest slope at a depth of 6 ft. The tough sod was then torn up with specially designed machinery, the peat burned off, and later plowed and disked with traction machinery. The land was laid off in tracts of from 5 to 10 acres, the majority being 10 acres. Every tract has a graded street in the front and an alley in the rear. The land is sold by direct purchase or on a bank-installment plan over a 30-month period and is turned over to the purchaser plowed and ready for crop. An irrigation system has been provided by which water is delivered at the owner's tract. The source of the

irrigation water is the creek flowing through the land, supplemented by the novel arrangement of pumping drainage water from sumps in the drain lines, the power line for pumping plants also supplies power for domestic lighting, pumping and cooking.

Reclaimed swamp land must of necessity be cropped for several years before becoming suitable to seed to permanent hay or meadow crops. The Farms Co., after the first tillage, plows, seeds and harvests the grain crops for the tract owners, charging them the actual cost of these operations. This obviates the necessity of landholders' owning tillage machinery and horses sufficient for the work, which would be impractical on such small areas. As an aid to their building operations, the lumber department of the company provides lumber at cost plus a small handling charge, and several carloads of lumber are kept in stock on the ground.

Many owners whose means are limited have built temporary houses which will be converted into barns or chicken houses when more costly homes can be afforded. In this connection the company has made arrangements

RESIDENCE AT OPPORTUNITY

EXHIBIT AT THE OPPORTUNITY FAIR

whereby land purchasers having their tracts paid for can secure a liberal loan on easy terms to help with their building operations.

Plans looking toward the development of the interest both of the parents and children in their homes and the enterprise are being worked out. A most successful agricultural exhibit and fair was held by Opportunity residents in the school building Oct. 9 and 10. The interest shown by the children was an inspiration and the exhibits a revelation even to the company officers who had shared in this development. Despite a heavy snow and rain, between 500 and 600 persons came to the little fair on Oct. 10. Next year greater things are promised—a school-garden competition for the children, a pig club and a sheep club and a bigger "Opportunity" fair. This year one tract owner showed 23 kinds of vegetables. Cows, pigs, chickens, turkeys, duck, geese and rabbits were shown. The best part of the fair, however, was the interest shown by the children.

Centrally located in the enterprise is a 65-acre park through which a clear, wooded mountain stream flows. The schoolhouse is in the park and the Anaconda Country Club is now building a clubhouse on a tract adjacent to the park, and a golf course has already been laid out.

With the Forty-Niners

The historically important discovery of gold in California was made in January, 1848, at John Sutter's mill on the South Fork of the American River near Coloma, a point only 10 or 15 mi. southeast of the town of Auburn. From 1850 to 1853 the greatest yield was derived from the gravels, and the largest annual output for this period was more than $65,000,000, in 1852. There was some reaction in 1854, due to previous wild speculation, but a production of about $50,000,000 a year, chiefly from placer mines, was maintained up to 1861, according to the United States Geological Survey.

At first the gold was won chiefly from the gravels along the present streams. Those who first got possession of the rich bars on American, Yuba, Feather, and Stanislaus Rivers and some of the smaller streams in the heart of the gold region made at times from $1,000 to $5,000 a day. In 1848 $500 to $700 a day was not unusual luck; but on the other hand, the income of the great majority of miners was far less than that of men who seriously devoted themselves to trade or even to common labor.

The gold pan, the "rocker," the "tom," the sluice, and the hydraulic "giant" or "monitor," named in the order of increasing efficiency, were the tools successively used by the miners. Into the "rocker" and the "tom" the miner shoveled gravel or "dirt," rocking the machine as he poured in water and catching the gold, often with the aid of quicksilver, on riffles set across the bottom of his box. Sometimes a stream was diverted into a flume to lay bare the gravel in its bed so that the miner could get at it. In sluicing, the gravel was shoveled into a similar but much longer box, through which a stream of water was allowed to run. The hydraulic giant was employed to wash into long riffle-set sluices immense quantities of gravel, especially from the higher (Tertiary) deposits, much of which was too lean to work out by hand. Water was brought for many miles in ditches and flumes from the high Sierra and conducted under great head to a nozzle, from which it was projected with tremendous force against the gravel. It was the vast quantity of refuse washed into the streams by these hydraulic operations that brought about the conflict between mining and agricultural interests finally decided in favor of the farmers.

Details of Practical Mining

Table Showing Minimum Grade of Copper Ore and Profits

By Frederick W. Foote

The accompanying table has been found useful in determining the lowest-grade copper ore that can be mined at a profit at any property. If the property is a copper producer only, the total cost of mining, milling, smelting, etc., is plotted on the table as a "deadline" above which no profit can be made. Of course lower grades can be mined with higher prices of copper. This causes the line to be jagged. Below the deadline, successive lines are drawn showing the range of percentages and prices in which the indicated profits are made. If any gold or silver is present, its value is taken from the cost of mining, so

TABLE GIVING PERCENTAGE OF COPPER AND VALUE PER TON OF ORE AT DIFFERENT PRICES *

Cu, %	Lb. per Ton	Value per Ton with Copper at 13c.	14c.	15c.	16c.	Profit per Ton
1.0	20	$2.60	$2.80	$3.00	$3.20	
1.1	22	2.86	3.08	3.30	3.52	
1.2	24	3.12	3.36	3.60	3.84	
1.3	26	3.38	3.64	3.90	4.16	
1.4	28	3.64	3.92	4.20	4.48	
1.5	30	3.90	4.20	4.50	4.80	$0.50
1.6	32	4.16	4.48	4.80	5.12	1.00
1.7	34	4.22	4.76	5.10	5.38	
1.8	36	4.68	5.04	5.40	5.76	1.50
1.9	38	4.94	5.32	5.70	6.08	2.00
2.0	40	5.20	5.60	6.00	6.40	
2.1	42	5.46	5.88	6.30	6.72	2.50
2.2	44	5.72	6.16	6.60	7.04	3.00
2.3	46	5.98	6.44	6.90	7.36	
2.4	48	6.24	6.72	7.20	7.68	
2.5	50	6.50	7.00	7.50	8.00	3.50
2.6	52	6.76	7.28	7.80	8.32	4.00
2.7	54	7.02	7.56	8.10	8.64	etc.
2.8	56	7.28	7.84	8.40	8.96	
2.9	58	7.54	8.12	8.70	9.28	
3.0	60	7.80	8.40	9.00	9.60	
4.0	80	10.40	11.20	12.00	12.80	
5.0	100	13.00	14.00	15.00	16.00	
6.0	120	15.60	16.80	18.00	19.20	
7.0	140	18.20	19.60	21.00	22.40	
8.0	160	20.80	22.40	24.00	25.60	
9.0	180	23.40	25.20	27.00	28.80	
10.0	200	26.00	28.00	30.00	32.00	

* Deadline with assumed production cost of $4 per ton of ore.

that the deadline is raised an amount equal to the aggregate value of the gold and silver. The table given covers the usual range of percentages and prices, but a table of this type can be made to suit the individual requirements of any mine. If preferred, the gold and silver credits can be shown separately, but it seems to me to be simpler to conceive of these credits as being applied to the cost of mining rather than to the ultimate profit.

In a particular case the cost of mining, etc., was $4 per ton. This caused the deadline to be as shown by the double line. If, for instance, $2.50 profit be required per ton and copper is at 15c., then coming along inside of the 2.50 block to the nearest approximation of desired value and going horizontally to the left, it is seen that 2.2% is the minimum ore minable.

An Electric Dragline Excavates 60,000 Yd. in 18 Days

Fast work was done by the operators of a 1¼-yd. electric dragline excavator on the drainage work of the Boise project, under way by the Reclamation Service. The *Reclamation Record* for October publishes the following data furnished by J. L. Burkholder, assistant engineer:

The machine was operated from noon on Aug. 14 continuously to the end of the month, and approximately three-quarters of the length excavated was in hard material which had to be blasted, 600 lb. of dynamite being used during the period. The dirt was moved at an average rate of two buckets per minute, or 2.3 cu.yd. per min. Counting the time actually spent in digging, the rate was 3 yd. per min.

RECORD ON 1¼-YD. ELECTRIC DRAGLINE

Operator	Amount Excavated Lin.Ft.	Cu.Yd.	Average Number of Cubic Yards Excavated Per Hr.	Per Shift
Martin	3,150	22,617.5	185.8	1,256.5
Gibson	2,680	19,787.7	175.9	1,164.0
Wirth	2,080	16,184.3	173.6	1,135.7
Total and average..	7,910	58,589.5	178.9	1,189.6

MACHINE EFFICIENCY

	Hr.	Per Cent.
Digging	327:30	77.2
Mechanical repairs	58:30	13.8
Electrical repairs	24:30	5.8
Moving	12:45	3.0
Blasting	0:45	0.2
Total	424:00	100.0

There were 49¼ shifts. The record run per shift was 1,583 cu.yd.

The Use and Abuse of Fuse

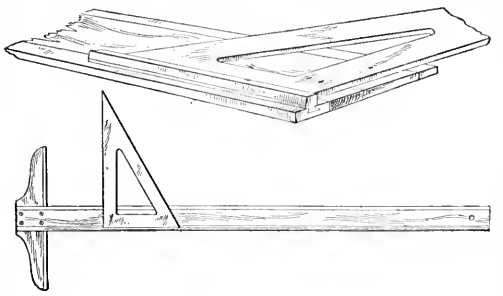
Many miners, acting in good faith but through a misconception of the waterproofing quality of axle grease or crude oil when applied to the outside of a capped fuse so as to make a so-called waterproof joint, start trouble for themselves. Grease and oil are solvents of the fuse varnishes, and when they penetrate the outer covering they destroy the powder train in the fuse with as great, if not greater, rapidity than would the water that the miner is trying to exclude.

When preparing fuse for use, it is common practice to coil it around the arm like coiling up a clothesline. This is bad practice because kinks are liable to occur to break the powder train. When cutting off the fuse care should be exercised to cut square across and not obliquely, which will leave a sharp point at the end of a fuse—not a particularly safe thing to jab into a blasting cap. Furthermore, if the point happens to be soft, as it is likely to be in warm weather, it will bend over or curl up and is liable to cause a misfire. Misfires are more likely to be due to lack of care on the part of the miner making up the primers than to fault in the fuse itself.

When making up primers, do not hesitate to cut an inch of fuse from the end of the coil. In doing this the damp ends will be prevented from getting into the detonating cap. Fuse that has been hammered or injured by falling ground, or damaged from any other source, should never be used. Any change in the covering of the fuse will either increase the burning rate or have the opposite effect and cause a misfire.

T-Square for Inking Over Fresh Lines

A T-square with three working edges on the bar has recently been patented by E. R. Ruehle & Co., 119 Fulton St., New York City. The third edge is furnished by a stop along the bar. By means of this addition the draftsman's triangle can be slid along the board, but held clear of the tracing, so that additional ink lines can be placed on a drawing without waiting for any fresh lines beneath to dry.



T-SQUARE FOR INKING OVER FRESH LINES

Diameter of Sheaves for Hoisting Rope*

The figures take care of the variables of depth of shaft, hoisting speed and acceleration stresses. The question of bending stresses is not considered. The bending stress of course increases as the diameter of the sheave or drum decreases. It could be kept from becoming too great by specifying minimum permissible ratios between sheave and rope diameters. The increase in stress caused by running a rope over too small a sheave is unimportant compared with the resulting increase in rope wear, and considerations of economy can be trusted to prevent the use of sheaves and drums too small for the ropes.

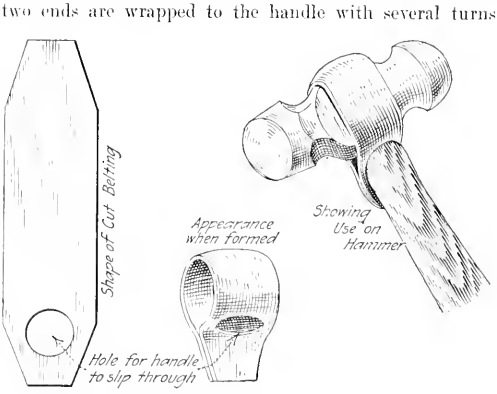
The economical ratio between rope and sheave diameters varies with the character of the wire in the rope and the type of construction. A pliable rope can run economically and safely over a smaller sheave than can a stiffer rope. The committee has reports of excellent results from the use of a 1¼-in. rope over an 84-in. sheave, which gives a ratio of 66, whereas in many cases, especially in the case of deep shafts and long ropes which usually are of necessity stiffer, a ratio of 100 has been recognized as not too high.

In connection with the question of sheave diameters, one point should be noted, namely, that it is possible to make the ratio too high under certain conditions, or more correctly stated, it is possible to make the sheave too heavy. This is the case frequently with turn-sheaves, guide pulleys, rollers, etc., on which the arc of contact and the compression between sheave and rope may be so little as to allow excessive slip, the rope failing to rotate the sheave easily. Of course such a condition would cause wear and tend to deteriorate the rope faster than would the use of a smaller, lighter sheave. To decide on a suitable size of sheave under such conditions the following rule is serviceable: Suppose that a ratio between sheave and rope diameters of 72 is considered permissible. Then when the deflection angle of the rope is less than 90°, that is, when it has less than 90° of contact arc on the sheave, the diameter of the sheave shall be eight-tenths of the deflection angle times the diameter of the rope. Thus as the deflection angle or arc of contact becomes less, the size of the sheave decreases. For a 45°-deflection angle a 3-ft. sheave is required for a 1-in. rope, and for zero degree no sheave is required, a rubbing board alone being sufficient.

*Abstract from "Rules and Regulations for Metal Mines," by Ingalls, Douglas, Finlay, Channing and Hammond; Bulletin 75, United States Geological Survey.

A Handy Soft Hammer*

A way in which to make an ordinary engineer's hammer serve in place of a mallet or wooden hammer for use on wood or other soft materials consists in using a piece of leather or belting in the manner shown in the drawing. A hole is cut in the leather large enough to be slipped over the handle of the hammer and then brought to the head of the hammer. The flap is then brought over the head of the hammer and nailed on to the handle, or the two ends are wrapped to the handle with several turns of fine wire. The hammer is used sidewise on wood, which brings the leather belting into play and softens the blow. In this way the user has a hammer ready for various uses in a very compact and convenient form. The leather will wear for a remarkably long time.



ENGINEER'S HAMMER WITH LEATHER CUSHIONING

*A. P. Connor, Washington, D. C., in "American Machinist."

P. & B. Paint for Spitting Fuses

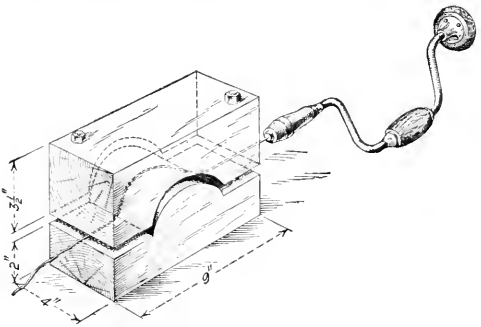
Many expedients are resorted to in order to insure the ignition of the powder train in fuse. Splitting the end of the fuse and inserting a pinch of dynamite or powder or a piece of candle wicking, and securing a stub of a candle to the end are schemes familiar to most miners, but

perhaps one of the best methods is that in use at the United Verde mines at Jerome, Ariz.

There the fuses, after being cut to the desired length, are dipped into P. & B. paint; one end only. The bunches of fuses are then laid up to allow the paint to harden. On application of a flame the ignition of the paint is instantaneous and is sure to fire the powder train. The paint will not drop off, as so frequently happens when using other attached means to fire the fuse, and the method has still another advantage in that the paint is waterproof and effectually guards the powder train from moisture, from the time the fuse is cut until it is set afire.

A Handy Wire Straightener*

One is sometimes confronted with the apparently hopeless task of straightening an old, crooked, kinked wire. To many this is no easy job, but to those that become



WIRE STRAIGHTENER IN OPERATION

familiar with the straightener here described the problem will be a comparatively simple one.

To make this straightener first procure two blocks of hardwood, each about 3½x4x9 in. Cut the two ends of one piece down from 3½ in. to 2 in. in thickness for a distance of 2½ in. from each end. This will leave a rectangular projection in the center of the piece. Round the two ends of this projection off as shown in the accompanying illustration. Now from the other block and on a 4x9-in. face cut out a concave depression to fit over the curved surface of the other block. Now, placing the two blocks together, bore two holes, one in each end and in opposite corners, as shown in the diagram.

By means of two bolts clamp the two blocks onto the wire to be straightened, near one end. Fastening a brace or something similar to the short end, turn the wire, drawing it through the block at the same time. The result will be a straight wire. This device will straighten a wire of any diameter.

Utilization of Peat Powder†

If peat that has been taken from the bog and allowed to disintegrate by lying on the surface of the bog during the winter be gathered, dried artificially and pulverized, a dark-colored nonabsorbent powder will result. The name "peat powder" has been applied to this product. It may be used in very much the same way that sawdust and powdered coal have been used.

When this powder is burned in specially constructed burners using a blast of air, it acts very much like a gas, on account of the intimate mixture that may be obtained, of powdered peat and air. The air supply can be regulated so as to approach that theoretically required for perfect combustion, and complete smokeless combustion results. The temperature of the flame is easily regulated, and temperatures sufficiently great for melting brass, iron and steel, and for other metallurgical operations, can be obtained.

Feeding Mine Animals

The one thing about a mine of which the superintendent knows less than any other is the proper care of livestock. Sometimes the entire mining proposition is dependent upon this livestock, and in many cases where no such vital importance attaches, great inconveniences and unusual expenses are caused by failure of the stock at some critical time. Furthermore, stock is expensive and forage is almost always unusually so in mining camps. Wasteful feeding is almost universal because it is generally left to some mule-skinner, who, if he has any idea of stock at all, has a very exaggerated idea of his own knowledge of the same.

The proper daily allowance of forage for a horse is 12 lb. of grain and 14 lb. of hay. If a horse weighs over 1,300 lb., however, he should be fed 14 lb. of grain and 17 lb. of hay per day. For a mule 9 lb. of grain and 14 lb. of hay should be allowed.

These allowances are prescribed for United States Army animals, but it is not deemed necessary to feed all animals the full allowance of grain. Each animal should be watched while eating and should be fed accordingly, except that the full allowance of hay should always be fed; if it is of good quality and the animal is in good condition, it will always be eaten. Grain should never be fed to animals when they are tired, hot or excited. If an animal continually fails to eat all of his allowance of grain, it should be cut down unless he shows signs of losing flesh; in that case he should be carefully watched and his mouth examined for lampas, and if he is found to be suffering from that cause, his grain should be soaked in warm water until soft. When changing grain, as from oats to barley or corn, cut down the portion of forage allowance, returning gradually to full feed in about five days. During this period more hay should be fed.

All animals need salt. The Army allowance provides for 2 oz. per week per animal, which is sufficient to allow a handful to each animal every 10 days. It is better, however, to feed salt a certain day each week.

Grain should always be fed before feeding hay. A mule will eat musty grain and hay, but a horse will not, and care should be exercised not to feed musty forage to either.

Mules give an indication that they are very tired when they fail to flap their ears while pulling a load. It may be relied upon that mules pulling a load and constantly flopping their ears, are in good condition.

Proper grooming of the animals every day will do much to keep them in condition and increase their pulling capacity.

*W. C. Eyl, University of Kentucky, Lexington, Ky., in "Coal Age," Nov. 6, 1915.

†Excerpts from Bulletin 45, "Peat Resources of Wisconsin," Wisconsin Geological and Natural History Survey, Madison, Wis., 1915.

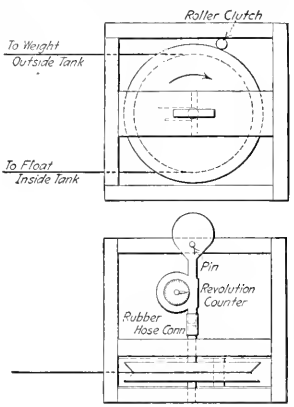
Details of Milling and Smelting

The Shapley Solution Meter

By Cooper Shapley*

In zinc-dust precipitation it is customary to use two gold sump tanks, one filling while the other is discharging. For measuring solutions under these conditions a meter must be used on each tank. The accompanying drawing shows one that is easy to make and has advantages of simplicity and accuracy.

Over the grooved wheel passes a light cord (fishline) to which a float is attached at one end and a light weight at the other. To the axle of this wheel is attached a revolution counter which registers the number of turns. The grooved wheel can move only in the direction of the arrow because of the roller clutch, which tends to wedge itself between the upright and the wheel when it tries to revolve in the reverse direction. When the solution in the tank is rising, the cord slips over the wheel and nothing is registered on the counter, but as soon as the level of the solution begins to fall, the wheel is turned in the direction of the arrow and the revolutions are registered. Each revolution represents so many tons of solution. It is an easy matter to calibrate the instrument, and as revolution counters usually register up to 5,000, it can be run for a month or several months at a time. In my case the wheel is 7½ in. in diameter and each revolution means 11.63 tons of solution. The float should be protected from ripples, since the slight up-and-down motion will cause the instrument to register too high.



SKETCH OF SOLUTION METER

*Mining engineer, Buckhorn Mines Co., Buckhorn, Nev.

Dolomite and Slag Furnace Lining

Owing to the present scarcity of magnesite brick, it may be of interest to some of the nonferrous metallurgists to try experimenting with a furnace lining recently patented by Albert P. Meyer (U. S. Pat. 1,160,085, assigned to the A. S. Davison Co., Pittsburgh, Penn.).

This consists of a uniform and intimate mixture of granules of basic slag and dolomitic lime, usually about 90 parts of lime and 10 parts of slag. Preferably a hard, compact, dense variety of dolomitic limestone should be used, and preferably those varieties high in magnesia. The limestone should be burnt to a degree sufficient to afford a sintered, clinkered or semi-fused mass, the material being thus prepared under conditions analogous to those of cement-clinker making, but with a higher finishing temperature; that is, around 2,800° F. The crude sintered granules of this lime are then mixed with granulated basic slag, in which state the material is either stored or shipped until wanted for use.

Effect of Sulphur Dioxide on Human Beings*

A careful consideration of all of the data concerning the occurrence of sulphur dioxide in the atmosphere in the Selby smoke zone and other places establishes the conclusion that the Selby smeltery, by the emission into the atmosphere of sulphur dioxide from its plant, does not maintain a nuisance in the southern portion of Solano County, California, as referred to an objectionable odor or disturbing physiological effects upon the mucous-membrane linings of the throat and lungs of human beings and domestic animals.

In order to determine the extent to which the invisible part of the Selby smoke may become a nuisance through the physiological effect its content of sulphur dioxide exerts upon man by disturbance of the normal functioning of the respiratory organs or disagreeably affecting the olfactory organs, the commission undertook an investigation to determine the sensitiveness of various persons to sulphur dioxide. It has already been shown that sulphur dioxide is the only gas discharged into the atmosphere through the stacks of the Selby smeltery that has an odor or can possibly be present in sufficient amount to produce any effect upon the throat and lungs when it is diluted by the air into which the smoke is discharged.

In the conduct of this investigation 60 subjects were experimented with. Some of them were observed through more than one experiment, so that a total of 85 experiments were recorded. Thirty-two of the subjects were persons thoroughly familiar with the odor and general characteristics of sulphur dioxide, and 28 were only sufficiently familiar with the gas to be able to identify it as "like sulphur matches when they burn," or by some similar method of comparison. Those thoroughly familiar with the gas were technically trained men or men that had worked in plants where sulphur dioxide is generated or is used; they were for the most part chemists, engineers and smelters. Those who were unfamiliar with the gas were the average intelligent citizens, sometimes capable of accurate description of the sensations they experienced under the tests and sometimes not; they knew the gas only as something that had a "sulphur smell."

Sulphur dioxide (SO_2) is a colorless gas of characteristic pungent odor and acid taste. It is 2.21 times as heavy as air, but mixes readily with it in all proportions

*Excerpt from "Report of the Selby Smelter Commission," Bull. 98, United States Bureau of Mines.

and once mixed does not, contrary to popular belief, again separate. In its concentrated form it produces marked physiological disturbances in all animal and vegetable organisms with which it comes in contact. It dissolves to a limited extent in water and has the property of combining with oxygen under proper conditions to form sulphur trioxide (SO_3). Sulphur trioxide combines very readily with water to form sulphuric acid.

Of those subjects who were acquainted with the gas and were trained to observe and report their observations correctly, none could detect the presence of the gas when it was breathed in concentrations of one part SO_2 per million parts of air. When the concentration reached two parts SO_2 per million, 13 of these subjects suspected the presence of something foreign in the air being breathed, but could not identify the substance, while two of the 32 thought they could identify the presence of the gas by their sense of taste, although they could not smell it. With three parts SO_2 per million in the atmosphere they were breathing, 26 of the subjects identified an acid gas as being present and six could detect nothing other than a foreign substance in the atmosphere. Of the 26 who could detect an acid gas, 21 identified it with more or less positiveness as sulphur dioxide, while five were doubtful of its identity. At four parts SO_2 per million parts of air, all but two of the 32 subjects were able to detect and positively identify the gas as sulphur dioxide. The two exceptions were men who had become more or less immune to the action of the gas from working in smelteries where the concentration is at times very high. At five parts SO_2 per million parts of air, all subjects but one, who was especially insensitive, were able to detect the gas. At eight parts SO_2 per million, all subjects except the same one could identify the gas as sulphur dioxide.

This would seem to indicate that persons who are thoroughly acquainted with the properties of sulphur dioxide, through study of, or experience with, the gas itself, can usually detect its presence in the atmosphere and identify the gas either by the sense of taste or smell when its concentration is about four parts per million or more. Approximately three-fourths of such persons are able to detect and identify the gas when its concentration is three parts per million, while about 40 per cent. are conscious that a foreign substance is in the atmosphere when the concentration is two parts SO_2 per million or more. In concentrations of less than two parts SO_2 per million, even persons thoroughly familiar with the properties of sulphur dioxide are unable to detect the presence of any foreign substance either by the sense of smell or the sense of taste.

Of those subjects who were unacquainted with the properties of sulphur dioxide, none could detect anything in an atmosphere containing one part SO_2 per million parts of air. This agrees with the observations of the "trained" subjects. At a concentration of two parts SO_2 per million, two of these persons detected a foreign smell in the atmosphere they were breathing but could not describe it. With three parts SO_2 per million, four subjects "smelled something" and six smelled "burning sulphur," while 18 "didn't smell anything." When the atmosphere contained four parts SO_2 per million, 10 of the "untrained" subjects smelled "burning sulphur," four "smelled something," and 14 did not note any sensation different from that experienced in breathing the ordinary air. With a concentration of five parts SO_2 per million, all of the "untrained" subjects except six "smelled something" or "smelled burning sulphur." At 12 parts SO_2 per million, all of the subjects could identify the gas as that of burning sulphur.

This would seem to indicate that the average citizen, not technically trained, can usually detect the presence of sulphur dioxide in the atmosphere and can identify it either by sense of taste or smell when its concentration is five parts SO_2 per million parts of air or more. One-half of such persons are able to detect the presence of the gas and some of them can identify it, when the atmosphere contains four parts SO_2 per million. When the atmosphere contains three parts SO_2 per million, 65 per cent. of the average citizens fail to record any unusual sensations when breathing it, whereas only 217 persons in every thousand would experience the feeling of breathing an atmosphere contaminated with "smell of burning sulphur." When the concentration is two parts SO_2 per million, only the most sensitive, 71 in every thousand, can detect a foreign odor; and below that concentration none can detect any foreign odor whatever.

Consideration of the data from all points of view indicates that a proper conclusion will be drawn from this investigation if it is stated that the average citizen is conscious of pollution of the atmosphere by sulphur dioxide when its concentration is approximately 3.5 parts per million parts of air; and the "trained" person is conscious of such pollution when the concentration is approximately 2.5 parts SO_2 per million parts of air.

In order to positively establish the minimum concentration of sulphur dioxide that would be considered a nuisance to all persons, it would be necessary to experiment with a much larger number of subjects. The time at the disposal of the commission did not permit of this. It was found as a result of the work done in this direction that the elements of psychology and personal idiosyncrasy entered into the matter to a great extent. The symptoms recorded by the various subjects, both "trained" and "untrained," were very dissimilar. No agreement was found between the ideas expressed as to what concentration was a nuisance. Without exception, however, all subjects considered that the point of concentration at which they could just detect a foreign substance or at which they were just conscious that there was something foreign in the atmosphere, was not a nuisance.

The commission is of the opinion, therefore, that in order that the smoke from the Selby smeltery shall produce a nuisance in the smoke zone, sulphur dioxide must be discharged from the smeltery in such an amount that as the smoke blows over the smoke zone, the concentration of sulphur dioxide in the atmosphere of the smoke zone must be three parts per million or more. This figure is the mean of those recorded from the "trained" and "untrained" subjects and refers solely to a nuisance brought about by the presence of a disagreeable or offensive odor. The difference between trained and untrained observers in susceptibility to the gas is extremely interesting.

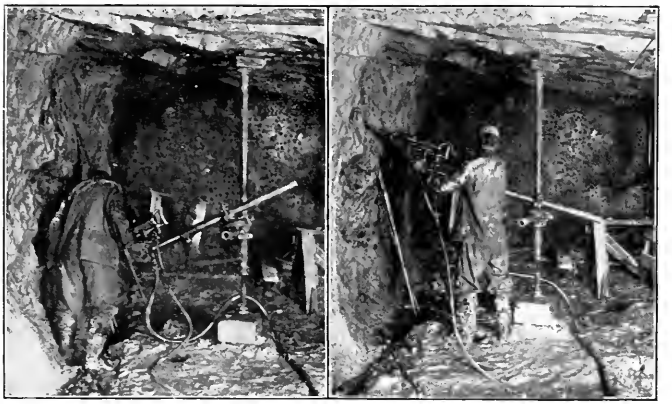
At the Mill of the Bunker Hill & Sullivan Mining and Concentrating Co., at Kellogg, Idaho, an Ottumwa box-car loader is used in an original way. The coarse jig concentrates are shipped in box cars, and it is found convenient to deliver them through a chute to the box-car loader, which expeditiously and satisfactorily loads them into the cars. The method is said to be very much quicker and cheaper than hand labor, and no fault is found with it.

Mining & Metallurgical Machinery

Sullivan Air-Feed Drifter

The Sullivan Machinery Co. is putting on the market an air-feed drifter that combines the advantages of the elimination of one man from the drilling crew, the introduction of hammer drills, the employment of a water jet, and the air feed, which eliminates the feed screw and shell of the old piston type.

The pneumatic feed mounting consists of a saddle on the outside end of a short arm attached at right angles to a piston rod 24 in. long. The rear end of this rod terminates in a piston that runs in a feed cylinder; the



SULLIVAN AIR-FEED DRIFTER AT WORK

combination being similar to that employed in reverse-feed stoping drills. The feed cylinder is clamped at any point desired in a hinged trunnion cradle that can be quickly loosened or tightened by means of one nut. The arm that supports the drill contains an air inlet with swivel elbow and a throttle valve by means of which air is admitted to both the drill and the pneumatic feed. This throttle has several definite positions, in each of which a different effect is secured. In one position of the throttle the drill and steel are carried forward against the rock by air admitted only through the rear end of the piston; in a second position the drill is started running; two other successive positions of the throttle bring the drill up to full speed; and in still another position air is exhausted from the rear of the feed cylinder and admitted to the front side of the piston head, thus carrying the drill and steel back out of the hole and away from their work. By simply turning the throttle the operator may thus throw the drill forward or back with perfect ease and in a remarkably short time. The advantages of such a device over the crank and feed-screw type are obvious. With this air feed, drill steel can be changed in as little as 30 sec., there being no chuck bolts to loosen and retighten, and steels of uniform length in sets are not necessary.

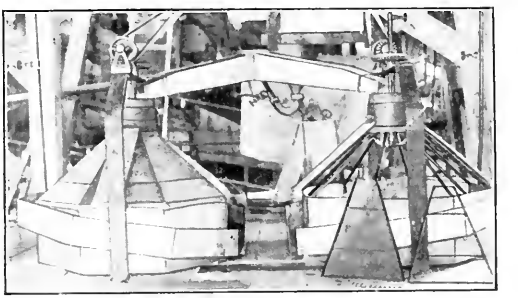
Should the drill steel show a tendency to stick while running, the operator, by setting a hand-brake on the throttle that throws on the reverse feed, can back the drill out of the difficulty with the hammer still running and the steel rotating. By simply turning the throttle valve, the drill may be made to alternately cut forward and retract itself, thus keeping the steel free and the hole round until the difficulty is passed.

With this drilling outfit, steels of a uniform length are not necessary.

The standard column for the air-feed drifter is 2½ in. in diameter, and arms can be used on this column up to 36 in. in length, so that it is entirely possible and practicable to drill a face 8 ft. high by 7 ft. wide, from one setting of the column.

The Wood Screening Machine

Machines for screen-sizing mill pulps have been in use for years, but the number of new ones that continue to appear indicates some difficulty in finding a perfect one. The device illustrated here is one designed to avoid, as far as possible, the inconveniences of the ordinary screening machines. It was designed by J. C. Wood, superintendent of the Hecla mill, near Wallace, Idaho, and is in use in that



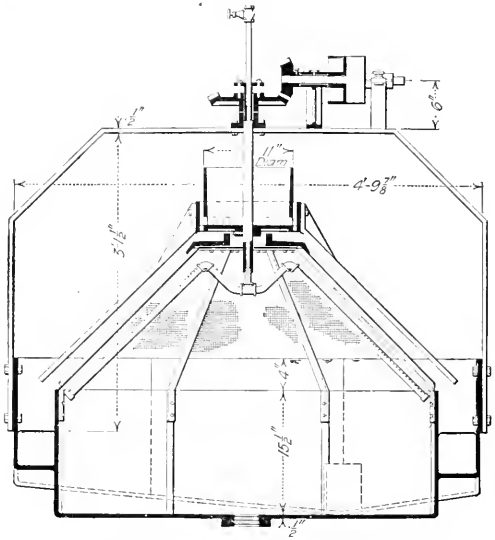
WOOD SCREENS, WITH FRAMES AND WITHOUT

plant. Mr. Wood has protected his machine by United States patent.

The Wood screen is in shape an octagonal cone, the eight sides of which are formed by steel frames carrying screen cloth of the desired mesh. Pulp for screening is delivered to the outside of the screens through an annular feeding box at the top of the machine, the undersize passing through the screen into a receptacle underneath, and the oversize sliding down over the screen surface into a launder at the base of the machine.

Revolving with the feeding box are two perforated pipes inside the screen, their function being to prevent blocking the screen apertures by delivering water under pressure against it. Outside the screen, directly opposite the perforated pipes and revolving with them, are two flat baffles, designed to avoid scattering or splashing the pulp.

The standard machine is made 4 ft. wide at the base and contains 24 sq.ft. of available screening surface. With



THE WOOD SCREENING MACHINE

16-mesh screen fitted to it, the machine is said to separate 80 tons of pulp per day of 24 hr., most of which is undersize. The accompanying drawing and photograph will give a clear idea of the construction of the device.

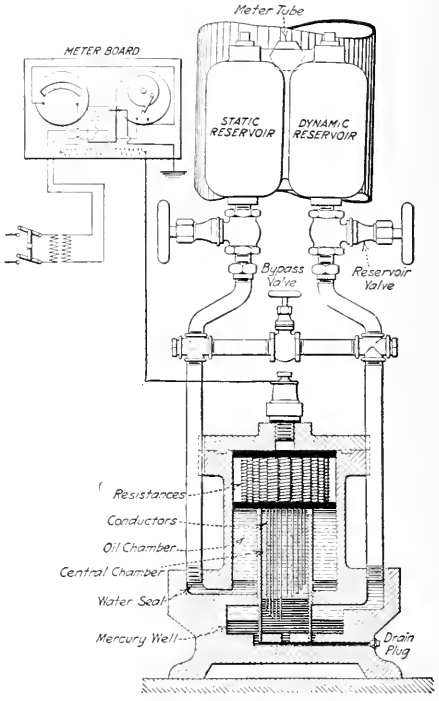
The Republic Flow Meter

The Republic flow meter has been developed recently to such an extent that in measuring steam, water, air or gas, it compares in accuracy and convenience with the standard wattmeter or ammeter. The principle is that of a U-tube containing mercury.

Contact wires of graded lengths are suspended over the mercury in the central chamber, each wire being connected to a resistance immediately above. A circuit is formed of the resistances, contact wires, mercury and ground, a current of given voltage usually 38 volts, being applied. All the resistances are in series with one another, and as the mercury rises as a result of the application of pressure on the surface of the mercury in the large chamber, a number of resistances are short-circuited. A definite quantity of current now flows through the circuit, actuating the indicating, recording or integrating instruments.

The resistances are of such magnitude that the quantity of current flowing at any time is a direct function of the velocity of the fluid flowing in the pipe, and therefore also of the quantity of fluid. The pointer of the indicating instrument moves equal distances for equal increments of velocity of flow.

The form of pitot tube used is a departure. It consists of two tubes extending completely across the pipe, impact holes being provided in one tube at the proper intervals. Each hole is located in the center of an annular ring, the cross-section of the pipe being divided into half as many equal-area annular rings as there are holes. The other tube is the aspiration tube and is identical with the impact tube. These tubes are placed back to back and are inserted in the pipe so that the impact holes will point upstream and the aspiration holes downstream. It has been found by actual experiment that



SECTION THROUGH REPUBLIC FLOW METER

this arrangement of impact holes results in the true mean of the velocities existing in the pipe.

The upstream side of the pitot tube is connected to the dynamic side of the mercury well, and the aspiration tube is connected to the other side of the mercury well. This results in the mercury being elevated in the central chamber to a height proportional to the square of the velocity of fluid in the pipe. The illustration shows that water is not permitted to touch the resistances or the contact wires, because of the oil seal.

A new feature is the micrometer adjustment for raising or lowering the resistance spool from the outside. In establishing the zero point the bypass valve is opened and the height of the contact wires is adjusted until the reading instruments show that no current is flowing.

Any combination of indicating, recording or integrating instruments may be connected to this meter. The Republic Flow Meters Co., of Chicago, is the maker.—*Power.*

Correspondence and Discussion

Concentration Formulas

I have read J. E. Clennell's short article under the heading, "Concentration Formulas," in the *Journal* of Oct. 30. In spite of the growing use of formulas I prefer simple arithmetic where it can be applied, as a formula, concealing its reactions, obscures the whole operation, however correct its results may be. This applies to mine-valuation formulas as well as those for metallurgical operations. The plain arithmetical solution, something on the line of blast-furnace balance sheets, which follows is preferable to the use of Clennell's formula. I respect his data and adopt his assumption that the assay value of the tailings and the concentrates will not be affected by clearing the middlings.

DATA OF CONCENTRATION TESTS

Product	Weight, per Cent.	Assay of Products per Ton, Gold, Oz.	Per Cent. of Total Gold
Concentrates	12.45	6.53	90.8
Middlings	11.45	0.35	4.5
Tailings	70.10	0.055	4.7

The head assay showed gold, 0.895 oz. per ton.

It is desired to find the effects of eliminating the middlings in this statement without actually performing the operation.

Let us assume that we have 100 tons of ore assaying 0.895 oz., which gives us 89.5 oz. of gold in the ore. In the concentrates we have $12.45 \times 6.53 = 81.29$ oz. The middlings will add to this $11.45 \times (0.35 - 0.055) = 3.37$, making a total extraction in concentrates of 84.66 oz. The percentage of extraction is $84.66 \div 89.5 = 94.6$. The former extraction in concentrates was 90.8%, making an increase of 3.8%, which will increase the weight of concentrates proportionately.

DATA ON CONCENTRATION AFTER ELIMINATING MIDDLINGS

	Weight, per Cent.	Per Cent. of Total Gold
Concentrates, 12.45×1.038 =	12.92	94.6
The tailings by difference =	87.08	5.4

Clennell's formulas require one addition, six subtractions, eight multiplications and five divisions. The plain arithmetical method requires only two additions, three subtractions, two multiplications and one division. Efficiency experts would therefore indorse the latter method, which has the added advantage of being clear and easily understood. LOUIS JANIN, JR.

San Francisco, Calif., Nov. 3, 1915.

Physical Control of Employees

The article in the *Journal* of Nov. 6, taken from the "Safety First Magazine" of the Nevada Consolidated Co., is somewhat misleading, in that it gives only one viewpoint. The company's orders of compulsory physical examination caused much dissatisfaction among its employees.

The age limit was placed at 44 years and the examination was so severe that one-half to two-thirds could not pass it satisfactorily. The employees felt that it was only a question of time when the older men and physical incompetents would be gradually weeded out. The company's physicians were unfeeling and arrogant, the men were made to strip, and the examination created much opposition and ill-feeling, the general public, without exception, being in sympathy with the men. The result was that finally the employees gave notice that unless these orders of compulsory physical examination were withdrawn, they would all walk out on Oct. 31, 1915. The company then withdrew the orders, evidently not desiring a strike with copper around 18c.

If this was generally adopted by all the large companies, the men and general public cannot see what would become of one-half or more of the laborers. Would the state take care of them? Is not a skilled workman a better man, past 40, than when 20 to 30 years old? Has he not better judgment, from experience? MINER.

Ely, Nev., Nov. 11, 1915.

Cost of Winter Construction

In the *Journal* of Oct. 2, H. Colin Campbell has taken exception to some of my recommendations under the heading, "Difficulties of Winter Construction."

Mr. Campbell's recommendations should be seriously considered where large masses of concrete are used, but they are hardly applicable to the class of work under consideration. On large concrete jobs of any kind conditions are more favorable than on the small one; they can be made so by virtue of size. The ultimate strength must be more nearly known in order to cut down the mass to a minimum. A smooth clean-cut surface might count for considerable, but in a small mill a little efflorescence is a matter of small moment. Heating the aggregate and mixing water would probably be the cheaper method with a large yardage of concrete, even at the expense of a special heating installation. The increased cost of concrete under these conditions would not reach 50%.

Unfavorable conditions, however, are the rule and not the exception for the average small mill constructed during the cold months in the north. Heavy snows and extreme cold weather, being conceded, make the obtaining of material a difficult task. The average small mill that, as a rule, the operating engineer will be called upon to construct does not require a large yardage of concrete, and very often it is not an easy matter to arrange for heating. Midwinter construction is safe and feasible as long as the company will stand for the extra expense, which will often reach 50% in concrete work.

Trautwine and other authorities claim that freezing will not damage concrete after it obtains the preliminary set. I have never attempted to protect concrete after 12 hr. when the heating method is used and have never seen the least sign of failing, even in a mortar block, which is about as severe a test as can be found in a mill. Twelve hours is ample time to allow for the initial set with any good grade of portland cement. However, freezing may give an apparent hardness, and care should

be used not to remove the forms too quickly, or impose undue loads, which could easily produce failure when the concrete thaws out. The ultimate strength could hardly be materially reduced if proper care be taken. Freezing will retard the final set, but it is difficult to find a good reason for material damage after the hydration has taken place.

There appears to be a variance of opinion about the use of integral salts, but the consensus of opinion seems to be that the salts in themselves can cause no damage if not used to excess. This being so, why should their use damage the concrete if they keep it from freezing? The slow crystallization due to a low temperature might possibly lower the ultimate strength, but the reverse is true if poured in warm weather. Trautwine gives the following experiment, which goes to prove that concrete made of portland cement in cold weather and kept from freezing by the use of salt will not have a lesser ultimate strength, although concrete made of natural cement under the same conditions will have.

EFFECT OF COLD AND MIXING SALT WATER

Specimens; compressive strength of 12-in. cubes of portland- and natural-cement concrete: 8 cubes Atlas Portland, 1 cement: 3 gravel (2 sand, 1 pebbles): 4 crusher-run hard limestone; 8 cubes Louisville natural, 1 cement: 2 gravel: 3 stone. Same as used in track-elevation masonry by C., M. & St. P. Ry. Treatment: All cubes made by same person in molds of 1-in. lumber, and left in molds until broken. Results:

	Portland		Natural	
	Temp., °F.	Lb. per Sq.In.	Temp., °F.	Lb. per Sq.In.
Cube in warm office, 28 days	80 to 18	1,290†	85 to 40	300
Cube in warm office, 28 days	80 to 18	1,290†	85 to 40	Defective
Cube outdoors*, 28 days	57 to —24	902‡	57 to —10	200
Cube outdoors*, 28 days	57 to —24	690‡	57 to —10	256
Cube in office, 28 days	85 to 32	1,290†	85 to 40	352
Cube outdoors*§, 28 days	57 to —24	1,290†	57 to —10	237
Cube outdoors*§, 28 days	57 to —24	1,290†	57 to —10	247

* During first part of 28 days temperature fell to —10 and —20° F., afterward thawing during day and freezing at night.
† Flaked slightly
‡ Cold believed to have retarded setting.
§ Mixed with salt water, 1 pt. salt to 10 qt. water.

Small quantities of concrete are often needed during the cold months around a mining property where heating is out of the question. I have had several occasions to use salts for such purpose; from all appearance the concrete was as firm as that put in during warm weather. It may have a lesser ultimate strength, but it is practical. The engineer with difficult winter work on hand is after practical results, namely, a sufficient factor of safety; he bothers his head very little about the surface appearance of a wall or foundation soon to be spotted over with slime, or about a few hundred pounds, difference in ultimate strength.

HARRY T. CURRAN.

Denver, Colo., Oct. 30, 1915.

Newfoundland's Mineral Resources

In the article on "Newfoundland's Mineral Resources" in the *Journal* of Oct. 23, Mr. McDonald failed to mention roofing slate. During the years 1901-04 the Newfoundland Slate Co. operated a quarry on Trinity Bay and produced a considerable quantity of high-grade purple and green roofing slate, which was sent to England and brought as high a price as the best Welsh slate. I understand that the reason for closing down the quarry was the death of the manager and moving spirit of the company and not the exhaustion of the deposit.

HORACE F. LUNT.

Colorado Springs, Colo., Nov. 15, 1915.

Timbering in New York Subway

In the *Journal* of Oct. 23 was published a letter of mine discussing Mr. Barbour's article on "Timbering in the New York Subway," which appeared in the *Journal* of Oct. 2. Following my letter was appended a criticism of it by Mr. Barbour, which shows a misconception of my statements. The object of my letter was to show that the principle of square-setting is not applicable to subway needs, because it depends on being wedged into place; while traffic vibration on the street structure and lack of abutments, including a light street structure, do not meet this requirement.

He says: "The statement that square-set timbering is not a self-contained structure applies only if one considers it in the nature of a house, which it is not. Square-set timbering underground is certainly self-contained when it is properly wedged in place, and it is not intended to be used any other way." I do not agree with this definition of square-setting. Underground it is not self-contained, but is wall-contained. In subway use it would be a house of cards, because of the impossibility of properly wedging it.

The next comment in the criticism is: "He also states that it is obvious that the use of continuous transverse members from side to side would be more secure than transverse members built up of short-length members tied together," and Mr. Barbour goes on to say: "Theoretically true, but 60-ft. cross-members, as would be required in the subway, are a scarce article, etc. . . . The only long cross-member used was one composed of two 24-in. I-beams at the ends, connected by two channels in the middle, and this construction as well as the entire framing of the bents, etc., . . . not only invited jack-knifing but got it."

The criticism has here confused the meaning of my statement by not fully quoting the paragraph. The full quotation states that square-setting could not be properly wedged in a subway cut, with the consequent necessity of tying and bracing and the disadvantage of short transverse members instead of long ones to better tie the structure together. I do not understand how this can be construed to mean that because the Broadway timbering had one long member in each bent I recommended the timbering. The structure jack-knifed because of no diagonal bracing between the bents, not because of the long member. It would have been the same or worse in this respect with cross-members built up of short lengths.

As to the comment about continuous cross-members being a scarce article, I did not refer to a single rolled I-beam or a single stick of timber, but to built-up continuous beams.

The last paragraph of my letter reads: "The best practice in subway timbering therefore includes continuous cross or transverse members to distribute loads, to brace the sides of the excavation and to tie the structure together more securely; the requisite rangers and lagging to hold the sides of the excavation; sufficient posting in all tiers and secure vertical diagonal bracing, both transversely and longitudinally, of all tiers of posts; sufficient struts or spacers and adequate street structure."

In the criticism only the first part of the foregoing paragraph is quoted, and the criticism states: "Inasmuch as the timbering in question did not brace the sides of the excavation which caved in and caused the fatal disaster,

I submit that the practice was not proper, even though it is considered the best practice in subway timbering."

On my part I submit that I made no statement whatever to the effect that the timbering of the accidents constituted the best practice; for if my whole definition on this point had been quoted, it can be readily seen that the timbering at the scenes of the accidents could not be construed as coming within the definition. It was lack of shoring that caused the rock slide, and lack of diagonal bracing caused the collapse of the street structures. JOHN SEWARD.

West Nutley, N. J., Oct. 30, 1915.

Roosevelt Tunnel Portal

My attention has been called to the fact that the pictures of the Roosevelt tunnel portal, published in the *Journal* of Oct. 2 and 23, do not seem consistent.

The one on page 683 of the issue of Oct. 23 was taken a few months after work was started. At that time I walked to the breast of the tunnel, about 200 ft. in, without getting my shoes muddy. The tunnel was dry until the main water course was cut, about 14,000 ft. from the portal. At the time the second picture was taken, recently, the water was about 2 ft. deep on the floor of the tunnel at the portal, but no work had been done there for years. As soon as the connection between the intermediate shaft and the tunnel was made, work was carried on through the shaft, and as soon as the El Paso shaft was sunk to the tunnel level the work was carried on through that shaft, which is the present practice.

Denver, Colo., Nov. 11, 1915. T. H. SHELDON.

Valuation of Ore Deposits

Misther Editor—'Tis interestin', the way some fellies figgers out the values av ore dayposits.

The other day Tim an' me was studyin' out the dope on wan av thim idle-rich mines in Arizony. Did ye iver notice how some av the idlest mines is bragged about as bein' the richest, jist like people?

Well, annyhow, there was a big bunch av maps, rayports, misfires an' John Hodgeses, certiffycuts, et cetery—enough paper to feed a dozen goats an' to indigest the wan they was intinded for—dished up by an imminent consultin' injineer with the assistance av siveral minin' injineers, assayers an' other boosters. Whin we got the stuff all b'iled down an' poured on the colander av pessimism, jist like Kathleen does with a bale av greens for dinner, we diskivered the follyin': (1) The old stopes was all caved in. (2) The shaft an' the drifts was timbered so tight that no wan cud luk at any walls or roof without pullin' things down like old Samson. (3) Ivery wan av thim injineers said he'd accept the figgers av the former superintendent (which was dead 12 year) on the assays av the samples taken whin the mine was bein' diviloped. (4) The only ividence av values was wan big chart av 479 assays taken on wan level, tellin' the number av inches av ore an' all that kind av thing.

It tuk Tim four days, not countin' three hours overtime, av multiplyin' inches, dollars, feet, assayers, et cetery; workin' like a full-grown rabit on all thim things he called faethors av numeraytor an' faethors av denominaytor. Whin he got through, the best raysult he cud get for the average value av all the ore was $11.17; while the big answer, han'somely engrossed at the bottom av the chart called for $27.63. So I sez to him, sez I, "Tim, now ye see what comes av playin' at bein' a delishency injineer whin the minin' business was dull. Have ye thried addin' up all the assay raysults an' dividin' by 479?"

"Why, Bill," sez Tim, "wud ye ignore complately all thim faethors av width av ore an' irregular intervals av samplin'? Ye're no injineer at all, at all."

"Sure, not," sez I, lightin' up me pipe again, "bein' only a prospector, like. But ye must raymimber that I sold a mine wance, mesilf."

Well, we tiggered out the av'rage in the schoolboy way an' got the same as on the big chart; which was the wrong answer for a buyer.

Now, misther editor, do ye suppose the imminent consultin' injineer was to get fifty-fifty if the mine was sold?

Brooklyn, Oct. 26, 1915. BILL MCGINTY.

NEW PATENTS

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

AGITATOR. Harry R. Conklin, Joplin, Mo. (U. S. No. 1,160,848; Nov. 16, 1915.)

ALLOYS—Apparatus for the Electrolytic Manufacture of Alloys of Light Metals with Heavier Metals and the Continuous Treatment of Such Alloys for Obtaining Final Products. Edgar Arthur Ashcroft, London, England. (U. S. No. 1,159,154; Nov. 2, 1915.)

AMALGAMATOR—Apparatus for Extracting Precious Metals. Victor I. Zachert, San Francisco, and Pierre A. Brangier, Agnew, Calif., assignors of one-third to Victor G. Bonaly, San Francisco, Cal. (U. S. No. 1,160,485; Nov. 16, 1915.)

CAR COUPLING—Automatic-Clench Car Coupling. William T. Lilly and Andrew J. Lilly, Glen Morgan, W. Va., assignors of one-half to Grover C. Hedrick, Beckley, W. Va. (U. S. No. 1,158,515; Nov. 2, 1915.)

CHARGING and Push-out Apparatus for Furnaces. William M. Neckerman, Youngstown, Ohio, assignor to The Youngstown Sheet and Tube Co., Youngstown, Ohio. (U. S. No. 1,159,702; Nov. 9, 1915.)

CORROSION—Method of Preventing the Rusting of Iron and Steel. Daniel F. Comstock, Brookline, Mass., assignor to Comstock & Wescott, Inc., Boston, Mass. (U. S. No. 1,159,748; Nov. 9, 1915.)

DRILLS—Drill-Steel-Turning Device for Percussive Fluid-Operated Drills. Caid H. Peck, Waverly, N. Y., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,160,648; Nov. 16, 1915.)

CYANIDING—Extraction of Metals from Their Ores. Hugh M. Leslie, Glasgow, Scotland. (U. S. No. 1,158,514; Nov. 2, 1915.)

ELECTRIC FURNACE, Intended Chiefly for the Manufacture of Nitrides. Georges Coutagne, Lyon, France. (U. S. No. 1,158,899; Nov. 2, 1915.)

FLOTATION—Improvements in or Relating to the Separation of Metallic Sulphide Ores. Minerals Separation and De Bavays Processes, Ltd., Melbourne, Australia. (Brit. Nos. 19,273 of 1914 and 19,374 of 1914.)

GOLD-SAVING MACHINES. John T. Voigt, Richmond Beach, Wash. (U. S. No. 1,160,550; Nov. 16, 1915.)

JIG—Ore-jig. Frank Franz and Eugene R. Day, Wallace, Idaho. (U. S. No. 1,160,502; Nov. 16, 1915.)

LEACHING—Apparatus for Leaching Ores and the Like. Percy A. Robbins, Timmins, Ont. (U. S. No. 1,160,200; Nov. 16, 1915.)

LEAD ALLOYS—Hard Lead Alloys. Francis C. Frary, Minneapolis, and Sterling N. Temple, St. Paul, Minn.; said Temple assignor of one-sixth of the whole right to said Frary. (U. S. Nos. 1,158,671, 1,158,673, 1,158,674, and 1,158,675; Nov. 2, 1915.)

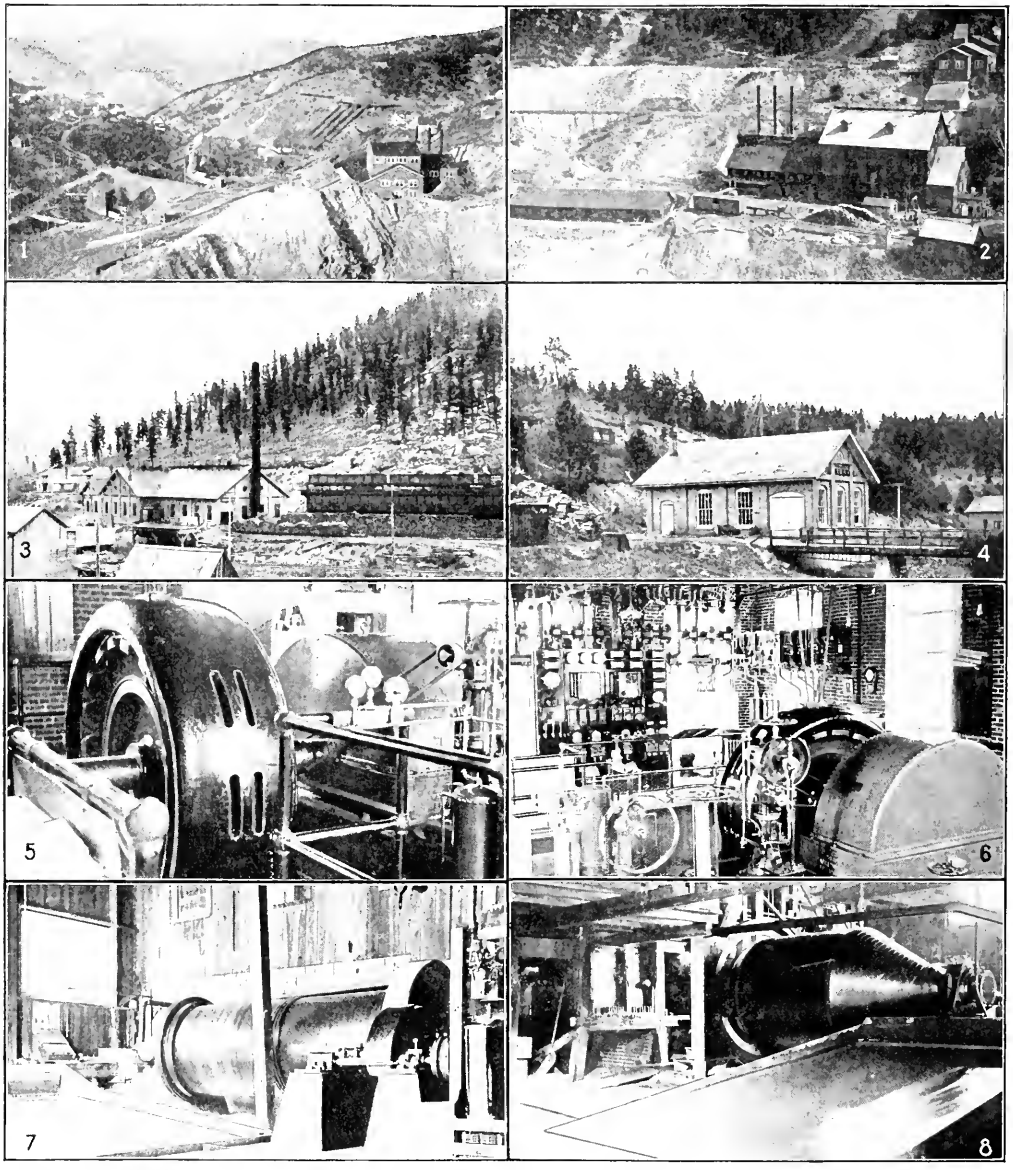
METAL COVERINGS—Method of Removing Metallic Coverings from Other Metals. Hans Foersterling and Herbert Phillipp, Perth Amboy, N. J., assignors to The Roessler & Hasslacher Chemical Co., New York, N. Y. (U. S. No. 1,160,590; Nov. 16, 1915.)

PEAT—Apparatus and Process for the Heat Treatment of Peat. Nils Testrup, London, England, and Thomas Rigby, Dumfries, Scotland, assignors to Wet-carbonizing Ltd., London, England. (U. S. Nos. 1,160,463 and 1,160,464; Nov. 16, 1915.)

PRECIPITATING APPARATUS AND METHOD. Harry R. Conklin, Joplin, Mo. (U. S. Nos. 1,160,845 and 1,160,850; Nov. 16, 1915.)

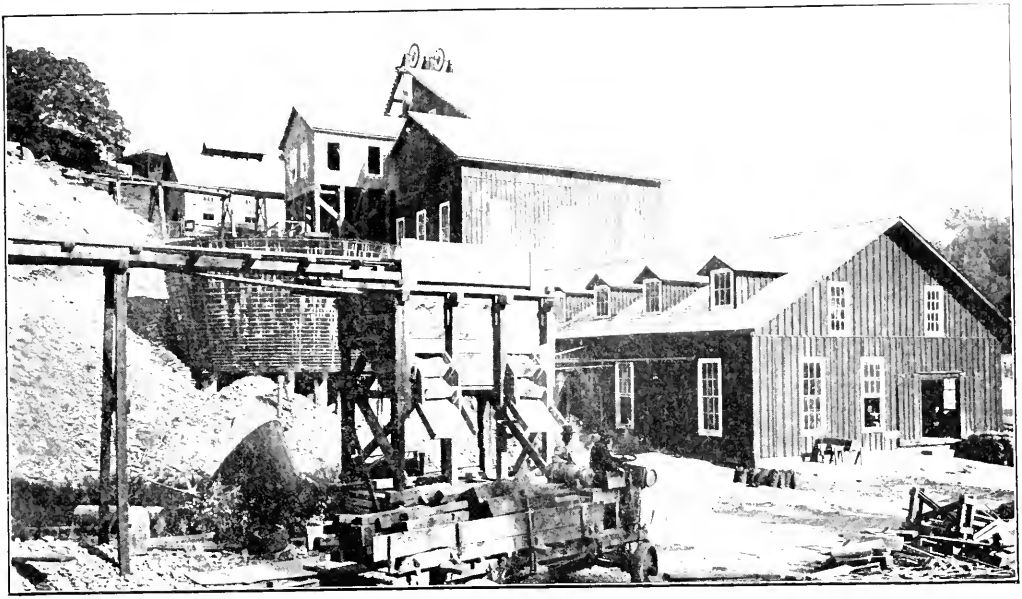
SCREEN—Vibrating Screen. Randall P. Atkins, Denver, Colo., assignor to Colorado Iron Works Co., Denver, Colo. (U. S. No. 1,160,812; Nov. 16, 1915.)

Photographs from the Field

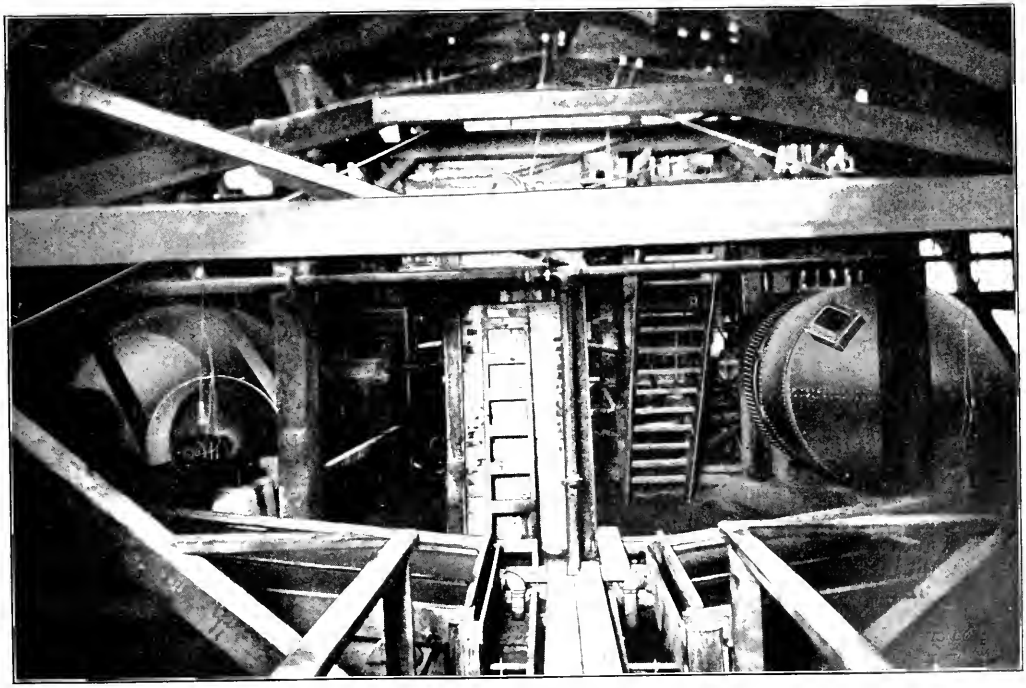


SOME OF THE HOMESTAKE MINING CO.'S MANY IMPORTANT UNITS

1—The stamp mills at Terraville. 2—The Father de Smet 100-stamp mill. 3—The pumping station at Hanna, where three 2,000-gal. steam pumping engines are being replaced by Jeanesville electric-driven centrifugal pumps. Water is elevated 387 ft, and then flows by gravity to Lead. 4—Electric generating station at Englewood. Water pumped over the divide is here utilized to generate power, using a Pelton wheel. 5 and 6—Interiors of Englewood power plant. 7 and 8—In the regrinding plant at Lead, showing tube and Hardinge mills



The mill uses amalgamation, concentration and cyanidation, handling the usual type of Mother Lode ores. It is equipped with 40 stamps and Hardinge mills for regrinding. The concentrates are cyanided in a Trent agitator and replacer, and solutions precipitated with zinc dust. The mill has a capacity of 300 tons daily



AN INTERIOR VIEW OF THE AMADOR CONSOLIDATED MILL

The stamps, regrinding mills and amalgamation tables are shown. The operation of this mill was described in the "Journal" of Aug. 14, 1915

Braden Copper Co.'s Concentrator at Sewell, Chile*

SYNOPSIS—A condensed description of the Braden Copper Co.'s ore-dressing equipment. The main features of the operation are briefly explained by the Braden mill staff.

The crushing plant and concentrator of the Braden Copper Co. at Sewell, Chile, are about two kilometers west of the mines on the northern side of the Teniente River. The topography of the mill site is such that full advantage is taken of a gravity flow of the ore, whether it is in its dry state as it comes from the mine, or after the addition of water as it is handled in the mill. The difference in elevation between the top of the coarse-ore bins, where the ore is received from the mine, and the bottom of the filter-press plant is 403 ft. The area covered by the entire concentrating plant itself is 130,000 sq.ft.

The Coarse-Crushing Plant

The ore is transported from the mine to the coarse-ore bins by means of an electric railroad. The bins have a storage capacity of 2,300 tons. Mechanical feeders deliver the ore to a belt-conveyor system that carries it to the crushing plant. The crushing plant is divided into two sections having the same number of machines and the same rated capacities; only one section will be described. The ore passes over a 1½-in. grizzly, the oversize falling directly into a gyratory crusher; the fines join the crusher discharge, which has been reduced to an average diameter of less than 2 in. These two products are then crushed to ⅞ in. in a pair of rolls 6 ft. in diameter and 20 in. wide.

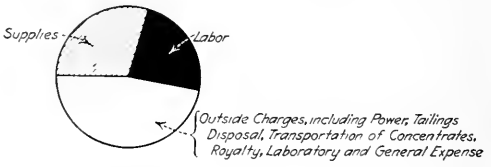
The discharge of the 72x20-in. rolls is divided into two parts, each passing into a trommel having diagonal openings, 6x30 mm. The undersize is carried direct to the fine-ore bins by means of conveyor belts. The oversize is fed into a 48-in. Symons disk crusher that crushes the ore to ⅝ in. between two manganese-steel disks rotating in the same direction and at the same speed, but supported at an angle to each other. The discharge of the Symons crushers passes over Colorado Iron Works Impact screens with openings 6x30 mm. The undersize goes to the fine-ore bins by means of the conveyors already mentioned. The oversize is crushed in two sets of 36x15-in. rolls. The discharge of these rolls is raised by a bucket elevator to another set of Impact screens, the oversize being divided, approximately one-third to the two 36x15-in. rolls mentioned above, and the remainder to two more 36x15-in. crushing rolls, for further grinding until all the ore will pass the 6x30-mm. openings of the screens. The fine-ore bins have a storage capacity of 3,000 tons.

Concentrating Mill in Three Sections

The crushed ore is delivered to the concentrator building by means of belt conveyors. The mill is divided into three sections, each with a nominal capacity of 1,200 tons per 24 hr., only one of which will be described as the other two are similar.

From the final belt conveyor the ore passes over four Impact screens with 25 openings to the square inch, making a separation between the smaller particles, which can now receive their first concentration, and the larger ones, which require further grinding in order to liberate the sulphides. The oversize from the screens is fed to two sets of rolls, then to an elevator, the discharge of which joins the fines that have passed the screens. At this point water is added and the ore flows to four trommels with screens having the same-sized opening as the Impacts. The material passing through these trommels is fed to six Wilfley tables. The concentrates flow to the collecting tanks at the foot of the mill, while the table sands, which need further grinding, are conducted to eight Hardinge mills; the oversize from the trommels is also fed to these mills.

The Hardinge conical mills make 28 r.p.m. and are half-filled with pebbles having a maximum diameter of 5 in. All the discharge is now run to two drag classifiers, the sands from which are concentrated on six Wilfley tables, the concentrates going to the collecting tanks, and the reject sands to the next floor of Hardinge mills for further grinding. On this floor there are six mills, which reduce the reject or table tailings to the size required for the final concentration. Each of these mills is operated in closed circuit with a drag classifier, the overflow of which runs direct to the flotation plants.



DISTRIBUTION OF CONSTRUCTION EXPENSE

Ore Ground to 60-Mesh for Flotation

The ore has now been ground so that all but 10% will go through a 60-mesh screen. The final concentration is effected by means of the Minerals Separation process. This is carried out in eight standard M. S. units that treat the tonnage handled by the three mill sections. The float from the last two boxes of each unit is low in copper and is collected separately and retreated, being pumped back to join the original feed.

The tailings, from which most of the copper has now been extracted, are all collected into one launder, passed through a sampler, and then conducted down the valley to the tailings dam, where they are stored.

The concentrates are collected in concrete tanks at the foot of the mill and loaded by means of a crane into railroad cars for removal to the smelting works. The overflow of these tanks, consisting of sulphide slimes too wet to be smelted, is run to Dorr thickeners. The thickened concentrates are further dewatered in two types of machines: the Kelly press and the Oliver filter. The

*Excerpts from a preliminary article by the Braden mill staff in "Teniente Topics" for October, 1915.

product of both machines is loaded directly into railroad cars for transport to the smelting plant.

OPERATING DATA, BRADEN MILL

Tons per man per day	8.50
Kilowatt-hours per ton milled	29.60
Acid per ton milled, lb.	7.00
Tar oil per ton milled, lb.	2.00
Fuel oil per ton milled, lb.	0.30
Local pebbles per ton milled, lb.	8.75

On account of the situation of the plant in a foreign country, the long distance from the main base of supplies, the duties and ocean freight on all sorts of material bring the item of supplies up to 60.4% of the total direct milling costs. The percentage of total costs assessable to the various departments, for labor and supplies respectively, is shown in an accompanying table. The relative proportion of the total milling charges is indicated in the diagram.

DISTRIBUTION OF DIRECT MILLING COSTS AT BRADEN

	Labor %	Supplies %
Coarse-ore bins and conveyors	4.07	2.51
Crushing plant	21.29	16.02
Fine-ore bins, conveyors, mill rolls and screens	9.02	7.17
Table concentration	7.04	2.97
Hardinge mills	21.98	25.00
Oil flotation, main plant and retreatment	22.81	42.58
Concentrate handling	8.33	1.14
Filtering M. S. concentrates	5.46	2.61
	100.00	100.00

⁂

Interstate-Callahan Report

The third annual report of the Interstate-Callahan Mining Co., Wallace, Idaho, for the fiscal year ended June 30, 1915, has been issued. For the fiscal year ending June 30, 1914, there was an operating loss of $99,315. During the year just closed, this deficit was wiped out, dividends aggregating $697,597 were paid and a surplus of $1,094,862 was accumulated. Ore was extracted during the year from four levels, only development work being done below No. 4. There is enough ore above No. 6 to last the mill for four years. An average of 180 men was employed in the mine and mill, and 309.5 tons of ore per day was sent to the mill.

Shipments of concentrates and crude ore totaled 41,963 tons. Income totaled $2,161,177.53, distributed as follows: Crude lead ore, 246 tons, $6,451; crude zinc, 8,473 tons, $421,238; lead concentrate, 2,563 tons, $90,096; zinc concentrate, 30,681 tons, $1,628,499; miscellaneous income, $14,895. Expenditures totaled $569,404.38, divided as follows: Mining and milling, $470,967; interest, $18,088; improvements, $80,350. The surplus after paying $697,597.50 in dividends was $894,175.65, to which is added $300,000 derived from the sale of bonds, less $99,313.64 loss in 1914, leaving $1,094,862.01 in the treasury.

The report of C. W. Newton, mine superintendent, covers only the first six months of 1915. Development work during this period totaled 1,510 ft.: Shaft, 25 ft.; crosscuts, 639 ft.; drifts, 814 ft.; raises, 32 ft. Ore mined totaled 56,025 tons: No. 2 stope, 3,921 tons; No. 3 stope, 19,924 tons; No. 3½ stope, 11,433 tons; No. 4 stope, 18,478 tons; development 2,269 tons.

⁂

Feldspar Production Marketed in the United States in 1914 was 135,419 tons, the largest annual recorded output. The sales of crude spar were 85,905 tons, and of ground spar 49,514 tons. The quarries are, with a single exception, restricted to the Eastern seaboard states, the exception being in California. It is chiefly used in the manufacture of pottery, enamel ware and electrical ware, according to the Geological Survey.

Mineral County, Montana, Mining Notes

By Hubert I. Ellis*

There is greater activity now in mining and prospecting in Mineral County, Mont., than for many years past. The principal centers of activity are Saltese, in what is sometimes known as the "East Cœur d'Alenes," and Superior, the county seat. The Superior mineral belt is probably better known as the Iron Mountain district, from the old Iron Mountain mine and the station of the same name on the Northern Pacific Ry. about a mile from Superior, which is on the C., M. & St. P. Ry.

The earliest mining in the area tributary to Superior was on Cedar Creek, which empties into Missoula River from the south about a mile above the town. Placer gold was discovered on Cedar Creek in 1869 and soon afterward on certain of its head-water tributaries, notably Oregon, California and Snowshoe Gulches, and on Freezeout and Deep Creeks. Walla Walla, Wash., was the supply center, provisions and such equipment as was essential being freighted to the mines by pack-train. Flour sold for $18 a hundred, according to an old account book found in a deserted cabin, and wages were $5 a day.

Early Mining Activities in the District

Some of the placers were rich, and it was not unusual for a small crew to average $80 or more each per day. Cedar Creek alone is credited with a production of nearly $3,000,000, which came chiefly from the upper portion of the creek and from Oregon and California Gulches. Drifting in the early days and hydraulicking at a slightly later date were the usual methods of working, although some deposits were worked by opencuts. The mining of placer gold is no longer an important industry, although the Cedar Creek Gold Mining Co. is operating a dredge 14 mi. from the mouth of the creek and 4 mi. above the Amador copper mine. The dredge was installed in 1907 and has worked every summer since. It was originally planned to operate throughout the year, and a steam-power plant for generating electricity was built 2 mi. below the dredge. It was soon found that the freezing of the surface precluded the possibility of winter dredging, and water power, being plentiful in summer, was substituted for steam for driving the generators. Water is taken from Cedar Creek, ¾ mi. below the dredge, and led through wood pipe of about 24 in. diameter to the power plant. The dredge, which seems to have been a money-making enterprise during the last three or four years, has a large area of practically virgin ground ahead, some of which has been prospected by Keystone drill.

The only producing lode mine on Cedar Creek is the Amador, 10 mi. from the mouth of the creek. A deposit of high-grade copper ore was found by the placer miners in cleaning bedrock, but no attention was paid to it at the time. Lode claims were eventually located, and a large amount of work was done by the old Amador company, which obtained the claims from the original locators. An adit on the vein was started on the left limit of the creek, but the showing in this seems to have been less encouraging than that in the creek bed and a winze was sunk a short distance from the portal. Ore was stoped to a

*Mining engineer, Kellogg, Idaho.

depth of 400 ft. A standard-gage railway was built to the mine from the Northern Pacific tracks at the mouth of the creek, and a smeltery was built at the junction where the town of Amador, now deserted, was founded. Partly owing to dissension among the stockholders, the mine was closed down in 1907, after a career said to have been featured by extravagance and general mismanagement. During the current year it has been taken over by the Intermountain Copper Mining Co. and reopened to a depth of 400 ft., on which level there is a 300-ft. shoot of milling ore ready for stoping. The flume, which diverts water from Cedar Creek and delivers it to the compressor plant at the tunnel portal, has been repaired. A new 100-ton concentrator is being built to treat the ore by jigging, table concentration and flotation, and it is expected to start early in November.

Prospects Attracting Attention

There are, near the Amador, other promising prospects that are receiving considerable attention. On Mary Ann gulch, 5 mi. below the Amador, is the Golden Sunset gold prospect, owned by Kittinger, Shattuck and associates. The ore is rich, but its occurrence is irregular. On the Gold Crag, at the head of Cedar Creek, Fuller brothers have driven 450 ft. of a 750-ft. crosscut tunnel to tap the vein at 500 ft. under a promising surface showing. On the divide between Freezeout and Snowshoe Creeks the Gildersleeve brothers have traced a copper-lead vein several hundred feet. At the head of Oregon Gulch and Deep Creek there are several gold prospects on which considerable work has been done, but nothing of value has been found.

One of the most promising properties in this area is that of the Clearwater Gold and Copper Co., which lies across the range on the Little North Fork of Clearwater River, in the State of Idaho. Two adits have been driven on the vein, the upper 1,200 and the lower 1,400 ft., and a winze has been sunk 100 ft. from the lower adit on an oreshoot 20 ft. in width. A small sawmill has been built, and the property is equipped with compressor and air drills. Only the lack of transportation facilities prevents this mine entering the list of producers. The most feasible outlet, in the absence of a railway, is probably by aërial tram to the Amador mine, a distance of 15 mi. over comparatively easy country.

The Iron Mountain, on Flat Creek, is the most important of the mines lying northwest of Superior. It is an old producer, the first mining having been done about 1887, and thousands of tons of silver-lead ore has been treated in the mill. The mine was closed in 1898, when the Montana law requiring two openings went into effect, and was practically idle until 1906, when work was started on a 5,680-ft. adit cutting the vein at a depth of 1,600 ft. A winze was later sunk, and the deepest workings are 2,200 ft. from the surface. Shipments of crude ore and concentrate were made regularly during the last two years until this summer, when the Federal Mining and Smelting Co. bid in the property at sheriff's sale for $110,000. The mill is receiving a thorough overhauling and will be operated.

Near the mouth of Flat Creek the Gildersleeve brothers have installed two Brookwater jigs to rework the old Iron Mountain tailings for zinc and lead, and have recovered as high as 3,000 lb. of 30% zinc concentrates in 24 hr. The operators plan to build a larger mill and will experiment with regrinding and flotation.

There are several copper prospects in the vicinity of Superior on veins associated with persistent dikes of a dark-colored basic rock, probably diabase. Oxidized copper minerals and some sulphides appear on the surface at intervals for several miles, and several bodies of commercial ore are reported, but insufficient work has been done to determine their true value. At the Superior-Montana group, on Kelly Gulch, a 470-ft. adit has been driven on one of these deposits; the copper ore carries $6 to $60 per ton in gold, but its occurrence is irregular. McKinnon has recently found a shoot of shipping ore on the same vein on Spring Gulch, and Whitmarsh, on a similar vein at the head of Thompson Creek, reports several feet of ore, much of which can be shipped crude in the face of a crosscut tunnel.

The Little Anaconda, at the head of Deep Creek and on the continuation of the Iron Mountain lode, is idle at present, the last shipments having been made two years ago. The adjoining Glen Metals mine is under lease to C. B. Etnier. The property has 3,000 ft. of development work on two veins, one of which is opened to a depth of 1,400 ft. and the other to 800 ft. A shipment of 65 tons taken from a shoot 1 to 4 ft. wide and 400 ft. long averaged 15% Zn, 20% Pb, and 10 oz. Ag per ton. At the eastern end the shoot carries 25% Pb and 10 oz. Ag. Shipments will be made from this portion to Northport as soon as the new plant is completed. Driving on No. 2 vein has been under way since Sept. 1; the face shows 7 ft. of milling ore. The King & Queen has been shipping for several years, and preparations are making for reopening the Little Pittsburg. The Red Elephant gold mine is working on a small scale, and the O. R. & N. is driving tunnel by contract.

Near Saltese, on Packer Creek, the Last Chance, which has shipped considerable high-grade silver ore, is being reopened. The Tarbox, Bryan and Hemlock, also on Packer Creek, are being developed. On the Hemlock drifts from the 150-ft. shaft show a shoot of lead-silver ore several hundred feet long. The Wilson Mining and Smelting Co. owns two groups of claims, one lead and the other copper. A crosscut is driving to cut the copper vein at a depth of 125 ft., and it is planned to resume work on the lead group during the winter. From the head of Silver Creek the Richmond is shipping copper-gold ore at the rate of four cars per month. A contract has been let for an aërial tram a mile long to deliver ore to the railway at Adair.

Natural Advantages Warrant Greater Development

Considering the varied mineral resources of Mineral County, it is surprising how little prospecting, except of the most desultory sort, has been done in recent years. The district is served by two railways, the branch of the Northern Pacific to the Cœur d'Alenes and the main line of the Chicago, Milwaukee & St. Paul, and since most of Mineral County drains into the Missoula River, transportation is a simple problem. Power at reasonable rates is available from Thompson Falls, and there is sufficient water in the creeks for many of the mines to have their own plants. Timber of satisfactory grade is abundant. Years of work on the Amador and Iron Mountain mines have demonstrated the continuity of the orebodies, and it is highly probable that new mines will be opened as a result of the present increased activity.

Editorials

Revision of the Mining Laws

Great interest is being exhibited in the convention to be held in Washington on Dec. 16, 1915, which was called by the Mining and Metallurgical Society of America and is to be conducted under its auspices. The purpose of this gathering of mining men is to urge upon Congress the desire of the citizens engaged in the mining industry that the mining laws of the United States be revised as speedily as possible. Upon this there appears to be remarkable unanimity of opinion. It is agreed, moreover, that there should be no piecemeal revision, but a thorough coördination of the whole system: and that a new law providing for this should be drafted upon the basis of the findings and recommendations of a commission to be appointed by Congress to study the subject. Upon these principles the Mining and Metallurgical Society of America, the American Mining Congress and the American Institute of Mining Engineers have taken formal action in perfect agreement, while many of the local mining societies of the country have done the same thing.

The need for a revision of the mining laws has been agitated for a good many years. Society after society has voted in favor of it, commission after commission has recommended it, but the final step to bring it about has not yet been taken. There are certain reasons for this, such as the inertia of Congress, the opposition of certain persons who conceive that their private interests will be adversely affected and the hugeness of the task of writing a new law. In discussions of this question some congressmen have offered to introduce and push any bill that the mining societies would put in their hands, but this was beyond the means of the societies. The preparation of such a bill—assuming the work to be thoughtfully done—is a task involving a great deal of time and expense. This is why the study of the question, the hearing of opinions and wishes in all parts of the country and the drafting of a bill should be delegated to a commission of congressional authorization. Such points as these ought to be brought out in the forthcoming convention.

The Mining and Metallurgical Society of America has had mining-law revision under consideration for a good many years. The report of its committee on mining laws is probably the most instructive literature upon the subject that has been offered. Following this report and the discussion of it in meetings of the society, a series of resolutions was submitted to the membership. Some of these resolutions were carried by an all but unanimous vote, others by only a bare majority, illustrating the nature of the differences in opinion that develop when details come into question. In issuing its invitations to the convention in Washington, the council of the Mining and Metallurgical Society said that it would offer only those resolutions upon which its membership was substantially unanimous. At a meeting of this council last week that action was rescinded, and it was decided to offer only those resolutions embodying the broad principles that there should be a complete and coördinating revision of the mining laws and that a commission to study the matter should be authorized by Congress. All other points, such as the question of extralateral rights and the question of discovery as a prerequisite to location, will come naturally within the purview of such a commission and need not be discussed at this time, when the main thing is to get a commission.

A matter which will, however, be usefully discussed in Washington pertains to the nature of such a commission—whether it should consist of three members, or five, or seven; whether lawyers or mining men should predominate in it; whether it should be paid or unpaid. These and many other questions are of vital importance. The great idea in the forthcoming meeting, however, is for mining men from all parts of the country to assemble in Washington and let Congress know that they want to have something done; and that, moreover, they will be able to propose a specific, practicable and conservative program, respecting which everybody will be substantially in agreement.

The Kennecott-Braden Deal

One of the most curious transactions in copper-corporation affairs is that which was announced last week, whereby the Kennecott Copper Co., operating mines in the Copper River region of Alaska, is to take over the Braden company, operating mines in Chile; and furthermore, is to acquire the interest (about 400,000 shares) of the Guggenheim Exploration Co. in the Utah Copper Co. No reason based on economy in operation of these far-apart mines has been advanced, nor has the public been apprised of any explanation of what it is hoped to accomplish.

The Kennecott, Braden, and Guggenheim Exploration are concerns in which the Guggenheims are largely interested. The Guggenheim Exploration Co., which is essentially a holding company, has been advertised in the squibs in the Wall Street journals as about to be dissolved. The Braden company has been borrowing several millions of the cash assets of the Guggenheim Exploration. The Kennecott company, which represents a huge investment in Alaska by the houses of Morgan and Guggenheim, was offered to the public for investment several months ago, in connection wherewith there has been a shrewd stock-market propaganda. The Utah Copper Co. plays no part in the deal, but the Guggenheim Exploration Co. owns a large block of its shares.

The Braden company owns a great mine, but it has experienced disappointments and probably was still far short of the time when it, going alone, could safely begin the payment of dividends. On the other hand, the Kennecott company, which made its début in Wall Street about the time when copper rose to 20c. per lb. last spring and soon afterward discovered what was heralded as the richest copper bonanza ever known, will soon be

in a position to begin the payment of dividends. The Braden and Kennecott mines are, in short, the antitheses of each other. Both are situated in remote regions and are subject to violent vicissitudes of climate, labor conditions, etc. The Kennecott mines are far up in the Northern Hemisphere and the Braden mines far down in the Southern. The latter have low-grade ore, a lot of it, and the probability of long life. The Kennecott mines have phenomenally high-grade ore, but there is doubt as to how long it will hold out. The idea of the Braden-Kennecott combination appears to be to average things. The Braden stockholders will probably not object to this. The Kennecott company is too new a thing to have a large list of stockholders of the investment class.

The strangest thing in the deal is the taking-over of the Utah shares from the Guggenheim Exploration Co., the latter receiving Kennecott shares in exchange. If the Guggenheim Exploration Co. is going into liquidation and is going to distribute its assets among its stockholders, the latter will get Kennecott shares instead of Utah shares. The principal Guggenheim stockholders are quoted in the Wall Street prints as talking as if they liked this. Of course there's no accounting for tastes. The Kennecott company will naturally increase its list of stockholders.

Some Prodigious War Wastes in Minor Items

High-explosive shells, which according to the newspapers are being fired at the rate of 1,000,000 a day on some of the 100-mile battle fronts in Europe, are of forged steel, made hollow to contain the bursting charge of explosive, and the nose of the shell threaded, into which is later screwed the nose detonating fuse. Between the time the shell is completed ready for shipment and its fusing prior to the action in which it is required, this opening in the nose of the fuse is closed by a plug screwed in temporarily.

The British have been using a brass plug for this purpose. The 4½-in. high-explosive shell manufactured in Canada has a brass plug which weighs 10½ oz., is very carefully machined and threaded, and screws into the nose of the projectile easily by hand, but has a square recess in the top for the insertion of a square-end wrench in case it cannot be unscrewed by hand. In the absence of specifications or an analysis of this particular plug, it is not possible to say just how high-grade this particular brass is, but if it conforms to specifications for other war material it can be assumed to be of the very highest grade and therefore the most costly. When the shells are fused in the battle area, these plugs are taken out and thrown away and are a total loss. If 1,000,000 of them were thrown away in one engagement in one day, some idea can be formed of the prodigous waste of war, so far as this item of copper and zinc is concerned. This of course is by no means the only use of copper and zinc in ammunition or for that matter on the explosive shell itself. The same shell that has this nose plug wasted has a copper rotating band near its base and has a time detonating fuse in its nose, both of which are converted into fragments on the explosion of the shell.

These same plugs when used for Russian shells are made of zinc. Information is not at hand about the grade required or specified for this purpose, but in any event the cost is excessive and the waste and loss complete.

There is no valid reason for making these temporary plugs of the most expensive material available, and evidently this has dawned upon those at the head of the munitions manufacturing department in England, because wood plugs are now being used for this purpose in place of the more expensive metals. Recently a manufacturer of war material was approached for a bid on a large number of these nose plugs. His figure, scaled down to the minimum, was more than a million dollars. This price being unsatisfactory to the representative of the foreign purchaser, the bidder made an alternative figure, which was less than $^1/_{100}$ of the first, if he were allowed to make the plugs out of wood. The turning of these plugs from wood and the cutting of a satisfactory thread on them is said to be one of the most difficult manufacturing details, but they are now being turned out and used and, so far as is known, with perfectly satisfactory results.

We have it from an authoritative source, that one reason why the Russian supply of ammunition was so slow in coming forward was because, prior to the exigencies of the recent campaigns, the Russian specifications required that all of their projectiles be nickel-plated, and neither the time nor the nickel was available for fulfilling these requirements on the vast number of shells that were being expended on the battle front. Nickel-plating the projectile of course reduces the wind resistance during its flight and therefore increases both its range and penetration, but with the modern grinding machine it is probable that nickel-plating the projectile does not gain any advantage over proper grinding and polishing, which are now done so cheaply and efficiently by United States manufacturers.

When these time fuses, which are very delicate pieces of mechanism, are manufactured and shipped, it is necessary to have them protected from moisture and dirt and dust. This is accomplished by covering them with a veil of tin-foil, which is wiped over the conical fuse. These veils are peeled off and thrown away when the fuse is put in the shell.

There was in the market recently an order for 25,000,000 fuses for the Russian government. The bidders were unable to find sufficient supplies of tin-foil, or the sources of such supply, to fill this order, and after a great deal of haggling, they succeeded in getting the specifications changed, substituting for tin-foil a lead-foil tinned on both sides, and by this means succeeded in providing sources for war material for the coverings required. This order of 25,000,000 was only a small part of the total order in hand, to be placed at that time.

This gives another idea of the prodigious waste of the less common and semi-rare metals in this war, and in both cases these wastes are minor items.

Mr. Manning is already showing in his conducting of the Bureau of Mines his earnest desire to live up to the traditions of Doctor Holmes. The guiding spirit is to make the bureau a useful thing to the mining industry and to keep in close touch with the men engaged in that industry in order to help in solving their problems. There is no policy of aloofness in this bureau, but rather the idea that mining men who visit Washington are welcome and that it is a good thing to talk matters over. This is of course just as it ought to be.

Liquidation Plan, Guggenheim Exploration Company

The Guggenheim Exploration Co. sent out a circular letter to its stockholders on Nov. 23, giving its liquidation plan. The letter, which is signed C. K. Lipman, the secretary, reads in part as follows:

For some time the directors have had under consideration the advisability of liquidating the business of the company and of distributing its assets among the stockholders. It is believed that the present is an opportune time for accomplishing that purpose. The most valuable single investment of the company consists of 404,504 shares of the capital stock of the Utah Copper Co. The directors deem it impracticable to dispose of this large block of stock in the open market at its fair value, and they consider it unwise to distribute it among the stockholders under conditions likely to result in a substantial shrinkage in values, to the injury of all concerned.

An opportunity has now presented itself which will enable the company to sell these shares to the Kennecott Copper Corporation on terms that will obviate these difficulties. It is proposed that the latter corporation shall purchase this entire block of Utah Copper Co. stock by giving in exchange therefor 1½ shares of its own stock for each share. The Kennecott Copper Corporation is perfecting arrangements with a syndicate which will purchase the requisite number of shares of the Kennecott Copper Corporation received by the Guggenheim company, whereby the stockholders will be enabled to elect whether they desire their proportions of the proceeds of the sale of this block of stock to be distributed to them in the shares of the Kennecott Copper Corporation or in cash at the rate of $75 per share for the stock of the Utah Copper Co. so sold.

The Kennecott Copper Corporation was organized on Apr. 29, 1915, under the laws of the State of New York. It has issued 720,000 shares of stock, without nominal or par value. Its present capital is fixed at $6,000,000. On May 27, 1915, it acquired the mining claims and property in Alaska known as the Kennecott mines, and shortly thereafter there was conveyed to it the mining property in Alaska formerly belonging to the Beatson Copper Co. These constitute copper producing properties upon which extensive valuable mineral deposits have been developed. The extraction of ore has been in progress on these properties in constantly increasing volume for several years past. The Kennecott Copper Corporation has now outstanding an issue of $10,000,000 first-mortgage 6% 10-year gold bonds, convertible into stock in the ratio of 40 shares of stock for each $1,000 bond. It has no floating debt except for current liabilities and for advances made against copper already sold.

The Kennecott Copper Corporation proposes, if it can do so on fair terms, to acquire additional properties and property rights, and to that end contemplates an increase of the number of its shares, which are to be issued without nominal or par value, from 720,000 to 3,000,000 shares, and of its capital from $6,000,000 to $15,000,000. The 2,280,000 of new shares are intended to be devoted to the following purposes, to the extent stated:

1. For the purchase of the 404,504 shares of Utah Copper stock owned by the Exploration company, 606,756 shares.
2. For the purchase from the respective owners thereof the shares of stock, convertible bonds and convertible debentures of the Braden Copper Mines Co., 800,000 shares.
3. For the purchase from the Alaska Syndicate of 48,174 shares of the capital stock of the Copper River & Northwestern Ry. Co., of the par value of $100 each, being its entire outstanding capital stock, of $23,020,000 par value of the 5% 50-year gold bonds of said railway company, being all of its outstanding bonds, and of 13,000 shares of the capital stock of the Alaska Steamship Co., of the par value of $100 each, out of a total authorized outstanding capital stock of 30,000 shares, 200,000 shares.
4. For the retirement of the $10,000,000 of convertible bonds of the Kennecott Copper Corporation, 400,000 shares.
5. For the compensation to be paid to an underwriting syndicate in consideration of the services rendered by it to the Kennecott Copper Corporation to meet the cash requirements of the proposed plan, which involves alternative offers of cash to the holders of the securities mentioned in the above subdivisions (1), (2) and (4), 65,000 shares. Total, 2,071,756 shares.

The remaining 208,244 shares of new stock and such of the shares above specified as may not be used for the purposes indicated will be available for the general corporate purposes of the Kennecott Copper Corporation.

The Messrs. Guggenheim, who are officers and directors of your company, are the owners of large holdings of the stock, bonds and debentures of the Braden Copper Mines Co. and of the stock and bonds of the Kennecott Copper Corporation. They are also members of the Alaska Syndicate, and as such are largely interested in the securities which the Kennecott Copper Corporation proposes to purchase from that syndicate and in the shares of stock of Kennecott Copper Corporation owned by such syndicate. Messrs. J. P. Morgan & Co. are likewise the holders of large amounts of the bonds of the Kennecott Copper Corporation, and are members of the Alaska Syndicate. That firm, as well as the Messrs. Guggenheim, and the directors of some or all of the corporations herein named, may become subscribers to the underwriting syndicate, when organized, and participate in its compensation.

Upon the consummation of this proposed sale of the shares of the Utah Copper Co., it is the present purpose of your directors, while retaining in the corporate treasury property exceeding in value the capital stock of your company, to make a distribution of a portion of its assets among its stockholders, as follows:

a. The proceeds of the Utah Copper Co. stock, by paying to such stockholders as shall elect to take their proportionate share of such proceeds in cash, $36.38⅓ in cash for each share of the Guggenheim Exploration Co. and to such stockholders as shall elect to accept shares of stock in the Kennecott Copper Corporation 72.77% of a share of the stock of the latter company for each share of the stock of the Guggenheim Exploration Co. held.

b. 97,750 shares of the capital stock of the Chino Copper Co., by transferring to each stockholder of the Guggenheim Exploration Co., 11.72% of a share of Chino stock for each share of the stock of the Guggenheim Exploration Co.

c. 69,500 shares of the common stock of the American Smelting and Refining Co., by transferring to each stockholder of the Guggenheim Exploration Co. of 8.33% of a share of common stock of the Smelting Company for each share of stock of the Guggenheim Exploration Co.

d. 154,300 shares of the capital stock of the Ray Consolidated Copper Co., by transferring to each stockholder of the Guggenheim Exploration Co. 18.50% of a share of the stock of the Ray company for each share of the stock of the Guggenheim Exploration Co.

Pan-American Scientific Congress

We are requested by the authorities in charge of this congress to announce that in addition to the general topics described in the preliminary program, issue of Apr. 15, the executive committee of the Second Pan-American Scientific Congress, which is to meet in Washington Dec. 27, 1915, to Jan. 8, 1916, has authorized the following important special topics, which will be discussed in a series of Pan-American conferences, a conference on each topic:

Mining—The mining law of each country and the changes that may be made to aid the development of mineral resources. History of the mining industry in each country with reference to the beginnings of that industry. The development of the Patio process. Bibliography of mining.

Metallurgy—Present methods of concentrating ores and the development of concentration methods.

International relations in the exchange of ores and metals. Bibliography of metallurgy:

A and B. Mining and Metallurgy—Development of hydroelectric power for mining and metallurgy, the amount probably available, and specific benefits from its utilization.

C. Economic Geology—The relation of geological work to the development of the country. A bibliography of economic geology.

D. Applied Chemistry—Natural and artificial nitrates; the present status and the outlook for these industries.

Safety Last

Pumping a man full of compressed air is still considered a joke by some people. Besides the case recently reported by the *Journal*, a worker at the Midvale Steel Works in Pennsylvania was subjected by two facetious fellow workmen, to an air hose containing air at a pressure of 80 lb. per sq.in. Immediate injury was not discovered, but soon after the man was suddenly taken ill while at work. At the hospital it was discovered that almost every internal organ had been ruptured by the air pressure, and it is not expected that the man can live. The fool-killer is a long way behind in his work.

Revision of Mining Laws

The Council of the Mining and Metallurgical Society of America—at the invitation, and under the auspices, of which a convention of mining men is to be held in Washington, D. C., on Dec. 16, to urge upon Congress the desire of the mining industry that the mining laws of the United States be revised—requests us to publish the following rules for the conduct of this convention, adopted at its meeting on Nov. 18:

The meeting to comprise three sessions, the first beginning at 10 a.m., the second at 2 p.m. and the third at 8:30 p.m.

The meeting to be organized with the president of the Mining and Metallurgical Society in the chair. The presiding officers in the several sessions to be the presidents of the M. M. S. A., the American Institute of Mining Engineers and the American Mining Congress, or representatives of those organizations.

A committee on credentials, three members, to be named by the Mining and Metallurgical Society of America.

The several sessions to be open to all persons interested in the mining industry, but the right of voting to be limited to accredited delegates and other persons especially invited.

Credentials to be: (1) Membership in the societies invited; (2) Representatives, one each, of chambers of commerce especially invited. Representatives, one each, of operating mines in the United States, provided that any such mines have no representation through membership in a society, or otherwise. Representation in all cases to be limited to citizens of the United States. Credentials to be passed upon by the committee on credentials, whose decision will be final.

A committee on rules, three members, to be appointed by the chairman.

A committee on resolutions, five members, to be appointed by the chairman.

All resolutions to be submitted to the committee on resolutions.

The committee on rules to have the right to make provisions limiting and concluding debates, if necessary.

We are further informed that the outlook is for a large and representative attendance. Persons attending the meeting are requested to register in the record book that will be provided for the purpose. Official headquarters will be in the Raleigh Hotel; registration in the United States Bureau of Mines; meetings in the Auditorium of the United States National Museum.

All persons expecting to attend the meeting are requested to notify F. F. Sharpless, secretary, Mining and Metallurgical Society of America, 52 Broadway, New York, as soon as possible. This is particularly important in the case of persons going from New York, in order that adequate sleeping-car accommodations may be provided.

Cyaniding in Closed Vessels

Recent discussion among cyanide metallurgists on the gold fields of South Africa has tended toward the saving of cyanide by carrying out the process in closed vessels. According to the *South African Mining Journal,* Sept. 25, 1915, in a paper presented to the Chemical, Metallurgical and Mining Society of South Africa by H. A. White, it was indicated that the average consumption of cyanide was 0.4 lb. per ton of ore treated, while zinc consumption was 0.32 lb. According to this, the annual requirement of sodium cyanide on the Rand is therefore about 5,000 tons, and it was said that, owing to its high price at the present time, any method of saving cyanide would be a distinct economy.

While efforts have been made recently to reduce the cyanide consumed, any actual reduction of consumption has been more than counterbalanced by a consequent loss of gold. H. M. Leslie believes that more definite beneficial results may be obtained through what he calls a "closed system" of cyanide treatment, which is in effect the carrying out of the process in closed vessels, so that there shall be no loss by evaporation.

Laboratory experiments have been carried out, and a considerable variety of information has been acquired, all of which tends to show that the loss by evaporation is great and that some steps should be taken to avoid it. Some authorities go even so far as to believe that the possible saving by using closed vessels may reach as much as 30% of the total now consumed. The matter will be further discussed, and a trial will be made to see just what can be done with the suggestion.

A New Flotation Experiment

SALT LAKE CORRESPONDENCE

A 25-ton experimental flotation plant employing the Fields process is being installed at the Ohio Copper Co.'s mill at Lark, under the direction of L. M. Walton, engineer for the Fields Electrical Flotation Co. This plant is being installed by John D. Fields and Irwin McNiece, who believe it will be of benefit to the General Exploration Co., now operating the Ohio Copper property under lease, and if it is successful a larger plant will be installed.

The recovery at the Ohio Copper mill has been only 64 or 65%, and if the Fields process is successful it will be used to treat the accumulated tailings, which include a 3,000,000-ton slime pile which carries about 0.8% copper. The 25-ton experimental plant is being installed in the western part of the mill, where it can cut in on any part of the feed. Experiments will be started first on the slime pile.

In a general way the process combines flotation and leaching and appears to be adapted to the handling of partly oxidized copper ores. Concentrates and electrolytic copper are produced. The crushed ore or tailings are placed in a cell with water to which a little sulphuric has been added, and agitated by air under 50 to 75 lb. pressure. Electric current, at from 10 to 25 volts and amperes depending on the size of the cell, is passed through the solution between copper electrodes. The current breaks down the water into hydrogen and oxygen, and these gases assist in the flotation of the sulphide particles, which are skimmed off. The oxidized portion of the ore is dissolved and deposited as electrolytic copper. The cost of treatment by this process, as indicated by experiments carried on at Maxville, Mont., on 1.57% copper ore, was approximately $1.25 per ton of material treated. A recovery of 92% was made. It is expected to have the experimental plant ready by the first or second week in December.

Canvass of Belgium's Metals

The Havas correspondent at Geneva, according to the New York *Times,* says that the German authorities at Ghent, Bruges, Mont. St. Amand, and Ledeberg have ordered by poster that all industrial establishments must declare how much copper, brass, and bronze they have, and in what forms. The directors of the industries are obliged to declare all old copper and extra pieces. The penalty for inexact or incomplete declarations is a fine of 20,000 marks, or imprisonment.

PERSONALS

Alfred Quimby, who is operating a gold mine in Guatemala, is visiting New York.

E. J. Collins, of Duluth, is in the Cobalt and Porcupine districts of Ontario on a trip of investigation.

Kirby Thomas has moved his office from 43 Exchange Place to Room 2744, No. 120 Broadway, New York.

Charles A. Banks, of the Jewel-Denero Mines, Ltd., and the Idaho-Alamo mines, both of British Columbia, is on his way to London.

Benjamin F. Tibby has opened a laboratory for microscopic analyses of rocks and ores at 419 Judge Building, Salt Lake City, Utah.

W. G. Norrie, mining engineer, lately of Vancouver, has been appointed manager of the Silver Standard mine at New Hazelton, British Columbia.

The Lehigh Portland Cement Co. announces the naming of Harold M. Scott as assistant secretary and the appointment of B. H. Rader as western sales manager.

E. Downie, president of the American Security and Investment Co. of Duluth, is in the Cobalt district in Ontario in reference to some projected operations there.

Charles W. Newton, general superintendent of the Consolidated Interstate Callahan Mining Co., Wallace, Idaho, was in Butte last week on business for the company.

J. G. McNulty returned to New York after several weeks spent examining pyrite deposits in Vermont, and has now gone to examine a copper property west of Sudbury.

Garnett Alfred Joslin, recently appointed mining engineer for the Ray Consolidated Copper Co., at Ray, Ariz., was married Nov. 9 to Miss Jessie E. Heber, of Los Angeles.

E. E. Kirkland, of Rome, Georgia, is opening a deposit of kaolin on his property near Lindale station. Several cars have been shipped recently and equipment will be installed.

Walter O. Snelling, formerly of Pittsburgh, Penn., has brought property in Long Island City, N. Y., on which he proposes building a large laboratory for chemical research.

W. W. Leck, superintendent of the merchant mill department of the Pennsylvania Steel Co.'s plant at Steelton, Penn., has been made superintendent of all the Steelton rolling mills.

R. J. Johnston, former assistant to the superintendent of the Donora plant of the American Steel and Wire Co. has been appointed superintendent of the zinc works of the company at Donora.

Frank L. Dalas, formerly chief electrician of the International Smelter Co., Miami, Ariz., has joined the electrical and mechanical department of the Youngstown Sheet and Tube Co., Youngstown, Ohio.

C. A. Buck, vice-president Bethlehem Steel Co., returned recently from Chile, where he has spent some months in the supervision of the new construction in connection with the company's Tofo iron mines.

Dr. S. J. Schofield, of Kingston, Ont., a graduate of Queens University and lately with the Canadian Geological Survey, has been appointed professor of geology and mineralogy in the University of British Columbia.

Gerald G. Dobbs, formerly chief engineer, ore mines and quarries, Southern District, Republic Iron and Steel Co., has been appointed superintendent of the Raimund Mining Division for the same company at Bessemer, Alabama.

E. V. Bray, vice-president A. L. Young Machinery Co., sailed from San Francisco on Nov. 20 for Celebes, Dutch East Indies, where he will design and construct a milling plant for the Minto concession of the Bolong Mongondou Company.

Alexander W. Behr, vice-president of the Russian-American Chamber of Commerce, Moscow, is now in this country in the interest of closer trade relations between Russia and the United States. His address is the Plaza, New York.

E. M. Hamilton, F. A. Beauchamp and S. E. Woodworth announce that they have become associated as metallurgical engineers under the firm name of Hamilton, Beauchamp, Woodworth, Inc., with offices and testing laboratory at 419 the Embarcadero, San Francisco, Calif

J. D. Mooney, for several years in charge of the sales of the mechanical rubber goods division of the B. F. Goodrich Co., Akron, Ohio, has become associated with the Hyatt Roller Bearing Co., Harrison, N. J. Prior to Mr. Mooney's engineering-sales experience he was an associate editor of the "American Machinist."

C. H. Williams, former assistant superintendent of the Schoenberger steel works of the American Steel and Wire Co. at Pittsburgh, has been appointed assistant to the superintendent of the plant at Donora. He has been succeeded by William Pickford, formerly superintendent of the bessemer department of the Schoenberger works.

OBITUARY

Joseph G. Hendrickson died at his home in Philadelphia, Nov. 4, after a short illness, aged 69 years. He was the founder of the Ajax Metal Co., which was established in 1880. He retired as president of the company a little over a year ago, and since then has been chairman of the board, also chairman of the board of the Ajax Metal Co. of the South, Birmingham, Ala., and president of the Ajax Lead Coating Co. He was a member of the Union League of Philadelphia.

William Carmichael died at Biwabik, Minn., Nov. 12, aged 69 years. He was born in Scotland and came to this country when a boy with his parents, who settled at Bruce Mines in Canada. In 1869 he went to Minnesota, settling at Tower on the Vermilion range. When the Mesabi range was opened he went to Hibbing, having risen to be mine captain. He was superintendent of the Rust Mine near Hibbing for a time, but in 1897 went to Biwabik where he was superintendent of the Duluth and McKinley mines. Later the Oliver Iron Mining Co. added the Graham and Weed mines at Mesaba to his charge. He was considered one of the foremost mining men on the Mesabi.

SOCIETIES

Society of Chemical Industry—The regular meeting of the New York section was held at Rumford Hall, New York, Nov. 19. The subject for the evening was "Industrial Chemical Research" and the program included addresses by G. R. Fonda, C. F. Burgess, R. F. Bacon and W. H. Walker.

Mackay School of Mines—The second session of the Prospectors' Short Course at the Mackay School of Mines of the University of Nevada will be held from Jan. 30 to Feb. 26, 1916. The work of the course will include both lectures and laboratory exercises, and the subjects taken up will be prospecting, assaying, mineralogy, geology, prime movers, chemistry, hygiene, sanitation, first aid to the injured, and mining law. In addition to these regular courses there will be a number of special lectures upon subjects of interest to the prospector. In the short time available it will be impossible to cover in detail any of the subjects taught, but an attempt will be made to acquaint the members of the class with as many practical points connected with these subjects as possible. This course is designed primarily to aid the prospecters of Nevada, but is open to residents of other states. Those who desire to attend should present themselves at the office of the Registrar in Morrill Hall, Reno, Jan. 30, and register. No charges will be made for instruction, but a fee of $5 will be collected to cover in part the cost of supplies used during the course.

INDUSTRIAL NEWS

The American Car and Ship Hardware Manufacturing Co., general offices and works, New Castle, Penn., is making large additions to its present plant.

The Bayard Chemical Co. is equipping a plant at Edgar Station, Woodbridge, N. J., for the manufacture of phenol, salicylic acid and a general line of pharmaceutical chemicals. Post office address is Woodbridge, N. J.

E. E. White, agent of the Mass patent drill hole compass, announces that 12 of these compasses have been rented to prominent exploring companies and drill contractors in the United States, Canada and Russia and are proving very successful.

The Homestead Valve Manufacturing Co., Homestead, Penn., is manufacturing an angle-type blow-off valve, to be used in connection with its plug cock, where a double blow-off arrangement is desired on steam boiler blow-off lines. The body of the "Hovalco" valve is of semi-steel, and the seat and disk are made of Monel metal. The valve is designed for 250-lb. pressure in 1¼ to 3-in. sizes and with screwed and flanged body.

Editorial Correspondence

SAN FRANCISCO—Nov. 17

The State Highway is Completed from Yreka to Hornbrook. The next advance will be to extend the road to the Oregon state line. Yreka is connected by a branch railroad to Montague, connecting with the Southern Pacific. The situation of Yreka in relation to the mining interests of the county is such that the mining men would be greatly benefited by good roads, in the building of which they should be aided by the State Highway Commission. The U. S. Steel Corporation is reported to be interested in manganese deposits near Sawyers Bar, but unless the wagon road from Etna to Forks of Salmon is widened and otherwise improved, or a new road is built following the trail to Orleans, there will be small prospect of developing the manganese. These improvements would permit transportation of ore by way of Etna and Yreka, or by Orleans to tidewater. But Siskiyou County and the wideawake towns should not wait for the Highway Commission to act in their behalf. The development of mines in Siskiyou County depends very largely upon good roads, and good roads depends very largely upon good citizens. Siskiyou County has the good citizens and should have the good roads.

The Dutch-Sweeney-App Mines in Tuolumne County, recently taken over by W. J. Loring, will be financed by American money, the Bewick, Moreing & Co. interests taking no part in the enterprise as a corporation or firm. Mr. Loring states that it is not at present possible to take British money out of the Empire and invest it in American mines or other enterprises without the consent of government. So he has interested Eastern investors in the exploration and development of this property. The three mines adjoin and for the sake of economical operation should have been worked under one management from the beginning of their productive period. The Dutch was developed into a good producer three or four years ago by C. H. Segerstrom, who installed modern machinery and extended development into the Sweeney ground. He got the property on a paying basis and would have undertaken to place the App on the same basis if he could have obtained the mine or secured control. Captain Nevills had numerous chances to sell the App, but about the time the proposed purchasers were ready to act the captain jumped the traces. He was a money-making miner and grew rich and was often broke. Always a hard man to deal with, the mine investors with the money and the ability to mine by modern methods concluded they would have to wait for Captain Nevills to die before undertaking to relieve him of the operation of paying mines which he was handling by early-day methods. Captain Nevills obliged them. He died, and the properties in Tuolumne and Amador Counties went into the hands of creditors. Then the chief creditor died. In the past year the Melones mine interests took over the Dutch-Sweeney, and it is probable the same interests would have considered the App in good time. Now that the three properties are in the hands of Mr. Loring, with Albert Burch in the position of manager for Bewick, Moreing & Co. interests in Amador and Eldorado Counties, the effect of British activity in the development of California gold mines will in a short time become quite evident, even if the company must now depend largely upon American investors. The showing made by the Plymouth Consolidated in Amador County under the management of Mr. Burch and the superintendency of Mr. Parks, and the active preparation at the Montezuma in Eldorado County and now the undertaking of the operation of these properties in Tuolumne County is proof enough that there is some inducement held out by the quality of the properties taken hold of. California has other mines that stand in the same need of money and men, and only await the application of modern methods to put them again in the producing class.

BUTTE—Nov. 18

The Montana Power Co. completed another of its many hydro installations. This time it is the Volta plant, situated 11 mi. northeast of Great Falls at the Big Falls of the Missouri River. This plant has a capacity of 90,000 hp., of which 61,600 hp. is now available. The plant will furnish the additional power required for the operation of the first division of the Milwaukee road and other large demands for power. The electrolytic refinery and other departments of the plant being installed by the Anaconda company at Great Falls will be ready for operation by Feb. 1, and a large amount of electric power will be needed there. The new equipment at the Washoe works at Anaconda is practically finished and the requirements there for additional power will likewise be large. Combined with the growth of the cities furnished with light and power by the Montana Power Co., this has made such an increase in the call for electric energy that all additions to the company power resources are practically taken in advance. The Volta plant is the largest of the company's hydro-electric plants. Its construction took three years. The equipment consists of four units of 15,000 hp. each and two smaller units of 800 hp. each, while provisions are made to bring the capacity of the plant up to 90,000 hp.

SALT LAKE CITY—Nov. 18

The Utah Iron and Steel Co., recently incorporated, has started operation at its plant at Midvale, and will supply iron and steel for building and manufacturing purposes. At present the plant is making round and square iron from ¼ in. to 4 in. in section, and flat material from 1x⅛ to 8x2 in. After the first of the year mine rails of 8, 12, 16, 18, 20, 25 and 30 lb. per yard will be manufactured. Other equipment will soon be installed, including an openhearth furnace. It is expected to manufacture structural angles for heavy construction. At present concrete-reinforcing bars are being made. C. W. Whitley is president. The properties and business formerly conducted by the Silver Bros. Iron Works Co. has been taken over by the Salt Lake Iron and Steel Co., which has assumed the obligations of the old company. The company announces that it is equipped to make nearly all kinds of iron, steel, brass and copper work, and asks to be allowed to bid on local iron and steel work, before orders are placed with eastern firms. A specialty is made of mining and especially designed machinery. O. C. Beebe is president.

Directors of the Utah Chapter of the American Mining Congress have passed a resolution, endorsing the resolutions of the Mining and Metallurgical Society of America, which has called a convention of mining men to be held in Washington, D. C., Dec. 16, for the purpose of urging upon Congress the necessity of revising the mineral-land laws affecting mining locations. Certain resolutions of the Mining and Metallurgical Society of America have been adopted by nearly unanimous vote and these the society will introduce at the meeting of Dec. 16. The subject is covered in the proceedings of the Society supplemental to Bulletin No. 87, Aug. 31, 1915, Volume 8, No. 8. Delegates of the Utah Chapter will be appointed for the purpose of presenting this resolution at the meeting on Dec. 16. The matter will also be taken up with Utah's Senators and Congressmen here with a view to getting them to take an active interest in the subject. The Secretary of the Mining and Metallurgical Society has been writing to the officials of mining companies here in Utah urging them to attend this convention or send representatives. R. C. Gemmell, governor of the Utah Chapter of the American Mining Congress, in a letter Nov. 16, to officials of Utah mining companies, outlining the above, says, he "realizes it is difficult for many of us here to get away for a trip of that kind, and therefore would respectfully suggest that if you cannot go yourself, you take the matter up with the officers of your company in the east, recommending that they send a representative of your company to the meeting." Mr. Gemmell states he has made such a suggestion to the New York officers of the Utah Copper Co. and adds that the meeting is a very important one and as many mining companies as possible should be represented.

WALLACE, IDAHO—Nov. 12

The Passing of the Ray-Jefferson into the control of the Days, reference to which is made in The Mining News of this issue, is a matter of deeper significance than appears on the surface. Prior to the meeting of the stockholders of the Ray-Jefferson in this city on Nov. 6, J. B. Beaty, secretary of and acting for the Consolidated Interstate-Callahan Co., who is also attorney for the American Metals Co., had offered 55c. per share for all or for a majority of the stock of the company, 1,500,000 shares, being on a basis of $825,000 for

the property, and it is learned from reliable sources that this offer was raised to practically a million when the stockholders met for the purpose of adding 500,000 shares to the capital stock of the company. This offer was met by Harry L. and Eugene R. Day, managers of the Federal and Hercules companies, respectively, both of whom were at the meeting, with the announcement that they stood ready to duplicate any offer that was made for any amount of the stock, and that as they had undertaken to finance the company, they felt that they should be given the preference by any stockholders who desired to sell. This talk won; the Interstate-Callahan offer was turned down, and the meeting proceeded to increase its capitalization by 500,000 shares which were turned over to the Days for their financial support and which gave them the control of the company. The Ray-Jefferson joins the Interstate-Callahan on the west and the development of both properties leads to no other conclusion than that the great orebodies of the latter extend into the former. The original Callahan ground lies next to the Ray-Jefferson. Reverting to the controversy within the Interstate-Callahan company over the appointment of a receiver and for the control of the company, which will engage the attention of the federal court at Coeur d'Alene the coming week, it will not be difficult to discover a motive for the control of the Ray-Jefferson outside of the actual value of the property. Since the appointment as receiver of the Interstate-Callahan by the state court, of Eugene R. Day, who is awaiting action by the federal court before taking charge of the property, the impression has grown that the ultimate purpose of the Callahan faction, which is trying to wrest control, is to dissolve the Consolidated company and combine the original Callahan property with the Ray-Jefferson. The receiver was already a large stockholder in Ray-Jefferson, had already guaranteed large financial support and the actual control of the property by him and his associates was clearly foreseen. That the Interstate-Callahan company believed this to be the purpose is plainly indicated by its eagerness to secure the Ray-Jefferson at almost any price, and it is equally evident that the Days, in meeting any offer, regarded it as essential to consummating their plans. In contending for the removal of the receiver in the federal court, it is expected that this phase of the case will be given much attention, in connection with the splendid financial condition of the Interstate-Callahan company, as showing that there was no valid ground for the application for a receiver and that it was not made in the interest of the stockholders of the company.

DEADWOOD, S. D.—Nov. 11

Lithium Ore is being Produced at three mines in the Keystone district, and several others are yielding these ores intermittently. The principal producing mines at present are the Hugo and Peerless, operated by H. Reinbold and the Bob Ingersoll, owned by C. H. Kamman. Amblygonite is the principal ore mined; it averages about 5% lithium and is worth $38 per ton, f.o.b. the Atlantic Seaboard, which is equivalent to about $28 a ton f.o.b. Keystone.

Wolframite is Being Produced on a large scale at the Wasp No. 2. Since the first of the year the production of ore, hand-sorted, averaging nearly 50% tungstic acid, has brought on the market over $100,000. Several hundred tons of medium-grade ore has been piled on the dump awaiting the construction of the contemplated concentrating unit of about 25 tons daily capacity. T. J. McGowan is taking out ore which will be shipped to McNish and Mills for concentration. The Black Hill Tungsten Co. is preparing to resume work in both mine and mill. Tungsten ores are also attracting attention around Hill City, where within the last few weeks, more than 50 locations have been filed on tungsten outcrops.

MORENCI, ARIZ.—Nov. 19

The Unionists Are Jealous of the Duncan tent colony, which is being added to by about 30 strike deserters daily. Although Gutierrez de Lara, organizer, denies the report that he advised the strikers, in public address, to consider means of breaking up the colony, he says that Duncan is the place for those who cannot distinguish between right and wrong; and that if supplication will not avail to bring them to a proper state of mind, a little physical force might turn the trick. The strike will be fought to a finish. Now is the time to "teach the mining companies their lesson" and to "stop, once and for all, assaults on organized labor." Everybody coming in is halted by strikers at the depot and his identity and business ascertained. The deputy sheriffs look on, or perhaps vouch for the "neutrality" of the visitor. Only 65 troops are still enjoying their outing here. Sunday train service between Morenci and Guthrie, Morenci So. Ry., and Sunday passenger service between Clifton and Hachita, N. M., A. & N. M. Ry., have been discontinued.

OATMAN, ARIZ.—Nov. 19

The Oatman District, which is enjoying such a substantial boom just now, is reached by wagon or automobile from Kingman, Ariz., about 25 mi. northeast, or about 12 mi. northeast from Needles Calif. Both points are on the Santa Fé. The old camp of Oatman is situated on rolling foot hills 10 mi. east of the Colorado River and is surrounded by mountains on the north, east and south sides. The population has increased from about 500, six months ago, to about 2,000 at present, and the dwellings now being erected have a look of permanency. The town enjoys a newspaper, ice plant, running water and other luxuries. Several properties in the district have changed hands recently, and much development work is being done. According to reports, there are any number of orebodies of all sizes and descriptions, assaying from $20 to $1,200 per ton. The Gold Roads mine, U. S. Smelting Co., ships about $65,000 gold bullion monthly, and the United Eastern has ore blocked out to the value of 8 or 10 million dollars. A few days ago the James mill at Secret Pass sent to Kingman a gold bar valued by the bank at about $850, the cleanup of only 105 hrs. run. The new slogan throughout the county is that "The greatest knocker in Mohave County is opportunity."

COBALT, ONT.—Nov. 20

Local Agitation for Coinage of a Small Cobalt Coin of 5c. denomination for Canadian circulation is being pushed, and some hope that England may also be induced to come into line on this financial innovation. It is argued that cobalt is as available for coins as nickel and it is hoped to have in circulation a distinctively Canadian coin which will be designated in the vernacular a "cobalt" in emulation of the ubiquitous and nimble American "nickel." Also there is the local motive of enlarging the market and uses for cobalt which is distinctively a Canadian product and which is found there in such superabundance.

The Future of the Silver Market is an ever present subject of discussion in this camp. When the war began all the "wise ones" predicted a rise in silver. Various reasons were advanced and high authorities were quoted to back the arguments. In fact, managements of the companies in the financial centers seemed to be of the same opinion as the local "wise ones," for several of the companies made arrangements to hold all silver for the expected great and immediate rise. After more than a year of very low market the "bull" argument is again to the front with the same reasons and some others based on the real or imagined financial status of the world as affected by the present prodigious expenditures of Europe. It is argued that Europe must go on a silver basis in order to meet the extraordinary conditions which have arisen or are likely to result from the war. The optimists have the floor for the time and the good behavior of the silver market for several weeks aids them. To the outsider the great concern about silver can be understood better than sympathized with. This camp produces silver for from 10c. to 25c. an ounce and while the extra cent or two on the selling price is interesting, it is not vital to the present or immediate future of the mining industry of Cobalt. Several of the strong companies have for some time been storing silver in the banks against the expected rise, which has resulted in a growing dissatisfaction among the stockholders who claim that the small gain so far evidenced is hardly an offset for the loss in interest, and anyway they would like their money for present opportunities. Already letters of protest are being sent to the managements by large stockholders. It remains to be seen whether the "wise ones" are as right now marketwise as they were a year ago. No doubt a strong rise in silver would result in a greatly enlarged production from the camp, for it is known that several of the large companies are not now pushing output to the limit and in fact recently several of them have curtailed mining operations presumably in hopes of a better market at some future time.

BALFATE (VIA TRUJILLO), HONDURAS—Nov. 8

The Discovery of Asphalt in Honduras, near Jutigalpa, was mentioned in a recent number of the "Journal," giving it as tributary to Amapalla as an outlet for the product, etc. As a matter of fact, it is tributary to Trujillo, on account of the shorter distance—approximately 180 mi. with a standard gauge railroad being built and well under way by the Truxillo R.R. Co., (Truxillo and Trujillo are one thing), which is heavily financed; Jutigalpa being the objective point, with Trujillo as the ocean terminal. This will open a rich mineral country, chiefly gold and copper; the latter exists in veins with vertical exposures in creek cañons of from 10 to 45 ft., and is rich ore, some assaying 42% copper with a gold content of $800 per ton. Some have been worked in a crude way. Most of the church bells in Olancho were cast with metal from this ore.

The Mining News

ARIZONA

Gila County

OLD DOMINION (Globe)—Production of Old Dominion smeltery for October was 2,700,000 lb. of copper, an increase of 400,000 lb. over September. Concentrator is handling daily about 100 tons of ore from Arizona Commercial and about 600 tons from other sources. Old Dominion mine is producing 900 to 1,000 tons of ore per day, and pumps are handling 5,000,000 gal. of water daily. The unwatering of Big Johnnie shaft is progressing satisfactorily.

Mohave County

LEXINGTON (Kingman)—Sinking of three-compartment shaft at Lexington mines to depth of 600 ft. will be started soon. Cross-cutting will begin at 600-ft. level.

Pima County

NEW CORNELIA COPPER (Ajo)—New railroad from mine at Ajo to Southern Pacific R.R. at Gila Bend will be completed Jan. 15.

Yavapai County

BAUMANN (Prescott)—Stockholders of Baumann Mines Co., St. Paul, Minn., men, contemplate extensive campaign of development work at mines. One-mile wagon road now being built to property.

PITTSBURGH (Briggs)—Work of developing Pittsburgh mine, situated on Castle Creek near Briggs, has been resumed by C. E. Champie. Has large quantity of rich ore blocked out and will soon begin making regular shipments.

ARKANSAS

Sebastian County

A NATURAL GAS WELL, sunk at Fort Smith, Ark., by Harry Kelly, at 2,300 ft., is yielding 15,000,000 cu.ft. of gas per day.

CALIFORNIA

Amador County

ZEILA (Jackson)—Reported that Kennedy Mining Co., which recently purchased this mine, will sink a new shaft for development and operation of orebody disclosed about year ago.

PLYMOUTH CONSOLIDATED (Plymouth)—Report of W. J. Loring, representing Bewick Moreing & Co., states that company expended $830,000 in development and installation up to time milling of ore began. Form Aug. 1, 1914, to Oct. 1, 1915, gross production has been $686,074; surplus over all expenses being $218,030. Mine is equipped with 30 stamps but only 25 have operated. In period named 141,623 tons of ore were treated; average duty per stamp at present time is about 11 tons, and recovery, fraction under 90%. Total cost including development has run from $6,000 to $9,000 per month, making per ton cost under $2.90.

Butte County

ZENITH IRON (Forbestown)—Reported that men representing U. S. Steel Corporation have undertaken development of this iron and chrome deposit. Ore is being hauled to Oroville by motor truck and shipped to Pennsylvania by Western Pacific.

WHITLOCK (Chico)—Shipment of 22 tons of sacked ore to Selby first ore shipment from Chico for several years. Mine is situated on Butte Creek; owned by Frank Whitlock, K. D. Crowder and others. Ore hauled distance of about 15 mi. to Chico in motor trucks.

Calaveras County

CALAVERAS COPPER (Copperopolis)—On No. 4 level 15-ft. body of ore in hanging wall reported to assay more than 8% copper. Besides ore going to concentrator, some shipments are being made.

GREEN MOUNTAIN (Angels Camp)—J. B. McGuire and J. Ivers operating under lease on this gravel mine in Chili Gulch are taking out pillars left in old workings and receiving good returns. Some of gravel yielded at rate of $50 per car. Gold is coarse.

Eldorado County

EUREKA SLATE (Placerville)—W. J. Dingee reported to have installation of new machinery near completion. Old machinery is being overhauled and tested aërial tramway has been repaired and will be extended to railroad. Production of slate is expected to be resumed soon.

Inyo County

CUSTER (Darwin)—J. H. Thorndike has resumed work. The shaft is being straightened and preparations are being made for active development.

DARWIN DEVELOPMENT CO. (Darwin)—Knox 10-ton tractor has been received and will be used in hauling the ore 24 mi. to Keeler, nearest railroad shipping point. Company is operating under lease and purchase option.

Kern County

GENERAL PETROLEUM (Taft)—New pipe line in north Midway in course of construction, with 100 men employed and 100 to be added as soon as work is in shape to handle them. Pipe line will be 26 mi. long.

YELLOW ASTER (Randsburg)—Both mills, with total of 130 stamps, crushing about 300 tons of ore per day. Earnings for first eight months of 1915 totaled $305,584. Total costs of operation, $199,068; surplus, $106,516; dividends for period, $11,000.

Monterey County

PATRIQUEN (Parkfield)—Small retort being operated, producing 20 flasks of quicksilver per month. Shipments go out by way of San Miguela.

San Bernardino County

TRONA POTASH (Trona)—Large amount of machinery received and new surface buildings erected preparatory to increasing operations at Searles Lake. Refining plant at San Pedro near Los Angeles will be installed.

Shasta County

MENZEL (Redding)—A. Meagher and Frank D. Barbet are reopening this mine on Flat Creek and have 200 tons of ore ready for shipment to Mammoth smeltery at Kennett.

MAMMOTH (Kennett)—A 2-unit zinc-oxide plant is being installed to be operated in conjunction with baghouse, in further reducing fumes. Drill sharpeners are being installed at Sutro and Friday-Lowden. An air-pipe line is being laid from Mammoth compressors to Friday-Lowden, distance of 4,000 ft. Tunnel to be driven from this point will tap Mammoth 500 ft. below present No. 5 tunnel, which is main working level.

Tuolumne County

DUTCH-SWEENEY and APP (Jamestown)—W. J. Loring, principal partner of Bewick Moreing & Co., has interested American investors and taken over these 2 mines. Dutch-Sweeney was recently acquired by Melones interests, and App has been idle for about 2 years, being closed down prior to death of Capt. Nevills, original owner.

COLORADO

Clear Creek County

PRODUCTION DURING THE MONTH OF OCTOBER from the mines adjacent to Idaho Springs amounted to $48,200. Of this amount, $30,200 is represented by 87 carloads, or 2,175 tons averaging $14 a ton, shipped through the Chamberlain Ore Co. The balance of $18,000, is represented by bullion from the Argo mill to the Mint at Denver. The production is about $2,500 or 5½% more than for the same month last year.

CAPITAL MINING AND TUNNEL (Georgetown)—Adit which is being advanced on Aetna vein has opened 12-in. vein of high-grade ore, assaying 1 oz. gold, 40 oz. silver and 25% lead.

GEORGETOWN TUNNEL AND MINING (Georgetown)—This development tunnel is to be advanced an additional 100 ft. under contract awarded to Chas. Jones and Edward Wing. John Keating, of Georgetown is manager.

ALMADEN MINES CO. (Idaho Springs)—Entire property of this company, situated in Lower Fall River Mining District, has been sold to satisfy judgment amounting to $27,620. Property was purchased by George Neill, of Topeka, Kan., and J. A. Greenfield, of Bellaire, Ohio. Active development of mines will be resumed in near future.

Denver County

WESTERN CHEMICAL (Denver)—Continues to make large expenditures for increasing its manufacturing capacity. Business has increased markedly since withdrawal of competition by eastern manufacturers who are filling war orders. This company now sells more than 1,500 tons of sulphuric acid per month; product being derived from complex Colorado sulphide ores that are purchased at an average price of $12 per ton.

Teller County

BEQUA SAVAGE GOLD MINING CO. (Cripple Creek)—This is new incorporation organized to take over holdings of old company of same name. Directors for first year are J. S. Guyer, Jas. Yeomans, Albert Schumacher, J. T. Hawkins and Sarah Finegan. Property is located on eastern slope of Beacon Hill adjoining Gold Dollar, St. Thomas, Commonwealth and Little Nell properties. Campaign of development is under advisement.

SHOO FLY (Cripple Creek)—This property on southwestern slope of Womack Hill is being developed under lease by Hickman & Co. Old discovery shaft has been cleaned out and will be sunk to depth of 100 ft. Rich surface discovery, which was made about 50 ft. north of the shaft, will be developed through new shaft. Recent sampling of vein indicates high-grade ore. A 2½-ft. streak assays over 9 oz. gold for distance of 15 ft. along vein. Screenings from ore produced from surface openings assay 15 oz. gold. Western extension of Shoo Fly vein has been opened in Iowana property. Ground is included in Block 160 of Stratton Estate.

JERRY JOHNSON (Cripple Creek)—Property is being operated from 650-ft. level to surface by Caley Leasing Co. which is performing active development. Caley mill has been started and it is estimated that available low-grade ore in mine will keep plant busy for four or five years. Rich strikes have recently been made on 160-ft. and 550-ft. levels. Concentrates from mill are averaging about $28 a ton. Mine is being actively developed on 850-ft. level by Cripple Creek Deep Leasing Co. which controls ground below the 650-ft. level. Payable ore has been opened in new development. Since commencing operations this company has completed 275 ft. of crosscutting and drifting. Another crosscut will be started on 950-ft. level

IDAHO

Shoshone County

NATIONAL COPPER (Mullan)—Mill started Nov. 11, after much delay in getting equipment. It is reported that bins hold 12,000 tons of ore and mine is in condition to keep mill going at capacity, 500 tons, per day. Recent development has disclosed better grade of ore in drift from bottom 200-ft. shaft and also in upper workings, improvement being in both copper and silver.

COEUR D'ALENE ANTIMONY (Kellogg)—This company which took over old antimony property at mouth of Pine Creek is building mill, frame work of which is almost completed and much machinery on ground. Shipped one car that averaged 36% antimony and second car is in transit. Much ore in sight in mine, one shoot being 80 ft. long and 4 ft. wide. All ore will be milled and it is expected that shipping product of not less than 50% will be turned out.

COLONIAL MINING CO. (Kellogg)—Company, of which Watson and J. D. Beebe are controlling factors, was recently organized to take over Little Pittsburg property on Pine Creek. Contract let to Union Iron Works of Spokane for tram 1½ mi. long; to deliver ore at base of hill; tram is to be completed in 5 weeks. Ore will be hauled by team from end of tram to railway station, 7 mi. Company has ordered machinery for sorting plant and expects to ship 30 cars monthly of crude zinc ore.

RAY-JEFFERSON (Wallace)—Meeting of stockholders Nov. 6 increased capital stock from 1,500,000 shares, par value of 25c., to 2,000,000 same par. Additional stock taken by Harry L. and Eugene R. Day, manager of the Federal and Hercules companies, respectively, and gives them, with their former holdings, 850,000 shares, or practical control. Mill will be built on Beaver creek early in spring, and it is regarded as certain that railroad will be built from North Fork branch of the O.-W. R. & N. to Ray-Jefferson, distance of about 10 mi. Company owns 32 claims and large ore shoots have been developed on two veins, both lead and zinc.

INTERSTATE-CALLAHAN (Wallace)—Report of John A. Percival, president of the Interstate-Callahan company, for quarter ended Sept. 30, 1915, has been made public. Total receipts were $1,049,478; operating costs totaled $162,351 and improvements $23,935, leaving operating profit of $863,192. Tonnage mined was 29,021; shipments of crude ore and concentrate aggregated 15,443 tons—ratio of run-of-mine ore to shipping product of 1.879 to 1. Of crude lead ore 203 tons was shipped, assaying 19.54 oz. silver and 40.68% lead; of crude zinc ore, 2,506 tons, 49.01% zinc. Ore milled totaled 24,595 tons, 28.5% zinc. Concentrates produced were: Lead, 792 tons, 23.86 oz. silver, 53.33% lead; zinc, 11,942 tons, 48.66% zinc. Ratio of milling ore to total concentrates was 1.93 to 1. Total cost per ton of ore mined was $5.495, of which $3.389 represents cost of mining and $2.106 the cost of treating and shipping.

MICHIGAN

Copper

CALUMET & HECLA (Calumet)—Shipments of silver to United States Mint increasing steadily. The amount this month was $27,000.

NEW ARCADIAN (Houghton)—Third mill test showed 34 lb. of mineral per ton in 1,132 tons of rock. Showing is quite as good as two previous tests.

NEW BALTIC (Houghton)—Has operations well under way to reach Arcadian lode. Treasury is amply supplied with funds, $60,000 in all when last assessment is fully paid.

WHITE PINE (Ontonagon)—In addition to copper is finding considerable silver and some gold in its recoveries. Another important development is the realization that the shale carries commercial copper. When this property first opened and for the first few years of its underground opening work greatest difficulty was narrowness of rich standstone vein, bounded by shale. Shale does not run as high as sandstone in copper, but it does give a width of 30 ft. of profitable vein matter.

MINNESOTA

Cuyuna Range

ROWLEY (Barrows)—Electric pump installed and sinking will shortly be resumed.

CUYUNA-DULUTH (Ironton)—After idleness of over a year this company's Ironton shaft will shortly resume operations.

CRAFT (Crosby)—Drifting is progressing but no production will be shipped this season. The 40-acre tract immediately east of Craft has been optioned for lease on a 25c. royalty and 20,000-ton minimum. Grantees in transaction are not named.

CUYUNA-SULTANA (Ironton)—Soo Line now laying steel on spur to mine. If same is completed before navigation closes, the 6000-ton stockpile of manganiferous ore will be shipped. Daily production 200 tons. Mine and concentrator will be operated all winter.

Mesabi Range

LA RUE (Nashwauk)—Washing plant being thoroughly overhauled. It is planned to increase production to 300,000 tons next season.

Vermilion Range

SOUDAN (Tower)—Concrete foundations being laid for new steel shaft house, superseding present wooden one.

MISSOURI-KANSAS

NEW CENTURY (Galena, Kan.)—Has started up again after being shut down for few weeks making some improvements in plant. Installed new set of sludge tables to help handle slime that comes from fine sand in overflow from steam jigs, which formerly was carried off by water to supply pond. Is one of best equipped plants in district.

J. M. SHORT (Joplin, Mo.)—Has made an exceptionally good strike on his 10-acre lease on Banker land southeast of Joplin. At 145 ft. struck ore which assayed 29% zinc. Ore continues down to 165 level where it assays 19%, with same grade of ore in bottom of shaft. Will drill another hole or two and if they prove as good as first one, will build new plant to handle ore.

GRAND TOWER (Joplin, Mo.)—To build new concentrating plant on lease of 10 acres southwest of town. Plant will be 150 tons' capacity; run by electric power. Ground was worked several years ago, but shaft and ground caved in and ground was abandoned. New company has sunk new shaft; struck first ore at 65 ft. which continued down to 90-ft. level, giving 25-ft. face of good ore which assays from 10 to 20%.

MONTANA

Dawson County

NATURAL GAS NEAR GLENDIVE—It is reported that natural gas in commercial quantities was struck Nov. 17 in well, 11 mi. southwest of Glendive. Drill was sent to depth of 751 ft. and flow of gas showed pressure of 400 lbs. per sq.in. Two other wells will be drilled at once and gas piped to city where a franchise for its use has already been awarded.

Jefferson County

BOULDER MINING DISTRICT—Doctor Ironside, of Butte, who owns Shield property, 12 miles south of Boulder on Little Boulder River, is building concentrator. He has put up sawmill near mine to cut timber for mine and mill; expects to complete mill next spring. There is said to be fine showing of ore containing copper, silver and gold. Forty men are employed at property at present.

Lewis and Clark County

UNIONVILLE MINING DISTRICT—Reported that rich strike of gold quartz has just been made in an old tunnel at mouth of Arrastra gulch. Vein is declared to be 7 or 8 ft. wide and the ore to be free milling carrying from $50 to $75 of gold per ton. Mine is located 3 mi. above road to Unionville in neighborhood of East Spring Hill properties. Strike was made while doing assessment work.

Missoula County

RICHMOND (Saltese)—Shipments average one car of ore a week to British Columbia smelters. Ore carries 8 to 29% copper and $4 to $8 in gold. Construction of aërial tram postponed and wagon road is being built from Adair, 3 mi. from mine. Ore is now shipped by way of Saltese, 6 mi. from mine.

Silver Bow County

NORTH BUTTE (Butte)—Widows of eight of the 16 victims of the explosion at Granite Mountain shaft which occurred Oct. 19, applied for lump sum settlements of $4,000 each when they appeared before E. A. Spriggs, chairman of state accident board, at meeting held in Butte Nov. 11 to determine compensation. Board hesitates about giving lump sums because few of these women have had business experience, and it would defeat purposes of act for them to lose their compensation in short time. Compensation in all will amount close to $75,000. Injured men will not receive full compensation until their injuries are determined. In meantime they will receive $10 a week.

NEVADA

Mineral County

LUCKY BOY (Hawthorne)—A 600-ft. tunnel completed recently for haulageway and drainage. Upper workings 300 ft. above face of tunnel which is 1,200 ft. below original Lucky Boy shaft collar. Several leasers are working around 800-ft. level.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 13 amounted to 9,189 tons, estimated value $191,362, compared with 10,343 tons week previous. The producers were: Tonopah Belmont, 2,887 tons; Tonopah Mining, 2,250; Tonopah Extension, 1,850; West End, 609; Jim Butler, 1,100; Halifax, 70; North Star, 53; and miscellaneous leasers, 370 tons.

Storey County

SIERRA NEVADA (Virginia)—Development on vein 2,500 level disclosed low-grade ore; 68 tons of ore saved averaging $11.42 per ton.

ANDES (Virginia)—Saved 15 cars of ore from stope above 175 level. Repairs to 250 level connecting with 250 level of Central has been started.

OPHIR (Virginia)—In Central tunnel 250 level disclosed 7 ft. good milling ore. Saved 359 cars of ore from stopes above north and south drifts; milled 312 tons.

MEXICAN (Virginia)—Sampling in west crosscut on 2,500 level and prospecting on 2,700 level. Winze on 2,700 level shows 3 ft. of vein matter in bottom; selected samples assay $50 per ton.

CROWN POINT-BELCHER (Gold Hill)—Saved 153 tons of mill rock from sill floor; north drift reopened to 130-ft. point; 86 cars mill rock saved; Jacket mill received 878 tons of dump rock and shipped bar of bullion.

UNION CONSOLIDATED (Virginia)—Extracted 105 tons of ore averaging $26.32 from south end of No. 3 stope on 2,500 level, and 56 cars of low grade in making room for timbers. Saved 50 tons of ore averaging $18.40 from raise in No. 1 stope. Top of raise in ore sampling $20 per ton.

NEW MEXICO

Grant County

J. T. OGLESBY (Pinos Altos)—Has arranged to finance custom mill for district. Plant will be erected on old Bell & Stephens mill site.

Lincoln County

WILD CAT LEASING (White Oaks)—North and South Homestake mines of the Wild Cat Leasing Co., and Old Abe mine, mills and water rights, also Miner's Cabin and Silver Cliff mines, were sold last week to Richard Wirhtman and associates, of New York, for $250,000. Edward Queen, formerly of the Wild Cat Leasing Co., will have charge of the properties. The new company will rush mining of tungsten ore, of which a carload was recently shipped that netted over $19,000.

PENNSYLVANIA

Allegheny County

PENNSYLVANIA SMELTING (Carnegie)—Day interests, identified with purchase of old smeltery at Northport, Wash., have announced purchase of refinery at Carnegie from Pennsylvania Smelting Co., and state that its capacity will be increased to take care of output of Northport plant.

SOUTH DAKOTA

Lawrence County

RATTLESNAKE JACK (Galena)—A chute of high-grade ore was encountered in the main workings. Two Wilfley tables are being installed in the mill and as soon as the Oliver filter is added the plant will resume operations.

Pennington County

BIG HIT (Keystone)—Shaft being unwatered and property undergoing repair for active development work.

INGERSOLL (Keystone)—Regular weekly shipments of a carload of spodumene are being made to the East.

COLUMBIA (Keystone)—At this property, financed by Supt. R. Blackstone, of Homestake Mining Co., shaft is to be sunk to the 200-ft mark, where further lateral work will be done. New shaft is 325 ft. from old shaft, which produced $100 ore. New shaft has disclosed ore; also found in crosscut on 100-ft. level.

TEXAS

Culberson County

HAZEL (Van Horn)—Is now being worked by Steele-Sutton-Steele Co., of Dallas. Last car shipped netted $125 per ton in silver and copper.

PECOS (Van Horn)—Which has been shipping copper ore for last six months, has been leased by P. B. Walker and associates, of El Paso and Mexico. They will start regular development at once and will sink 120-ft. shaft to depth of 200 ft., where they expect to find silver ore.

UTAH

Beaver County

CROFF (Milford)—Fifteen inches of silver-lead ore has been opened in bottom of Lucky Boy shaft, at this property in Lincoln mining district.

MOSCOW (Milford)—New electric hoist has been shipped and should be installed shortly. Cullen shaft is to be sunk 300 ft. deeper from 800 to the 1,100 level.

DAVIS LEASE (Beaver City)—A 30-ton mill test is being made on second-class ore from this lease at Fortuna. Ore is being hauled 10 mi. to Sheep Rock mill to be treated.

FORTUNA GOLD QUEEN (Beaver City)—Work at this property has been started under direction of R. N. Strickland. Material has been delivered for erection of mine buildings, etc.

LUMLEY & MOORE (Beaver City)—Joe Davis lease has opened ore running well in gold. Five and a half feet are exposed. Harris & McGillis lease on parallel vein has opened 12 ft. of ore.

MAJESTIC (Milford)—Last car shipped by this company from its Old Hickory mine in Rocky district, carried 3.85% copper and 2.2 oz. silver per ton. Work is being done from bottom of large open cut. Vein is 20 ft. wide.

Juab County

UTAH POWER AND LIGHT CO.'S CONSTRUCTION WORK on new substation, owned jointly by Eagle & Blue Bell and Chief Consolidated, is well under way. The transformers have arrived. An automatic voltage regulator is being installed.

EAGLE & BLUE BELL (Eureka)—Foundations for new 250-hp. hoist have been laid, and gallows frame is nearly finished. Much of electrical equipment has been delivered, and is being installed.

YANKEE CONSOLIDATED (Eureka)—Shipments from new strike have been started; these are high in silver. New tunnel is being driven to tap ore at greater depth, which will facilitate handling and allow for disposal of waste. About 125 ft. of work will be necessary to make connections with winze. New work has been started in southeastern part of ground where tunnel is being driven in search of Beck Tunnel vein. Shipments of high-grade zinc ore from old stopes being made by leasers.

Salt Lake County

WORK IN BIG COTTONWOOD is being done at the following properties: Reed's Peak, five men; Branborg, three men; East Carbonate, three men; Big Cottonwood Consolidated, five men; Tar Baby, four men; Price Mining, six men; Monte Cristo, six men; American Consolidated Copper, six men; Kennebec, three men; Cardiff, 115 men; Last Chance, two men; Thor & Venus, two men, total, 160 miners.

ALTA CONSOLIDATED (Alta)—Drifting has been started at 100-ft. point in winze sunk on Braine fissure.

PRICE MINING (Salt Lake)—Tunnel is in 120 ft., and still in heavy ground. Spiling and timbering is necessary. Property adjoins Cardiff in south fork of Big Cottonwood.

UTAH COPPER (Bingham)—Up to 30,000 and 31,000 tons of ore are being mined and milled daily. Of this Magna mill is handling about 20,000 tons and Arthur between 10,000 and 11,000 tons.

SELLS (Alta)—Ore has been opened from raise 70 ft. above tunnel level. This is thought to be downward extension of Skipper fissure, which produced ore from surface workings. Sells is being operated by A. O. Jacobson and associates, through main tunnel of South Hecla.

ALBION (Alta)—Eight carloads of silver-lead-copper ore, carrying gold, have been shipped by leasers since the middle of October. This comes from old Wellington workings. Ore occurs in strong vein 4 to 5 ft. between walls. Royalties from leasers are sufficient to pay operating and development expenses of company.

NEW ENGLAND GOLD AND COPPER (Bingham)—Suit has been filed in third district court by International Trust Co., of Boston, asking for receiver and foreclosure on this company's property. Action is based on default in interest on $390,000 bonds. Trust company, as trustee of mortgage and trust deed, has been requested by bondholders representing $373,300 to file action and bring about foreclosure. Interest due Feb. 1, 1914, was not paid; interest to date amounts to $46,800. Property consists of seven claims in south branch of Carr Fork, and adjoins Utah Copper and Last Chance claims. Recently operations have been carried on by leasers only.

Summit County

PARK CITY ORE SHIPMENTS for week ended Nov. 11 amounted to 2,156,224 lb. by four shippers. Heavy storms have interfered with ore hauling.

SILVER KING COALITION (Park City)—Working forces now amount to 300 men at mine and mill, as compared to 370 men before strike. Reorganization of force is in progress.

BIG FOUR EXPLORATION (Park City)—New mill at Atkinson is treating 250 tons of old tailing dumps daily. Plant is now in good running order, and efficiency has been greatly increased. Concentrates carrying up to 40% zinc being made.

VIRGINIA

Augusta County

CRIMORA MANGANESE CORPORATION (Crimora)—Has contracted with Ruggles-Coles Engineering Co., New York, for first unit of its new washing plant, which is to have capacity of 100 tons of washed ore in 10 hr. Mill will comprise Kennedy slugger-roll crusher, McLanahan-Stone log-washers and jigs and Stephens-Adamson conveyors and transmission machinery. Foundations are in and it is expected that mill will be ready in January. It is proposed to mine with Schofield-Burkett dragline excavators. W. L. Hogg, manager.

WASHINGTON

Stevens County

UNITED COPPER (Chewelah)—United Copper mine, 60 mi. north of Spokane, earned $4,423 net in September, according to official report of directors. Report states that profits for October will be considerably larger, as mine and mill were working at greatly reduced capacity in September; it is estimated that November earnings will be between $25,000 and $35,000. Mill has been increased by addition of 50 stamps, making 74 in all; plant now is operating at capacity, 235 tons of ore daily. "During the early months of the year we were endeavoring to adapt the new oil flotation process to saving the values from our concentrates," states President Conrad Wolfle, of Spokane. "This entailed considerable experimental work and necessitated tearing out our slime tables and installing the tanks and cells of the new system, as well as making exhaustive tests to ascertain the proper kind of oil required for our sulphide ores. It took some time to get the process down to a profitable working basis, but for several months our saving has ranged from 77 to 80%, which is as good as is being secured by any other plant in the northwest from a similar class of ore. The percentage of saving is being increased continually by further tests and improvements to the process."

CANADA

Ontario

ORE SHIPMENTS OVER THE T. & N. O. Ry., for October, were from: Cobalt proper, Beaver, 30 tons; Buffalo, 92; Cobalt Comet, 63; Coniagas, 32; Crown Reserve, 99; Kerr Lake, 57; La Rose, 37; McKinley-Darragh, 81; Mining Corporation of Canada, Cobalt Lake Mine, 216; Townsite City, 202; Nipissing, 103; Penn Canadian, 31; Peterson Lake, 141; Right of Way, 38; Temiskaming, 31; total, 1,311 tons; from New Liskeard, Casey Cobalt, 29; from Elk Lake, Miller Lake O'Brien, 23; from South Porcupine, Dome Lake, (gold) 31; Porphyry Hill, (gold) 20; from Porquis Junction, Alexo Mine (nickel), 799 tons.

CANADIAN COPPER (Sudbury)—Has given up option on copper property in West Shining Tree on which it was working.

TEMISKAMING (Cobalt)—Has declared 3% dividend; time of payment not being specified. It is 2½ years since company has paid dividend. There is large amount of cash on hand and ore reserves are estimated at about $250,000.

VIPOND (Porcupine)—With reference to rumors of dividend, President Ward states that while results of operations have been satisfactory, it would be premature to consider definite plans for dividend in immediate future. Report covering operations from Apr. 1 to Sept. 30 will be issued soon.

MOOSE MOUNTAIN IRON MINES (Sudbury)—Has been closed. This was largest attempt to work concentrating magnetic iron ores of Northern Ontario. Difficulty was experienced in getting satisfactory briquettes from fines. Over million dollars has been spent by MacKenzie & Mann, and Gates interests.

MANIGOTAGAN GOLD MINING AND DEVELOPMENT CO. (Toronto)—New company formed by Toronto men to operate claims in Gold Lake district of northeastern Manitoba. Section has been known for several years, but recent discoveries are several miles from Rice Lake where first properties were opened up. Development work in that section was unsatisfactory, but new property has all indications of making good. It is in the hands of responsible people and will get a fair chance.

CENTRAL AMERICA

Honduras

NEW YORK & HONDURAS ROSARIO (San Juancito)—The directors and officers of the New York & Honduras Rosario Mining Co. have sent out splendidly engraved announcements, to stockholders and friends, of the Thirty-fifth Anniversary of the company's corporate existence and uninterrupted operation, dating from Nov. 17, 1880.

The Market Report

Metal Markets

NEW YORK—NOV. 24

The outstanding feature of the metal markets last week was the extraordinary strength of copper, which advanced further on large business. Spelter also was stronger. Lead was stationary, but firmer in tone. Tin advanced.

Copper, Tin, Lead and Zinc

Copper—On Thursday, Nov. 18, the market opened at 19c., r.t., on which basis it had become firmly established on the previous day. A large business was done, and before the end of the day 19¼c., r.t., was realized on million-pound lots. The story of the following days is about the same up to Nov. 23, when the market rested at 19¾c., r.t. Some sellers were asking 20c., but, reports to the contrary notwithstanding, this price had not been realized on any important business up to the close of our week of record, and at the close copper was still available in large quantity at 19¾c., r.t.

The advance was orderly throughout the week. Whenever any producer sold all he wanted to at a certain price he raised his asking price ¼c. per lb., while others kept on selling at the previous price until they too had disposed of all they wanted to at that price.

The volume of business done during the week was large, possibly as large as in the previous week. The major portion of it appears to have been done, however, in the early part of the week at prices from 19@19½c., r.t. Business with domestic manufacturers predominated. There was a good demand from wire drawers and an improved demand from the rolling mills. The bulk of the sales was for copper to be delivered the first quarter of 1916. There were some contracts running ahead to May and June. The larger producers report themselves excellently sold up. In some cases the entire expected output for the next four months has been contracted.

Copper Sheets, base price is 24¼c. per lb. for hot rolled and 25¾c. for cold rolled, with usual extras. Copper wire is 20@20¼c. per lb., carload lots at mill.

Copper Exports for the week ended Nov. 6 are reported by the Department of Commerce at 5,820,478 lb., of which 2,241,175 lb. went to Sweden, 1,652,869 to France, 706,337 to Italy, and 508,744 to England. Imports for the week were 953,521 lb. metal and 969,248 lb. in ore and matte; 1,922,769 lb. in all. The chief imports were from Peru, Japan and Canada.

Visible Stocks of Copper in Europe on Nov. 15 were: Great Britain, 15,473; France, 1,645; afloat from Chile, 1,050; afloat from Australia, 3,400; total, 21,568 long tons, a decrease of 3,317 tons from the Oct. 31 report.

Tin—This market experienced a natural reaction from the sharp advance in the previous week. It might have gone further, keeping step with the decline in London, were it not that the supplies of spot tin here are so tightly held. The volume of business during the week was rather light.

Lead—A good business was done, but conditions were quieter than in the previous week. The St. Louis market was a little stronger, especially owing to the sharp demand for chemically hard lead.

Spelter—The conditions in this market are chronically mixed. The change from week to week in the confusion is purely relative, more or less. Last week was one of those in which the confusion was more. Spelter for prompt and early delivery sold up to 18½c. Contracts for December-January-February shipments were taken at 16½@16¾c. Some considerable business for the second quarter of 1916 was done at 14½c. The total volume of business was not very large. The major portion of what was done in some important quarters was for export. Sales to Great Britain were but trifling, the producers reporting that they could not realize the published prices. On the other hand, France was a free buyer. In this country the galvanizers did some buying, out the larger part of the business was with the brass makers. Brass special spelter for delivery during the first quarter of 1916 sold at 18@20c. per lb.

The continued strength of the spelter market causes a good deal of surprise. The explanation offered in a well-informed quarter is the following: The present American consumption for brass is about 240,000 tons, for galvanizing, 100,000 tons, for sheet zinc and miscellaneous purposes, 60,000 tons; the exportation is about 120,000 tons. This gives the total requirement at the rate of 520,000 tons. The present rate of production is probably about that, or only a little in excess of it. The accumulation of unsold stocks so far has been confined to the superior grades of spelter, of which there is undoubtedly an accumulation. The output of the new smelting works has not yet attained large proportions, and probably will not until after the end of this year.

Zinc Sheets base price was advanced ½c. on Nov. 18, making it $19.50 per 100 lb. Nov. 22 there was a further advance and the base price today is $22 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Demand is good.

DAILY PRICES OF METALS IN NEW YORK

Nov	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
18	4 6850	51⅞	18.80 @19.00	41	5 25	5 17½ @5 20	15.50 @18.25
19	4 7000	51¾	19.00 @19.30	40	5.25	5 17½ @5 20	15.50 @18.50
20	4.6913	51⅝	19.05 @19.30	40	5 25	5 17½ @5 20	15.50 @18.50
22	4.6900	52⅛	19.30 @19.55	39½	5.25	5 17½ @5.20	15.50 @18.50
23	4 7013	52½	19.50 @19 60	39½	5 25	5 17½ @5.22½	15.50 @18.50
24	4 7000	54⅛	19.50 @19.60	39	5.25	5.17½ @5.22½	15.50 @18.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Nov.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
18	24 12/16	79¼	79¼	94½	19.77	173½	172¼	26 5/16	5.55	87	18.19
19	25	81¼	80⅞	95½	20.03	172¾	171	27	5.67	98	20.64
20	24⅞	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	25⅛	82⅛	82⅛	96½	20.22	172	170	27⅛	5.74	100	20.92
23	25⅛	81⅞	82⅛	98	20.55	168½	167¼	27⅛	5.83	100	20.96
24	26⅛	80½	80⅞	98½	20.66	166½	165¼	27	5.67	100	20.96

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Nov. 24

Aluminum—Conditions in the market are not changed, and metal for early delivery commands a high price. Futures are lower. Current quotations are 57@59c. per lb. for No. 1 ingots, New York. As high as 60c. is reported paid for one lot.

Antimony—Supplies are scarce and futures uncertain, owing to the difficulty about arranging for shipments of Chinese, and delays in transit. Business has been on a small scale this week, and prices have advanced again, ordinary brands bringing 39@41c. per lb. Cookson's is quoted at 47c. per lb., but is almost wholly nominal, as very little is to be had.

Antimony ore is also scarce. Only a small quantity is offered at about $2.40 per unit.

Quicksilver—Prices continue high in view of a good demand, with only moderate stocks. New York quotations are $105 per flask of 75 lb. for large quantities and up to $110 for smaller orders. San Francisco reports by telegraph an active market, with sales up to $105 per flask. London price remains £16 10s. per flask, with no discount from second hands.

Nickel—There is no change to be noted. Ordinary forms are still nominally 45@50c. per lb., according to size and terms of order. Electrolytic nickel is 3c. higher. The exports have been about the same as last year, a decrease in shipments to Germany being made up by an increase in those to Great Britain.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium metal,** 75c. per lb., New York.—**Cobalt metal,** 97% pure, is sold at $2 per lb.—**Magnesium,** pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.

Gold, Silver and Platinum

NEW YORK—Nov. 24

Gold production in the Transvaal in October was 797,631 oz., being 20,881 oz. more than in September, and 63,885 oz. more than October, 1914. For the 10 months ended Oct. 31 the production was 6,967,166 oz. in 1914, and 7,531,547 oz.—or $155,667,076—in 1915; an increase of 564,381 oz. this year.

Actual arrivals of gold from Europe at New York were $15,750,000 for the week.

Exports of gold from Australia in the months of July and August were £3,468,676, which compares with £444,271 in the corresponding months of 1914. The large increase this year was mainly in shipments to San Francisco from Sydney.

Platinum—Prices are still rising, and are fast becoming altogether nominal, each transaction being a separate negotiation. Sales have been made from $64 up to $70 per oz. for refined platinum. Some dealers decline to quote.

Silver—The silver market has suddenly advanced, owing to combined buying on Mint orders and on India and continental account. It closed at 26¼d. in London and 54½c. in New York.

Shipments of silver from London to the East Jan. 1 to Oct. 27, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£4,679,500	£3,394,000	D £1,285,500
China	42,000	6,250	D 35,750
Total	£4,721,500	£3,400,250	D. £1,321,250

China has been taking very little silver this year, having sold as much or more as has been received in the country.

EXPORTS AND IMPORTS

Imports and Exports of the Minor Metals in the United States eight months ended Aug. 31, in pounds except platinum which is in ounces:

	Imports 1914	Imports 1915	Exports 1914	Exports 1915
Nickel	27,080,939	34,159,151	19,203,732	20,001,725
Antimony	10,031,198	12,942,755	3,673	950,867
Aluminum	10,559,359	6,332,873	18,939	40,102
Quicksilver			24,441	150,042
Platinum, oz	51,821	27,002	143	9

Exports include reëxports of foreign material. Exports of aluminum manufacturers—not included above—were valued at $642,133 in 1914, and $2,678,770 in 1915. Nickel and antimony include contents of ore, matte and regulus.

The tin smelting plant of the American Smelting and Refining Co. at Perth Amboy, N. J., will start up about Jan. 1, it is expected. The initial capacity will be 750 tons monthly.

Exports and Imports of Secondary Metallic Products in the United States, eight months ended Aug. 31, in pounds:

	Exports 1914	Exports 1915	Imports 1914	Imports 1913
Copper sulphate	6,925,087	10,038,396		
White lead	12,201,138	15,926,023		
Zinc oxide	20,069,717	28,473,070		
Zinc dust	47,557	293,358	3,025,911	903,738
Zinc dross	648,631	7,387,208		

The exports of zinc dust reported were all reëxports of foreign material.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Nov. 20

The base price paid this week for zinc ore was $100@108 for 60% grades. The base price paid for 80% lead ore was $64 per ton.

SHIPMENTS, WEEK ENDED, NOV. 20

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,796,000	310,000	$31,300
Year	183,567,750	6,338,640	25,693,990

Shipped during week to separating plants, 5,044,000 lb. zinc ore.

JOPLIN, MO.—Nov. 20

Blende, high price $118; base per ton 60% zinc, premium ore, $115; medium, $114@105; lower grades down to $100; calamine, base per ton 40% zinc, $80@70; average selling price, all grades of zinc, $101.67 per ton. Lead, high settling price, $65.75, base per ton 80% metal content, $64@70; average selling price, all grades of lead, $62.50 per ton.

SHIPMENTS WEEK ENDED NOV. 20

	Blende	Calamine	Lead	Values
Totals this week	13,307,750	2,238,480	2,360,100	$864,100
Totals this year	519,789,440	38,661,560	81,149,870	$23,510,480

Blende value, the week, $715,500; 47 weeks, $20,407,500.

Calamine value, the week, $74,850; 47 weeks, $955,080.

Lead value, the week, $73,750; 47 weeks, $2,147,900.

Sellers held out until noon Friday for $125 for premium ore, but buyers would not offer in excess of $115 and transactions were made at this figure. The advance for blende was $5; calamine advanced $10 and lead $6 per ton. The bulk of reserve ore has been held at Granby, 1,200 tons of the 4,000 tons being shipped this week, with the sale of another 1,000 tons for next week's shipment. Practically all smelting companies closed the week with large purchases for next week's delivery.

Iron Trade Review

NEW YORK—Nov. 24

The iron and steel markets are now fairly on the boom. The mills are everywhere full of orders and in some cases premiums are being asked for early deliveries.

The rush is not all for export trade, as domestic orders are piling up steadily and price advances have not checked the demand. The latest branch of the trade to show rising activity is structural steel. Orders for new construction are being placed rapidly. The demand for plates and shapes for shipbuilding have added to the rush, while new cars are being rather freely contracted for.

Exports from Baltimore for the week included 1,824,700 lb. tinplates to Glasgow.

The pig-iron market is strong and advances of 50c. per ton are recorded. Foundry-iron demand has shown a notable increase, and in some cases early deliveries are sought. Furnaces are going into blast where it is possible, and it looks as if November and December would improve upon the record production of October.

PITTSBURGH—Nov. 23

Buyers of steel seem to be exerting as much pressure as ever to secure the acceptance of orders by steel mills. Recent advances in steel prices were made with the full expectation that demand would be curtailed thereby, the mills feeling amply strong to stand such a decrease, and in the circumstance of demand being as heavy as ever further price advances are now predicted. Last Thursday noon the Carnegie Steel Co. advanced its price on bars, plates and shapes from 1.60c. to 1.70c., and the advanced price was at once adopted by other mills, making a total advance in these products from 1.40c. to 1.70c., or $6 a ton, in five weeks. Galvanized sheets are up $5 a ton, to a range of 4.50 to 4.75c., black sheets being stronger at 2.40 to 2.50 cents.

Steel interests are canvassing all possibilities of increasing production, but erection work promises to be slow and new construction is undertaken only where the conditions are particularly favorable. Pig iron and steel making capacity will not increase by more than a very few per cent. in the next twelve months, by additions at various points and the

completion of a few complete plants that have been under way for a long time.

The Pennsylvania R.R. system on Saturday decided not to buy any freight cars, finding prices and deliveries proposed under its inquiries for 9,000 cars unsatisfactory. The plate mills involved profess relief that the business is postponed. Other roads are slower than was expected in placing car orders, but nevertheless at least 15,000 freight cars have been bought thus far this month.

Inquiry for structural material has increased, indicating at least fairly heavy building operations next season. The demand for structural steel to date has been conspicuously light as compared with demand for other steel products.

Prices on Lake Superior ore for the season of 1916 are likely to be announced before the week is out, at an advance of 75c. or $1 a ton over the schedule obtaining in the past season, these prices having been the same as for 1912 and 1914 and the lowest since 1904. In ore circles it is stated that all the ore available can be sold in a few weeks, large reservations having already been made, and that the limit will be fixed by lake transportation facilities, rather than by mining capacity, and at 55,000,000 to 60,000,000 tons for the season, against the previous record of approximately 50,000,000 tons in 1913.

Pig Iron—The Republic Iron & Steel Co. has bought 25,000 tons of bessemer pig iron from a Shenango Valley furnace interest at $17 at furnace for shipment over the first three months of next year, the market thus being established at an advance of 50c. A few small lots had already been sold at the figure. Offerings of basic iron are limited and an early advance is predicted, with possibilities of continued and sharp advances as there are only two idle merchant furnaces now in the general district. Foundry iron is stiffening sharply, even in the face of a rather light demand, and quotations are 50c. higher than a week ago, with some furnaces quoting above the general range. We quote: Bessemer, $17; basic, $16@16.25; foundry and malleable, $16@16.50; forge, $15.50@16, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Supplies from England are coming in more freely. The English price on contract is steady at $100, Baltimore, while domestic producers may possibly occasionally shade their former quotation of $110 on contract.

Steel—Quotations are difficult to obtain on bessemer steel, while openhearth is scarcely quoted at all, mills being completely sold up for near-by positions and being unwilling to quote for late deliveries. The market is regarded as quotable approximately at the following advanced figures, though the prices are largely nominal: Bessemer billets, $27; bessemer sheet bars, $28; openhearth billets, $28@29; openhearth sheet bars, $28.50@29, f.o.b. maker's mill, Pittsburgh or Youngstown. Rods are about $35 and forging billets about $48 at mill.

FERROALLOYS

Ferrosilicon, 50%, is quoted $83@85, Pittsburgh, according to quantity. Bessemer ferrosilicon is quoted from $33 for 16% down to $23 for 10%, all at furnace.—**Ferrotitanium** is 8@12½c. per lb., according to size of order.—**Ferrotungsten** continues to command high and irregular prices. A sale of **Tungsten** metal, 98% pure was made this week at $7 per lb. for a lot of 500 lb.; and higher prices are expected.

IRON ORE

The leading ore shippers on the Lakes came into the market last week and chartered all the available tonnage to carry ore next season. These charters were made at an advance of 10c. over those for the season just ending, making the rate net to the ship for 1916 delivery 50c. from the head of the lakes, 45c. from Marquette and 35c. from Escanaba.

The anticipated need of a larger quantity of iron ore than had been expected, combined with delays in November ore shipments caused by bad weather, have made heavy shipments of ore imperative in the short time remaining of the season. About all the wild boats available have been chartered, and it is understood that $1 a ton has been paid for ore from Duluth to a Lake Erie port.

Shipments of iron ore from deposits near Waukon, Iowa, are being made to South Chicago, where the ore will be used in the Iroquois Iron Co.'s stacks as an experiment. Possible shortage of Lake Superior ore has led the company to seek a reserve supply from Iowa and tests will be made at once to determine the practicability of its use in ordinary practice. Several thousand tons have been contracted for.

Imports and Exports of Iron Ore in the United States nine months ended Sept. 30, in long tons:

	1914	1915	Changes
Imports	1,094,972	971,098	D. 123,874
Exports	536,115	508,557	D. 27,558

Leading imports this year were 610,698 tons from Cuba and 151,619 tons from Sweden.

British Iron Ore Imports 10 months ended Oct. 31 were 986,518 tons in 1914, and 5,108,770 in 1915; increase, 122,252 tons.

OTHER ORES

Manganese Ore—In Great Britain, according to the London "Mining Journal," October imports were above the average, amounting to 60,931 tons, but owing to the fact that freights entirely govern business shipments are necessarily irregular. Prices remain nominal, but business has been done this week at from 1s. 8d. to 1s. 9d. The situation in India is one of sharp competition between sellers, the f.o.b. rates ruling there being from 6 to 6½d., with occasional shading. The conditions of war are tending to reduce output, and stocks are diminishing. The Bombay figures on Oct. 22 last were 85,649 tons.

Imports of manganese ore in the United States nine months ended Sept. 30 were 215,274 tons in 1914, and 173,992 tons in 1915; a decrease of 41,282 tons this year.

Imports of manganese ore in Great Britain 10 months ended Oct. 31 were 444,975 tons in 1914, and 270,745 tons in 1915; decrease, 174,230 tons.

COKE

Production in the Connellsville region for the week is reported by the "Courier" at 427,381 short tons coke; shipments 430,503 tons. Shipments of Greensburg and Upper Connellsville districts were 42,815 tons.

Connellsville—The market for prompt furnace coke is easier, there being offerings down to $2.15, while $2.10 has been done on one or two odd lots. Corrigan, McKinney & Co. are understood to have closed for their remaining requirements for next year, leaving very little uncovered contract business. We quote: Prompt furnace, $2.15@2.25; contract, first half, $2.35@2.50; year 1916, $2.25@2.35; prompt and contract foundry, $2.90@3.25, per net ton at ovens.

Exports and Imports of Fuel in the United States nine months ended Sept. 30, in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	3,062,057	2,594,754	18,257	2,524
Bituminous	10,902,780	12,421,960	980,284	1,077,799
Coke	485,171	573,084	83,980	36,602
Bunker coal	5,711,948	5,678,815		
Total	20,161,956	21,268,613	1,082,521	1,116,925

The bunker coal or coal furnished to steamships in foreign trade is practically all bituminous. The principal trade, both exports and imports, is with Canada.

Chemicals

NEW YORK—Nov. 24

The General Chemical Co. has declared an extra dividend of 15% on its common stock, payable in new stock. At the same time it is paying its employees a bonus of 10% on their yearly salaries.

Arsenic—Business is quiet, without change. Current quotations are $3.75@4 per 100 lb. for both spot and future deliveries.

Copper Sulphate—Business is steady and sales about as usual. Prices have been advanced and the current quotation is $8 per 100 lb. for carload lots and $8.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is fair and prices are a little stronger. High ocean freights are keeping up the quotation. The current figure is $2.90@2.95 per 100 lb. for spot and December; $2.85 for later deliveries.

Pyrites—Imports at Baltimore for the week included 5,983 tons pyrites from Huelva, Spain.

Sulphuric Acid—60° Bé. acid is selling at $60 per ton, f.o.b. works.

Imports and Exports of Fertilizing Chemicals in the United States eight months ended Aug. 31, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Kainit	317,265	6,646		
Manure salts	150,973	13,647		
Other potash salts	182,091	67,427	2,746	960
Nitrate of soda	371,952	555,846	6,114	14,779
Sulphate of ammonia	51,483	25,745		1,294
Phosphates			899,100	157,806

Exports include reëxports of foreign material. Some phosphates are imported, but are not given separately in the returns.

PETROLEUM

Shipments of Mexican oil to the United States in October from Tampico were 986,616 bbl.; from Tuxpam, 681,968; total, 1,668,584 bbl. This does not include shipments to Europe

Assessments

Company	Delinqe	Sale	Amt.
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0.01
Clear Grit, Ida	Dec. 14	Jan. 5	0.0015
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah	Dec. 11	Jan. 3	0.02
Cons. Imperial, Nev.	Nov. 30	Dec. 21	0.01
Copper Mt. M. & D., Ida	Oct. 28	Dec. 1	0.002
Danley-Lloyd, Utah	Nov. 14	Nov. 30	0.0025
Darby M. & M., Ida	Nov. 16	Dec. 16	0.00125
Dry Canon Cons., Utah	Dec. 18	Jan. 17	0.001
Eastern Star, Ida	Nov. 20	Nov. 29	0.002
Emerald Oil, Utah	Nov. 27	Dec. 16	0.06
Eureka M. & M., Ida	Nov. 26	Dec. 27	0.001
Great Western, Nev	Nov. 15	Dec. 7	0.001
Hancock Cons., Mich	Jan. 3		1.00
Hector, Ida	Nov. 18	Dec. 10	0.005
Idaho & Los Angeles, Ida	Nov. 26	Dec. 27	0.005
Idaho-Nevada Exp., Ida	Nov. 1	Dec. 1	0.002
Ivanhoe, Ida	Nov. 8	Dec. 9	0.0025
Jack Waite, Ida	Nov. 20	Dec. 20	0.01
Laclede, Ida	Dec. 6	Dec. 27	0.003
Leonora M. & M., Utah	Nov. 27	Dec. 17	0.005
Lucky Swede, Ida	Nov. 11	Dec. 11	0.002
Military M. & M., Ida	Oct. 28	Nov. 29	0.0065
Missoula Copper, Ida	Nov. 15	Dec. 15	0.002
Montana Standard	Nov. 15	Dec. 15	0.005
National Copper, Ida	Nov. 20	Dec. 18	0.01
National Lead, Ida	Nov. 15	Dec. 15	0.001
Nevada-Douglas, Nev	Nov. 30	Dec. 31	0.10
New Arcadian, Mich.	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0.50
Northern Light, Ida	Nov. 2	Dec. 2	0.004
O. K. Ex. M. & R., Utah	Nov. 20	Dec. 15	0.005
Old Veteran, Ida	Nov. 1	Nov. 27	0.002
Oom Paul Con., Ida	Nov. 16	Dec. 6	0.01
Oriental, Nev	Nov. 6	Dec. 7	0.003
Original, Nev	Nov. 5	Dec. 7	0.003
Pacific M. & M., Ida	Nov. 10	Nov. 30	0.0005
Phoenix, Mich	Jan. 1		1.00
Reseue Eula, Nev	Dec. 6	Jan. 10	0.01
Seg. Belcher & Midas, Nev	Dec. 12	Jan. 6	0.02
Silver Cliff, Ida	Nov. 8	Dec. 6	0.0025
Sonora M. & M., Ida	Nov. 4	Dec. 17	0.003
Sunset Dev., Ida	Dec.	3	0.002
Sunshine, Ida. (post.)		Dec. 15	0.0006
Ton. Gipsy Queen, Nev	Oct. 29	Dec. 6	0.01
Tonopah Midway, Nev.	Dec. 11	Jan. 11	0.01
Umatilla Ton., Nev.	Nov. 8	Dec. 13	0.005
Wolf Mountain, Utah	Nov. 12	Dec. 14	0.0025

Stock Quotations

The General Development Co. has announced that it will make the par value of its shares $25, issuing four for each one now outstanding.

COLO. SPRINGS	Nov. 22	SALT LAKE	Nov. 22
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	02½	Beck Tunnel	06½
Cripple Cr'k Con.	01	Black Jack	05
C. K. & N.	‡ 02	Colorado Mining	05
Doctor Jack Pot	09½	Crown Point	01
Elkton Con	28½	Daly-Judge	7 20
El Paso	79	Emma Cop	26
Findlay	03½	Gold Chain	52
Gold Dollar	02	Grand Central	52
Gold Sovereign	‡ 04	Iron Blossom	85
Golden Cycle	1 83	Lower Mammoth	07½
Isabella	19½	May Day	17
Jack Pot	06½	Opohongo	00½
Jerry Johnson	05	Prince Con	81
Lexington	‡ 005	Seven Troughs	011
Mary McKinney	44	Silver King Coal'n	2 25
Pharmacist	‡ 008	Silver King Con	2 32½
Portland	1 71	Sioux Con	02½
Raven B. H	03½	Uncle Sam	07½
Yankee	1 66½		30½

TORONTO	Nov. 22		
Bailey	04½	Dome Exten.	28½
Chambers Ferland	19½	Foley O'Brien	55
Conlagas	4 00	Hollinger	26 25
Peterson Lake	31½	Imperial	04
Right of Way	‡ 04	Jupiter	13
Seneca Superior	70	McIntyre	75
Silver Queen	‡ 01	Pearl Lake	‡ 00½
T. & Hudson Bay	20 00	Porcu Crown	78
Timiskaming	48	Preston E. D.	04½
Trethewey	‡ 13	Vipond	77
Wettlaufer-Lor	‡ 07	West Dome	08½

SAN FRANCISCO	Nov. 22		
Alta	‡ 04	Belmont	4 25
Andes	10	Jim Butler	93
Best & Belcher	06	Lone Star	03
Caledonia	49	MacNamara	03
Challenge Con	‡ 06	Midway	12
Chollar	‡ 02	Mont.-Tonopah	32
Confidence	16	North Star	13 00
Con. Virginia	22	Reseue Eula	07
Gould & Curry	04	West End Con	74
Hale & Norcross	04	Atlanta	25
Jacket-Cr. Pt	16	Blue Bell	03
Julia	‡ 02	Booth	38
Mexican	37	C. O. D. Con	04
Occidental	75	Comb. Frac	07
Ophir	28	Dfield Daisy	03
Overman	08	Jumbo Extension	1 17½
Potosi	‡ 02	Pitts.-Silver Peak	06
Savage	06	Round Mountain	41
Sierra Nevada	47	Sandstorm Kendall	09
Union Con	56	Silver Pick	07
Utah Con	03	Central Eureka	08

N. Y. EXCH.	Nov. 22	BOSTON EXCH	Nov. 22
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Juneau	11½	Adventure	12
Am. Sm. & Ref., com.	97	Ahmeek	‡397
Am. Sm. & Ref., pf.	113½	Alaska Gold M.	27
Am. Sm. Sec., pf. A	91½	Algomah	1½
Am. Sm. Sec., pf. B.	85	Allouez	57½
Anaconda	88½	Am. Zinc	70½
Batopilas Min.	1½	Ariz. Com., ctfs.	8
Bethlehem Steel	468	Bonanza	‡ 30
Bethlehem Steel, pf.	161½	Butte-Balaklava	3½
Chino	54½	Butte & Superior	72½
Colo. Fuel & Iron	51½	Calumet & Ariz.	69½
Crucible Steel	75½	Calumet & Hecla	570
Dome Mines	25½	Centennial	17½
Federal M. & S., pf.	50½	Copper Range	62
Great Nor., ore., ctf.	50½	Daly West	2
Greene Cananea	45½	East Butte	15½
Guggen. Exp.	79½	Franklin	9½
Homestake	120½	Granby	84
Inspiration Con.	45½	Hancock	17
International Nickel	185½	Hedley	28
Miami Copper	34½	Helvetia	45
Nat'l Lead, com.	64½	Indiana	51
National Lead, pf.	109½	Island Cr'k, com.	43
Nev. Consol.	16½	Island Cr'k, pfd.	89
Ontario Min.	6	Isle Royale	28½
Quicksilver	3½	Keweenaw	2½
Ray Con.	26½	Lake	13½
Republic I&S, com.	51½	La Salle	26
Republic I&S, pf.	108½	Mason Valley	1 85
Tennessee Copper	58	Mass	13
Utah Copper	77½	Mayflower	14½
U. S. Steel, com.	86½	Michigan	12½
U. S. Steel, pf.	116	Mohawk	86½

N. Y. CURB	Nov. 22		
Alta Con	12	New Arcadian	10½
Beaver Con	32	North Butte	32½
Big Four	05	North Lake	11½
Braden Copper	16	Ojibway	1½
Buffalo Mines	50	Old Colony	3½
Can. Cop. Corpn.	2⅜	Old Dominion	59½
Cashboy	06	Osceola	86½
Cerro de Pasco	39½	Quincy	91
Chile Cop.	25½	Santa Fe	3½
Con. Ariz. Sm	1 5/16	Shannon	7½
Con. Coppermines	2	Shattuck-Ariz.	36
Con. Nev.-Utah	5/16	Superior	28
Dia. Black B.	05½	Superior & Bost.	12½
Florence	40	Tamarack	156
Goldfield Con.	1 5/16	Trinity	10½
Goldfield Merger	18	Tuolumne	35
Howe Sound	4	U. S. Smelting	47½
Kennecott Cop.	54	U. S. Smelt'g, pf.	48
Kerr Lake	4	Utah Apex	3½
La Rose	75	Utah Con	13½
Magma	15	Victoria	12½
McKinley-Dar-Sa.	40	Winona	3½
Mines of Am	2½	Wolverine	59
Mother Lode	34	Wyandot	1½
Nevada Hills	17		
New Utah Bingham	2½		
Niplssing Mines	7		
Oro	06		
St. Joseph Lead	14½		
South Utah	‡ 30		
Stand'd Oil of N.J.	500		
Standard S. L.	1½		
Stewart	1 1/16		
Success	65		
Tonopah	6½		
Tonopah Ex.	3½		
Tonopah Merger	42		
Tribullion	75		
Yukon Gold	2½		

BOSTON CURB	Nov. 22
Bingham Mines	8½
Boston Ely	45
Butte & Lon'n Dev	40
Calaveras	1⅜
Calumet-Corbin	05
Chief Con	1½
Cortez	45
Crown Reserve	57
Davis-Daly	1½
Eagle & Blue Bell	1 1/16
First Nat. Cop	6½
Houghton Copper	2½
Mayo Cap Cop., pf.	7
Majestic	93
Mexican Metals	35
Nevada-Douglas	69
New Baltic	3½
New Cornelia	9½
Ohio Copper	21
Onondaga	1
Raven Copper	12
Rex Cons.	32
Smokey Dev.	15
So. Lake	5½
Tonopah Victor	32
Unified Verde Ext.	5½
Utah Metal	10

LONDON	Nov. 12
Alaska Tre'dwell	£6 17s 6d
Burma Corp.	1 12 6
Cam & Motor	0 3 9
Camp Bird	0 7 9
El Oro	0 10 0
Esperanza	0 11 0
Mexico Mines	4 6 9
Nechi, pfd.	0 12 6
Oroville	0 14 3
Santa Gert'dis	0 10 6
Tomboy	1 4 6
Tough Oakes	0 7 6

‡ Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.855	28 983	26 553	22.731
February	61 642	57 506	48.477	28 357	26 573	22.753
March	57.870	58 067	50.241	26 669	26 788	23.708
April	59 490	58.519	50.250	27 416	26 958	23.709
May	60 561	58.775	49.915	27 825	26 704	23.570
June	58 990	56.471	49.034	27 199	25 948	23.267
July	58 721	54.678	47.519	27 074	25 219	22.597
August	59 293	54.344	47.163	27 335	25 979	22.780
September	60 640	53.290	48.080	27 986	24 260	23 591
October	60 793	50.654	49.385	28 083	23 199	23 925
November	58 905	49 082		27 263	22 705	
December	57 760	49 375		26 720	22 900	
Year	59.791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60 540	76.011	64 955	91.409
August	*	16.941	‡	68 673	‡	82.333
September	*	17.502	‡	68 915	‡	85 250
October	*	17.686	‡	72 601	‡	88.000
November	11 739		53.227			
December	12.801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.938	48.426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33 360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33 088	‡	151.554
November	33.304		139.391	
December	33.601		147.102	
Av year	34 301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.065	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3 738	5.531	19.051	24.611
August	3.875	4.656	3 715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3.384	4.498	‡	23.994
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.777			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21 433	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5 074	14.781	4.924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	19.026	4.770	18 856	21.568	97.250
August	5 568	12.781	5 418	12.611	‡	67.786
September	5 280	13.440	5 230	13.270	‡	67.841
October	4 909	12.800	4 750	12.596	‡	66.536
November	5.112		4 962		25.016	
December	5.592		5 430		27.369	
Year	5.213		5.064			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13 23	$13 45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13 91	13.45	14 10	13.95
April	14.90	14.55	13 90	13.45	14 13	13.95
May	14.90	14.61	13 90	13.60	14.27	13.83
June	14 90	14.70	13 90	13.67	13.96	13.77
July	14 90	14.94	13 90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14 90	16.86	13.90	15.95	14.05	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59		13 43		13.83	
December	14.70		13.45		13.83	
Year	$14 88		$13 78		$14.01	

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Magnetic Separation in Sardinia

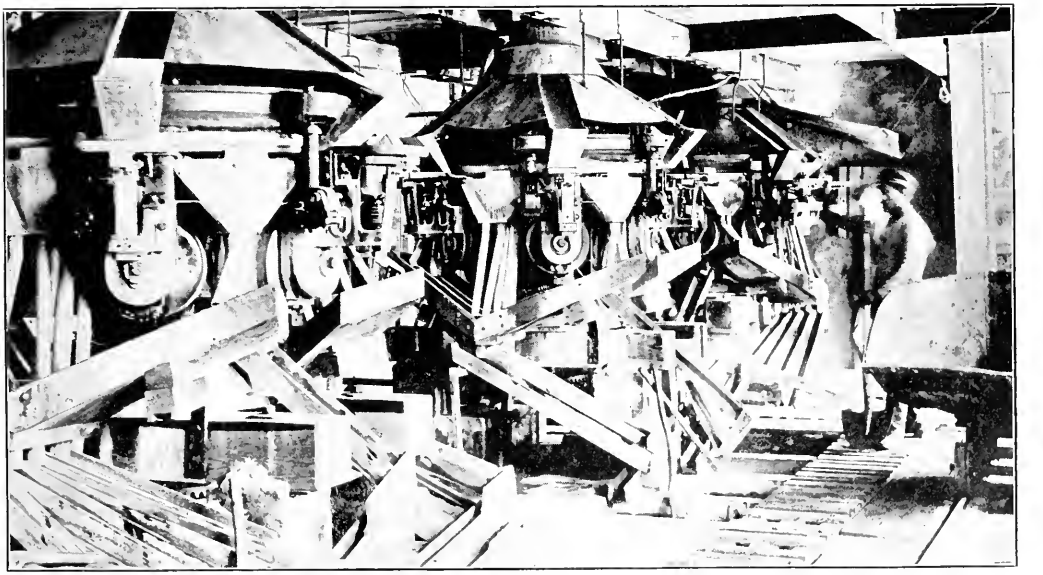
By Charles W. Wright*

SYNOPSIS—In order to improve the recovery at the Gennamari-Ingurtosu mine, Ullrich electromagnetic separators were installed. Results were immediately improved and have continued satisfactory. Description of the process and its cost are given.

The production of a high-grade blende concentrate from ores containing much siderite or pyrite cannot be accomplished satisfactorily by ordinary methods of milling. At most ore-dressing plants where such material is treated, a low-grade product or rich middling containing the blende and heavy gangue minerals is made in the jigs and on the tables. This product is first roasted or calcined so as to make the iron-bearing minerals more magnetic, and it is then separated by a magnetic separator. Such was the process employed until recently in the treatment of the blende-siderite ores at the Gennamari-Ingurtosu mine. The treatment costs, however, were high as well as the metal losses.

To improve these results a series of tests was carried out by the Elmore and Minerals Separation flotation processes, but only fair results were obtained, while the treatment costs were high. Tests were then made with the wet magnetic separators of the Electro-Magnetische Gesellschaft and with the Ullrich separators built by the Fried. Krupp Grusonwerk. The latter machines gave the best results and were therefore installed at our mill. They have now been in operation for over a year, and fairly accurate results as to their efficiency and costs have been obtained.

The occurrence of the blende-siderite ore at the Gennamari-Ingurtosu mine is in a lode that traverses a schistose country rock. This lode has been developed for 3 km. in length and averages from 3 to 15 m. in width. The blende ore is free from other sulphide minerals, and besides the siderite the gangue contains quartz, calcite and some barite, as well as a large amount of the altered schist. Portions of the lode contain well-defined veins, while other parts consist of a schist breccia, the ore forming the matrix. It is also noteworthy that the siderite occurs in greater quantities in certain parts of the lode and that



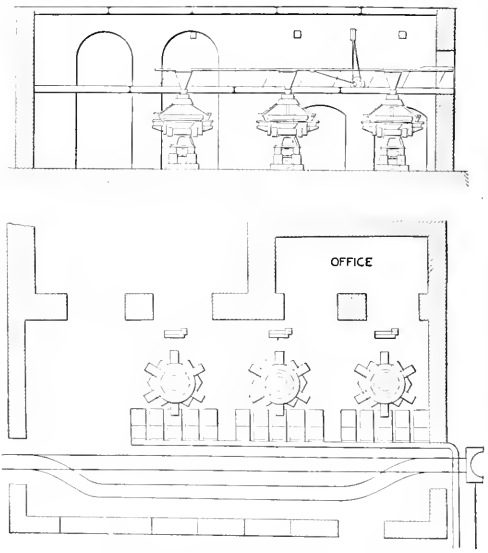
A ROW OF MAGNETIC SEPARATORS IN A SARDINIAN CONCENTRATOR

*Mining engineer, Ingurtosu, Sardinia, Italy.

when possible the ore from these parts is mined and treated separately.

The ore from the mine averages from 10 to 15% zinc. The richer ore is first treated on the *piazzale* by hand sorting and hand jigging to recover the coarse blende, and it is then sent to the mill for further treatment. The lower-grade ore goes direct to the mill. Here it is first reduced to 7 mm. and under, and then screened and 7 sizes made, 6 of which are treated in small four-compartment jigs, and that under 1 mm. size is treated on tables. The jigs produce a blende product, a rich middling of blende and siderite, which is sent to the magnetic separators, and a poor middling which is recrushed and retreated. Similar products are obtained from the tables. All of the rich middlings and in some instances the products containing an excess of siderite are sent to the magnetic-separator plant. The average tenor of the ore subjected to magnetic treatment is from 25 to 35% Zn and from 30 to 40% iron.

The former plant, used until last year for the separation of siderite from blende, consisted of an Oxland



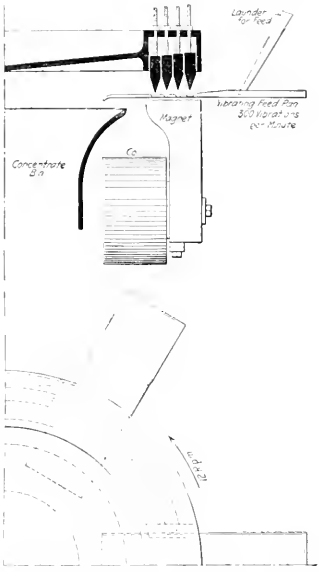
THE MAGNETIC SEPARATING PLANT

revolving calcining furnace and two dry magnetic separators of the Primosigh type. The capacity of this plant was about 1¼ tons per hr. The ore was first calcined in the furnace so as to reduce the siderite superficially to Fe_3O_4, thus making it more magnetic. The furnace was 10 m. long and had a diameter of 0.65 m. inside the fire-brick lining. It revolved at the rate of one revolution in 2½ min. and had a capacity of 1½ tons per hr. The ore before roasting was mixed with 100 kg. of fine coal per ton. The total cost of calcining was 5 lire per ton. The Primosigh separators were in drum form, with electromagnets inside. Passing around this drum and over pulleys at the side were four wide belts. As the ore traveled along a shaking trough under, and at right angles to these belts, the siderite was drawn up on them and carried over the side of the shaking trough, while the blende continued to the end and discharged into a car. To operate the Primosigh separators, 5 hp. was required, and the cost of this separation was 2 lire per ton. The concentrates from the separators contained 50% zinc and 10% iron, and the tailings carried 6% in zinc and 45% iron, the zinc recovery being 93%.

The Reformed Electromagnetic Plant

The new magnetic separation plant consists of a series of three Ullrich magnetic separators arranged in tandem, shown in the illustration. The siderite-blende ore is fed by a bucket elevator to a Ferraris shaking screen, which separates the ore into 3 sizes—0-2, 2-4 and 4-7 mm. Each size is fed to one of the separators along with about 4,000 liters of water per ton of ore.

The Ullrich separators consist of a series of six electromagnets arranged in sextants of a circle. A half-section of the machine is shown in the drawing. Above these magnets are four iron rings which revolve, passing from the positive magnetic field of the first pole to the negative field of the second pole and then to the third pole, which



SYSTEM OF MAGNETIC CONCENTRATION

is positive, and so on, completing the circle in about 5 sec. Between the six electro-magnets and these rings, and traveling at right angles to the rings, are six brass shaking pans, on to which the ore is fed from a central distributor. As the ore passes into the magnetic field, the siderite is drawn up from the pan by the iron rings and is carried off the side of the shaking pan into a trough divided into two compartments. Some of the blende is dragged off of the pan and drops into the first compartment along with some siderite, and this constitutes the middling product, which is retreated. The siderite free from blende is carried forward on the ring to the second compartment, where it is washed from the rings by small jets of water. The blende free from siderite is discharged off the end of the shaking pans into a central launder.

To operate an Ullrich separator, about 1½ hp. is required for the mechanism and a current of 10 amp. at 125

volts is required for the magnets. The entire plant is operated by a 20-hp. motor. The plant runs 10 hr. per day and treats from 2½ to 3 tons per hr.

The ore fed to these separators averages about 34% zinc and 38% iron, the concentrates contain 53% zinc and 5% iron, and the tailings carry 2½% zinc and 48% iron. The zinc recovery by this treatment is 96%, while 90% of the siderite is eliminated from the concentrates.

COST OF PLANT OPERATION

	Lire per Day
Power, 20 hp. × 10 hr. × 0.07 lire	14
Labor, 4 men at 3 lire	12
Repairs, per shift	6
Supervision, per shift	2
Amortization, 70,000 lire in 10 years	28
Total cost per day	62
Cost per ton treated (25 tons per day)	2.48

The total cost of the plant was 70,000 lire. The cost of operating is given in the accompanying table.

Injury to Mine Timbermen

By A. L. H. Street*

The Michigan Supreme Court was lately called upon to determine the liability of a mining company for injury to a timberman, caused by fall of rock, where he entered the place without looking and in advance of the usual announcement of the timber boss that it was safe to enter. (Vrelenich vs. Calumet & Hecla Mining Co., 154 Northwestern Reporter, 39.) The court holds that there can be no recovery under such circumstances; that the rule of law that requires an employer to use reasonable care to provide a safe place of work for his employees does not extend to the occupation of timbermen, for the very nature of their work is to make places safe for the miners to follow them. The employer's full duty to timbermen is discharged, the court declares, when reasonable rules are promulgated, the workmen are properly instructed, and when suitable tools and materials are furnished for the work, with competent men to perform it.

The fellow-servant rule was applied in a similar case by the same court (Kangas vs. Cleveland-Cliffs Iron Co., 154 Northwestern Reporter, 41). Plaintiff was a timberman working on a night shift and was injured through fall of a rock through a hole leading up into an old stope, and suit was brought on the theory of negligence of the day crew in not blocking up the hole. But recovery was denied on the ground that the members of the two crews were fellow-servants. The court expressly decides that it is not necessary, in order to constitute men "fellow-servants" within the rule in force in Michigan, exonerating an employer from liability for their negligence toward one another, that they be engaged in the common work at the same time. It is sufficient that they be engaged in the same work designed to effect the same general purpose.

Recent Scarcity of Monazite from Brazil, according to a consular report from Madras, has directed attention to the possibilities for commercial development of the large deposits of monazite sand in Travancore, South India. The production of monazite in British India in 1913 was valued at over $200,000. Most of the output was exported in a raw state. A European firm recently purchased land in South Travancore for the express object, it is said, of carrying on an export trade in monazite. It is now announced that under a recent order of the British Government the export of monazite sand from British India except to the United Kingdom is prohibited.

*Attorney, Security Bldg., Minneapolis, Minn.

Conservation of Mineral Resources*

For purposes of illustration and comparison the losses caused by the waste that conservationists hope to lessen or to eliminate are usually expressed in tons or in terms of monetary value, but as our individual ideas of the value of money vary widely, I should prefer to discuss these losses in terms of a labor-unit value. The statement that in certain industries a loss of $1,000,000 per day is caused by waste conveys vaguely the idea of great loss, but if we express this by stating that a loss of 500,000 days of labor is daily caused by waste, this statement conveys the same idea to all, namely, that the labor of 500,000 employees is wasted every day—a concrete statement of fact that gives a more definite conception of what waste really means, for going one step farther, we see that if this waste could be avoided we would immediately have available the labor of an army of 500,000 men, which could profitably be employed in other productive industries.

I have introduced this homely example because it directs attention to the value of labor as a national asset and as the real basis of our prosperity and the foundation of all wealth. The engineer should remember that the conservation of labor is more important than the conservation of coal or other resources which the Creator has furnished us in most abundant supply, for labor that is unnecessarily expended is an absolute loss and never can be regained.

Conservation of Labor the Great Aim

Conservation of labor is more important than any other economic issue and should be adopted as a governing principle of national policy. The object of the engineering sciences is to produce a given product or to accomplish the greatest quantity of work of any kind, with the least possible expenditure of labor. This is sometimes called engineering efficiency, but is more broadly described by the term conservation of labor.

I may perhaps make this meaning clear by a concrete example illustrating the application of the principle of conservation of labor to mining. If we assume that one ton of iron ore can be mined and prepared for shipment to the blast furnace from average mines at an average cost of one day's labor, it would be an economic waste to attempt to mine iron ore from deposits that require two or three days' labor per ton of ore produced, because by employing one day's labor at a mine of the first-mentioned class the same quantity of ore could be produced and two days' labor would be released for employment in other useful work; and it would be a similar economic waste to attempt to recover ore from the tailings or waste dumps of a mine of the first class, if the recovery of each ton of ore from this material required the expenditure of two or three days' labor.

The same principle of the conservation of labor may be applied to all mining and metallurgical industries, the rule being that labor is unwisely expended when the labor cost of producing any product exceeds the average labor cost at which the product can normally be produced.

*Excerpts from an address delivered by H. M. Chance at the dedication of the Mines Building at Pennsylvania State College, State College, Penn., Nov. 5, 1915.

I would now like to say a few words in defense of the coal-mine managers and engineers whom conservationists of the extreme type charge with wholesale waste in the mining of coal. The fact that many graduates of this School of Mines are now employed in coal mines justifies discussion of this subject in some detail.

Most of our bituminous coal is mined from coal beds that are nearly or quite horizontal, and it will easily be understood, even by those who never have visited a coal mine, that as the coal is removed some method must be provided for supporting the roof of the workings; that is, for sustaining the great weight of rocks that lie upon the coal and extend from the coal bed up to the surface of the ground. By what is known as the longwall system of mining some coal can be worked without supporting the roof, which is allowed to settle down and fill the space made by the removal of the coal, but in most mining districts the use of this system is not feasible and the roof must be supported to a greater or lesser extent as the coal is removed. Timber, structural steel and concrete or rubble masonry have been used for this purpose, but these materials are costly and therefore are used sparingly. At present prices the cost of timber, rubble masonry and concrete per cubic yard is respectively about $12, $4 and $6, while loose material such as sand or gravel, or broken stone (brought into the mine and used for the purpose of supporting the roof) will vary in cost in different localities, but will range usually from 75c. to $1.50 per cu.yd., plus the cost of timber or masonry necessary to confine and hold these loose materials in place.

To Waste Coal Is Sometimes To Save Labor

As the value of coal in the ground as measured by royalty rates is rarely greater than 10 or 15c. per ton, in using concrete or rubble masonry, or even loose materials to support the roof, the engineer must so design these supports that each cubic yard of material so used will permit of the mining of from 15 to 40 tons of coal, but this is rarely possible, as in most cases a cubic yard of masonry or concrete would be necessary for each 10 or 15 tons so mined. If this method were adopted the cost of the coal would be increased about 30c. per ton.

As it is obviously foolish and wasteful to use high-priced materials when other cheaper materials are available, the mining engineer has preferred to substitute in place of masonry for supporting the roof, certain portions of the coal bed itself, which by the plans for working the coal, are not to be mined but are to be left as pillars to support the roof, thus substituting in place of concrete or rubble masonry costing $4 or $5 per cu.yd., coal that has a nominal value (but no labor value because no labor has been expended upon it) of but 10 or 15c. per cu.yd. The coal left as pillars to support the roof is thus utilized and performs a necessary and useful function, yet the principal part (perhaps two-thirds) of the 200,000,000 tons our friends the conservationists claim is willfully and avoidably wasted every year is this coal that is left in pillars to support the roof. I think we can safely claim that this is not waste, but on the contrary is engineering efficiency of the highest type, in that it utilizes the cheapest and least valuable material available to support the roof and saves the whole labor cost of building supports of other materials.

Investigation as to what becomes of that part of the 200,000,000 tons claimed as wasted, that is not utilized as pillars to support the roof, will disclose the fact that a large portion is coal that is left in mine workings that are abandoned because the roof is unsafe and because a continuance of operation would result in injuries or loss of life. Coal left in the mines in order to conserve human lives cannot be classed as avoidable waste. A small part of the 200,000,000 tons is lost because it is intimately mixed with refuse and because the labor cost of recovering it and separating it from the refuse would be greater than its value.

Relative Values of Our National Assets

If we are to realize the full benefits of conservation, it becomes necessary to distinguish clearly between the relative values of the assets sought to be conserved, otherwise waste of the more valuable assets may result from the efforts to conserve those of less value. From an industrial and economic point of view our national assets may be grouped as to relative values in the following order:

1. The life of the workman.
2. Labor.
3. Capital (the accumulated products of labor).
4. Supplies needed for current consumption.
5. National resources—timber, minerals, water power, fish, animals, fertility of the soil, etc.

The acceptance of the principle of conservation as applied to human lives is shown by the extension of "safety-first" methods to nearly all industries. "Safety first" has always been the motto of the mining engineer. Most mine accidents are caused by unusual or unforeseen conditions, or by ignorant or careless workmen, or by lack of knowledge of what constitutes a dangerous condition. Mine accidents have rarely, if ever, been traced to a disregard of the safety-first principle by engineers.

Next in importance to the conservation of life, engineers have always placed the conservation of labor. In conserving labor by so directing its application as to secure the best results at the lowest labor cost, the engineer protects the capital invested in industrial enterprises and secures satisfactory profits as compensation for its use.

Capital is increased by conservation of the supplies carried in stock to meet the requirements for current consumption, and accumulated wealth grows principally from the surplus thus saved.

A proper regard for the conservation of our national resources is imposed upon the engineer by the ethics of his profession, and we can feel sure that this duty will be performed efficiently and conscientiously by the graduates of the Pennsylvania State School of Mines and of other similar institutions.

In preparing this brief discussion of the conservation of mineral resources in its relation to the work of the School of Mines, my object has been to present the subject in a form capable of being understood by the student at the very threshold of his entrance upon the study of engineering. A further object has been to furnish a reply to the exaggerated and misleading statements promulgated by conservationists—a reply which could be understood by those who are not familiar with mining and metallurgical work, and which would show by simple and logical arguments that the engineer should not risk human life, waste the labor of employees, risk the loss of the capital of his employer or waste materials or supplies by attempting to carry out in practice doctrines or theories based upon the teachings of conservationists of the extreme type.

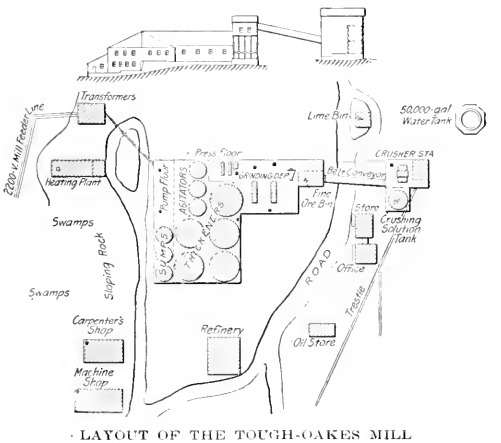
Building the Tough-Oakes Mill—II

By John A. Baker*

SYNOPSIS—Continuing the description and cost of the erection of the Tough-Oakes mill. The heating system, electrical motive-power machinery and equipment, piping and transmission machinery are discussed in detail. Finally, the metallurgical operation of the mill is described.

Since it is necessary to maintain a temperature of about 65°, the problem of economical heating during eight months of the year merits careful consideration. Low-pressure steam, using the gravity-return system, is employed. The boiler is of the inclosed-firebox type, designed for carrying 15 lb. of steam as a maximum. It is rated to supply 8,500 sq.ft. of steam radiation. The water level of the boiler is 5 ft. below the bottom of the lowest radiator in the mill. This factor is important if the radiators are to be kept free from water.

The boiler building has concrete retaining walls and floor. It is 15 ft. wide and 50 ft. long, with 12-ft. wall.



LAYOUT OF THE TOUGH-OAKES MILL

Included in this is a coal bin, 15x10x12 ft., at the eastern end of the building. The boiler setting is a combination of a brick arch and stone side walls lined with one course of brick. The stack is of steel and is 36 in. in diameter and 60 ft. high.

The total area of all radiators installed is 6,000 sq.ft. The total cubic contents of all buildings heated is 338,000 cu.ft. This gives a ratio of 1 sq.ft. of radiator surface to 56 cu.ft. of volume. This is over 10% less than the amount recommended by radiator manufacturers, but has been found ample, even in the severest weather.

The average coal consumption per day is about 2.5 tons, costing $10 per ton. With attendance, this amounts to $30 per day, or a total of $7,200 for eight months. In round figures, then, the heating of every 1,000 cu.ft. of building volume costs $50 per annum.

*Formerly Construction Engineer for Tough-Oakes Gold Mines, Ltd

The total cost of installation, excluding boiler plant, is $13 per 1,000 cu.ft. Including boiler plant, the cost is $21 per 1,000 cu.ft. The detailed cost of the boiler house is shown in the accompanying table.

TABLE 6. COST OF BOILER HOUSE

	Labor	Material	Total	Labor in Cost	Supervision	Total
Clearing, excavation and foundations..	$222.60	$93.81	$316.41	70%	.....	.....
Building and erection	265.45	358.30	623.75	42%	.....	.....
Boiler setting and equipment	759.09	1313.70	2072.79	36%	.....	.....
Totals	$1247.14	$1765.81	$3012.95	41%	$198.95	$3211.90

The weight of the boiler, stack and trimmings complete was 14,000 lb. and the laid-down cost at the mill site was $1,140. Six thousand red brick at $22 per M and 400 firebrick were used in the setting. The main steam line is 7 in. and the water-return main 5 in. in diameter. The summarized cost of the heating system distributed among the various buildings is shown in Table 7.

TABLE 7. COST OF HEATING SYSTEM

Building	Labor	Material	Total	Labor in Cost	Supervision	Total Cost
Crusher station.	$109.77	$248.48	$358.25	31%	.....	.....
Cyanide plant..	731.45	2800.95	3532.40	20%	.....	.....
Office	14.58	43.44	58.02	25%	.....	.....
Storehouse	6.03	20.00	26.03	23%	.....	.....
Carpenter shop.	25.59	46.03	71.62	35%	.....	.....
Machine shop..	53.98	107.37	161.35	33%	.....	.....
Totals	$941.40	$3266.27	$4207.67	22%	$499.40	$4707.07

Floor radiators costing 19.5c. per sq.ft. are used in the crusher station, office and shops. In the cyanide plant, wall-type radiators costing 22.4c. per sq.ft. are employed on account of the limited floor space. Cost of maintenance is higher for this type than for the floor radiators. This statement may appear to be contradicted by the higher cost of labor in the crusher station. This is not the case, however, since the higher labor charge in this case is due to the extra work on the trench and box carrying the pipes between the two buildings.

Electrical Power Equipment

All power used on the property is supplied by the Charlton & Englehart Power Co. The transmission line is 28 miles long and carries 33,000 volts. The frequency is 60 cycles, and the voltage is stepped down to 2,200 at a central transformer station. From here, the mill feeder line of 000 copper 1,630 ft. long connects with the mill transformer station. All mill motors use 550 volts. There are two sets of outside lightning arresters, pole-mounted. Cedar poles 30 to 35 ft. long and not less than 7 ft. at the top were used, the maximum distance between poles being 120 ft. All pole fittings are galvanized, and poles are securely guyed and dead-ended. As the line crosses a low-lying area covered with muskeg, some difficulty was at first experienced in digging post-holes, owing to the surface water. The muskeg is about 2 ft. deep over a bed of impervious clay. A box, open at both ends, 36 in. square and 30 in. deep, was forced down through the muskeg to the clay. This sealed off the muskeg water and permitted the remainder of the hole to be dug with ease. The cost of the pole line is given in Table 2, and

also in Table 9 of detailed electrical costs. It is at the rate of $3,930 per mile.

At the mill transformer station the voltage is stepped down from 2,200 to 550 volts in a bank of three 150-kv.-a. single-phase Westinghouse transformers. Space is left for a second bank in the same building. A main oil-switch of 450-kv.-a. capacity with indicating wattmeter is placed on the secondary side of the transformers. From the switch the main circuit runs to the busses of the mill switchboard upon which are six plain disconnecting switches controlling the motor circuits. All 550-volt conductor used in the mill is cable and is placed in conduit. The data on the various circuits are shown in Table 8.

A 10-kv.-a. lighting transformer, 2,200 primary to 110 secondary, is connected directly to the high-tension bus bars. A separate meter and switch control the 110-volt side. The lighting mains run along the outside walls of the mill to two Crouse-Hinds distribution panels, one in the central portion of the cyanide plant and the other in the crusher station. From these centers, 12 separate lighting circuits control the group lighting. Tungsten lamps are used throughout. For general illumination in the cyanide plant, 600-watt nitrogen-filled tungsten lamps with ground-glass bulbs are employed. If properly erected, these lamps last 5 or 6 months. No arc lamps are used.

TABLE 8. MOTOR-CIRCUIT DATA

Circuit No.	Length Ft.	Wire Size	Conduit Size	Motors Hp.	R.p.m.	Driven Machinery
1	120	2	1¼	40	580	2 centrifugals, vacuum and triplex pumps.
				20	690	Low-pressure air compressor.
				15	1120	5 thickeners, 3 agitators, 4 diaphragm pumps.
2	125	2	1¼	10	890	Conveyor belt and lime elevators.
				10	890	2 Dorr classifiers and elevators.
3	280	2	1¼	50	580	2 crushers, elevator, trommel and skip hoist.
4	50	4	1¼	40	580	16x60 Hardinge ball mill.
5	20	00	2	100	580	5x20 tube mill.
6	20	00	2	100	580	5x20 tube mill.
Main Feeder	2 Circuits 75	250,000 C.M.	2½	All motors		Total mill load.

Total shipping weight of all motors, transformers, starters, etc., 46,000 lb. Laid-down cost, 18c. per lb.

All motors are of the Westinghouse G.M. mill type. With the exception of the circuits Nos. 3 and 4, all machines are much underloaded. Conductor size permits of 25% overload on each machine on the circuit. All motors 40 hp. and over have panel-type starter and ammeter. Smaller machines have the standard starter. With this starter an asbestos-lined box with knife switch, starting and running fuses is used. The summary of the detailed electrical costs is given in Table 9.

TABLE 9. COST OF ELECTRICAL EQUIPMENT

Building	Labor	Materials	Total	Percentage of Labor	Supervision	Total
Crusher station	$65.60	$856.68	$922.28	7.1	.....	.....
Cyanide plant	559.09	5,789.03	6,348.12	8.7	.....	.....
Transformer station	171.17	3,508.15	3,679.32	4.7	.....	.....
Machine shop	70.02	194.00	264.02	26.9	.....	.....
Power line	420.16	712.00	1,132.16	38.0	.....	.....
Total	$1286.04	$11,059.86	$12,345.90	16.4	$760.45	$13,106.35

The total cost does not include the transformer building.

The number, size and cost of motors and transformers can usually be estimated at an early stage of mill design. In the case of the Tough-Oakes, the total laid-down cost was $8,282. The ratio between this sum and the total of Table 9 gives us 1.6, a useful factor for estimating purposes.

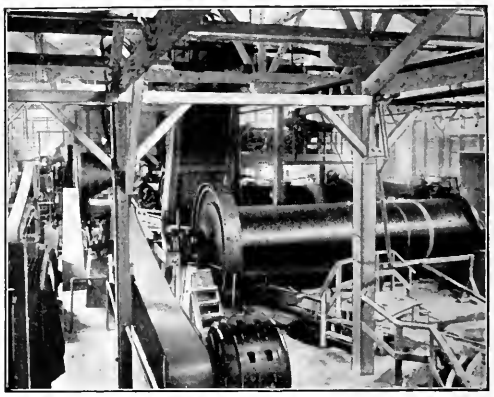
Estimating the amount of pipe that will be used in a mill is not so easy as might appear. While in no sense a standard, the exact bill of piping used in the Tough-Oakes should be of interest and is given here.

DETAILS OF PIPING ON THE PLANT

Size, In.	Amount Ft.	Price per 100 Ft.	Size, In.	Amount Ft.	Price per 100 Ft.
¾	51	3.00	2	1,900	9.90
1	102	3.50	2½	250	16.07
1¼	163	4.00	3	1,173	21.04
1½	880	4.25	3½	473	25.27
1	1,209	4.59	4	3,708	29.94
1¼	240	6.50	5	104	42.25
1½	1,430	7.42	6	150	54.45

These prices are for carload lots f.o.b. Swastika and are the lowest of several competitive bids. The foregoing list comprises all the pipe in the mill, whether water, solution, pulp or air, but it does not include the piping used in the heating system nor in connection with the refinery. It also includes the mill water-service pipe—a 4-in. line 1,200 ft. long.

All the thickener overflow pipes and main solution lines are 4-in. The 6-in. line is used on the gravity return from the presses to the No. 4 thickener. The large size is necessary on account of the small head available. Lunkenheimer all-iron clip gate-valves are used exclusively on all lines. Pipe work was started on Jan. 21 and completed Mar. 14. Five men composed the pipe-fitting gang. Wages were $3.25 for pipe fitters and $2.75 for helpers. A power-driven cutting and threading machine taking pipe up to 4 in. was available during the work.



REGRINDING DEPARTMENT

SUMMARY OF PIPING COSTS

Total cost of all pipe	$2,300
Total cost of valves	490
Total cost of fittings	600
Total cost of labor	1,050
Total cost of installation	$4,440

Of the total, labor comprises only about 24%. Valves and fittings cost about 50% as much as pipe. If we deduct the 1,200 ft. of 4-in. supply line containing almost no fittings, we get a figure of 60% for this ratio, which is nearer correct for straight mill work.

The mill water-supply line previously mentioned runs from the mine water tank to the mill water tank. For 100 ft. of its length the pipe lies in a box filled with sawdust. For 300 ft., rock cut was necessary to secure the required 4 ft. of cover. The balance is ordinary earth

excavation. Total cost for labor and material, from Table 2, is $2,291.58, or $1.91 per ft. This cost is rather high, as freezing weather was encountered before the work was completed. Under favorable weather conditions $1.70 per ft. could be achieved.

The mill water tank is 22 ft. in diameter by 20 ft. high, with sides and bottom of 3-in. British Columbia fir, and holds 50,000 Imperial gallons. It cost $464 f.o.b. Swastika. The bottom of the tank is 27 ft. above the ground. The substructure is of 10x10-in. timber on concrete piers. Costs are shown in Table 2.

Transmission Equipment and Machinery Installation

All bearings are of the ring-oiling type; split cast-iron pulleys are used throughout. A liberal factor of safety was allowed in all shafting, and the number of sizes used reduced to three—$1\frac{15}{16}$-in., $2\frac{7}{16}$-in., $2\frac{15}{16}$-in. The laid-down cost of all transmission equipment, excluding belting, was $1,534. Cost of belting was $2,050, making a total first cost for all transmission equipment of $3,584. Endless stitched rubber belts are used on all motor drives. All transmission and conveyor belting is of the best-quality rubber. Balata is used on the two elevators.

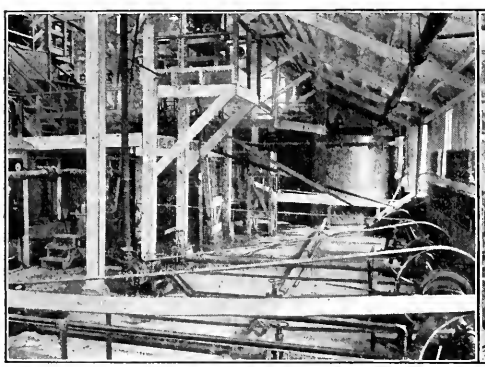
The data on piping and transmission already given are included under the heading of "Machinery and Equipment" in the main tabulation of cost given in Table 1.

In righting to carry it back over the 22 ft. of weighing platform and onto the down-grade, where gravity returns it to the shafthouse. A $\frac{1}{2}$-in. cable is used. The trestle is 950 ft. long, with a 10% grade for two-thirds of the way and 4% for the remainder. The track is 26-in. gage, using 20-lb. rails. The average height of trestle is 12 ft. and the hoisting speed is 150 ft. per min.

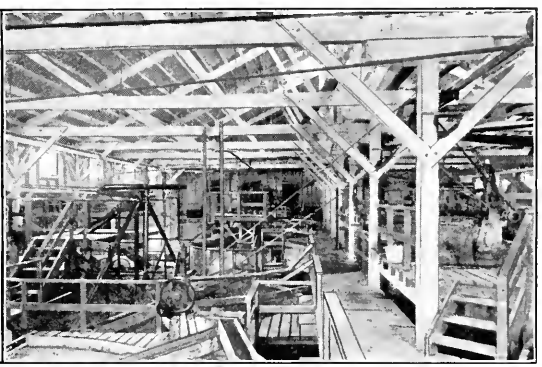
From the ore bin, holding 75 tons, the ore is drawn out through an arc gate into a 12x20-in. all-steel Buchanan jaw crusher set to 2 in. The product falls to a 14-in. 6-ply Balata-belt elevator with 12x7x7-in. manganese-steel buckets running 375 ft. per min. on 36-ft. centers.

The elevator delivers to a 30x60-in. Gates-type revolving screen running 20 r.p.m. and having $1\frac{1}{2}$-in. round perforations in $\frac{1}{4}$-in. plate. The oversize of this screen returns to a 10x16-in. all-steel crusher set to $1\frac{1}{8}$-in. with special smooth jaw-plates for fine grinding. The product from this machine drops to the same elevator and is returned to the screen. The undersize of the screen falls to a hopper, whence it is fed to the incline conveyor belt delivering to the cyanide-plant ore bin. This belt is 14-in. 5-ply rubber conveyor belting running at 125 ft. per min. on a 14° slope. It is driven by a separate motor.

The large crusher runs 250 and the small crusher 275 r.p.m. Each crusher is driven through a split friction clutch on a main lineshaft. Another clutch cuts out the countershaft driving the elevator, trommel and skip hoist.



PUMPING FLOOR, SHOWING ZINC FEEDER



INTERIOR OF THE TANK AND AGITATOR ROOM

In fact, this account is a blanket one covering everything that could not be properly charged to any of the other work orders. Besides all machinery proper, it includes the initial charges of pebbles and balls, amalgamating tables, all launders, elevator housings, platforms and walk-ways, guard rails and labor incident to trying out and adjusting machinery before it went into regular operation.

In the crusher station, labor forms 24% of the total; in the cyanide plant 17% and in the combined machinery installation, 18% of the total.

At the crushing station, floors and stairways were completed on Dec. 20 and machinery installation commenced on that date. The motor and shafting were turned over on Feb. 20 and the first rock was crushed on Mar. 8. The skip coming up the incline runs over a platform scale of 3 tons' capacity. The average weight of ore is 1.45 tons. The skip is then pulled up over a tipping device, and the empty skip acquires sufficient momentum

The crusher station has a normal capacity of 15 tons per hr. and often makes 20 tons when all conditions are favorable. The ammeter of the 50-hp. motor driving this department springs between 35 and 45 amp.

Description of the Cyanide-Plant Arrangement

The crushed-ore bin is flat-bottomed and holds 165 tons when filled up to the conveyor discharge. Of this, 85 tons will run out by gravity. From three chutes along one side of the bin, the ore is delivered by eccentric plunger feeders to a 12-in. conveyor belt traveling 75 ft. per min. This belt spills into the scoop box of a 16x72-in. Hardinge ball mill running 30 r.p.m. and set with $2\frac{1}{2}$-in. fall toward the discharge end. Sodium-cyanide solution titrating 2.5 lb. KCN per ton is added to the scoop box. The ball load is between 4 and $4\frac{1}{2}$ tons.

Under these conditions the capacity of the mill has been found to be between 85 and 90 tons per 24 hr., using 40 to 45% moisture. A lower moisture gives a

finer product but less tonnage. With 55 to 60% moisture a large quantity of coarse oversize is thrown out. It is hoped that by leveling up the mill, decreasing the speed to 29 r.p.m. and using a choke plate to raise the ball load, a considerable increase in capacity will be obtained. On medium-grade ore, $20 to $25 per ton, tube mills and cyanide plant will handle 110 tons. A screen test of the ball-mill feed and discharge is shown.

SCREEN TEST SHOWING BALL-MILL WORK

Feed (Average of 3 tests)	%	Discharge	%
On ⅜x1⅜	7.4	On 2-mesh	1.3
On 2-mesh	64.1	On 4-mesh	3.6
Through 2-mesh	28.5	On 10-mesh	7.1
		On 20-mesh	20.2
		On 60-mesh	18.7
		On 150-mesh	15.2
		Through 150 mesh, sand	11.0
		Through 150 mesh, slime	18.2

The ball-mill discharge is split between two duplex Dorr classifiers, each 20 ft. long, but except for the extra 4 ft. of length, standard machines. The rakes are lengthened 6 in. to prevent fine sand banking near the overflow. They are set on a slope of 2¼ in. per ft. The sand coming over the head end gravitates to the feed box of a 5x20-ft. tube mill equipped with a scoop of 26-in. radius. Pebbles are fed through the scoop and the load is kept 4 in. above center.

Moisture is kept at 40% of the total. The mills are provided with cast-steel heads, manganese-steel head liners and cast-iron gears. The shell liners are chilled cast iron with concentric ribs known as the Globe type. A set of shell liners weighs 10,500 lb. Exact power-consumption measurements are not at present available, but the ammeter registers between 70 and 80 amp. under normal conditions. A 100-hp. motor drives each mill through a 72x18-in. clutch pulley, thus leaving a margin for the use of manganoid balls if found desirable. Pulley centers are 22 feet.

The discharge from either tube mill may return to its classifier or to a 12-in. bucket elevator which raises it to two amalgamated copper plates from which the pulp returns to the classifiers. Each plate is 5 ft. wide and 30 in. long. Longer plates were tried out, but as the bottom one caught no gold and became corroded from the action of the cyanide, it was discarded.

Classifying and Filtering the Pulp

The dilution in the classifiers is kept between 5 and 6 to 1, the specific gravity of the ore being 2.7. The primary, or No. 1, thickener is a standard Dorr machine of heavy pattern. It makes one revolution in 8½ min. The pregnant solution overflowing it carries $4 to $5 per ton on medium ore and runs by gravity to a clarifying filter box containing twelve canvas vacuum leaves. Each leaf is 9 ft. 6 in. by 1 ft. 6 in. When precipitating at 375 tons per 24 hr., an average rate, this gives 70 sq.ft. per ton per hr. Experience shows that an allowance of 100 sq.ft. per ton per hr. would be better on Tough-Oakes ore.

An 8x10-in. vacuum pump delivers the clarified solution to the 16x10-ft. pregnant sump. A tipping-box with a counter measures the tonnage going into the tank. A 5½x7-in. triplex pump, with connection to Merrill zinc feeder on the suction side, forces the solution through two 36-in. 16-frame Merrill presses. The barren effluent carrying 2 to 6c. per ton can gravitate to No. 1 agitator, No. 1 thickener, or the 16x10-ft. barren-solution sump.

The vacuum and triplex pumps are belt-driven from the pump-floor lineshaft, which also drives two 3-in. Gwynnes centrifugal slime pumps. These pumps run 1,600 r.p.m. and handle the crushing and barren solutions. The crushing solution, being the overflow of No. 2 thickener, runs to a 16x10-ft. sump and is elevated continually by the centrifugal to the upper 20x10-ft. storage sump. The barren-solution pump is used only intermittently and is cross-connected so that it is available for handling crushing solution. A small motor-driven low-pressure air compressor is located on the pump floor. It has a capacity of 217 cu.ft. of free air per min. to 25 lb.

Returning to the primary, or No. 1, thickener, the underflow is elevated by diaphragm pump through 4-in. suction pipe to the first agitator at 40% moisture. The pump is of the constant-stroke variable-speed type, with a normal speed of 25 pulsations per minute. It is driven from the main lineshaft running the full length of the building. This shaft is supported on boxing mounted on the sides of the central row of posts. From it are driven all thickeners, agitators, diaphragm pumps and the sump elevator.

Agitation and Continuous Decantation Systems

The Dorr agitators are 16 ft. in diameter by 12 ft. high, with 6 in. fall between each tank. The arms make two revolutions per minute. Air is introduced at the top. The piping permits either crushing or barren solution to be added to secure the desired dilution—in this case 2.75 to 1. Present practice is to add cyanide sufficient to bring the solution in the first agitator up to 3 lb. per ton, or 0.15% KCN. Adding a portion of the cyanide to the tube-mill circuit is contemplated. As the experimental work indicated high acidity, dry lime was first added to the fine-ore bin. Practice showed the acidity to be not nearly so great, and it was found better to add the milk of lime to the thickeners. A protective alkalinity of about 1 lb. per ton, expressed as NaOH, is employed. The agitators dissolve about $2 per ton on medium-grade ore. The washed pulp from the last agitator will assay $1.60 to $1.80 and the same product in the final thickener discharge, $1 to $0.80c. There is no material difference between the plus and minus 200-mesh material. The solution going to waste assays 15 to 20c. per ton, which at 37% moisture means 7 to 12c. per ton soluble loss. This will undoubtedly be cut down when time has given an opportunity to perfect all details of the metallurgy. Thorough mixing of the solution and pulp entering the decantation thickeners is absolutely essential. The underflow solution value is at times double that of the overflow. The mill has not been running long enough to give representative figures for pebble and ball consumption, cyanide loss and cost per ton. Approximate estimates for the latter two items are 1¼ lb. and 2 lb. per ton.

The raw precipitate is worth $35 per lb. It is acid-treated in a wooden tank and then melted in a tilting furnace, using a No. 400 crucible. The resulting bullion is 600 fine in gold and 250 fine in silver.

The Houghton Copper Co., Winona, Mich., reports that during 1914 the sinking of the winze below the 820-ft. level was continued and bottomed at the 1,020-ft. level. The 620-ft. level was run north 383 ft. The 1,020-ft. level was extended 397 ft. to the south of the winze and 334 ft. to the north of the winze, and some good copper ground was encountered on both sides. Expenditures amounted to $23,440 and liabilities exceeded current assets by $7,650 at the end of the year. A mill test is to be made of about 7,500 tons of accumulated rock from development work.

Callow Flotation Process*

SYNOPSIS—The Callow pneumatic process is the result of development and modification of former systems. Its operation is described. Different oils affect different ores in various ways, but there is nothing but actual experiment to determine what will happen. The theory is that the process is an electrostatic one.

Early in 1909 I did a great deal of work with the Macquisten flotation process and was instrumental in the tube-plant installation at the Morning mill, at Mullan, Idaho. This work was followed by a large amount of experimenting on the different kinds of existing flotation processes, the outcome of which was the development of the pneumatic process.

The first application of pneumatic flotation for the treatment of ore was made at the mill of the National Copper Co., at Mullan, Idaho. The plant went into operation about Apr. 10, 1914. The flow sheet is shown in Fig. 1. Since that date, the process has been adopted by nearly all the other mills in the Cœur d'Alenes treating lead and lead-zinc ores, notably the Gold Hunter, Morning, Hercules, Bunker Hill & Sullivan, Caledonia, Last Chance, Hecla and Standard. The same process, too, has since been adopted by the Inspiration Copper Co., the Arizona Copper Co., the Anaconda Copper Mining Co., the Magma and other copper companies, and by the Silver King, Daly-Judge, Dusquesne, and El Rayo mining companies, on lead, zinc and other ores.

The Callow Floating Apparatus

The various elements composing the Callow process are shown in Fig. 2. In the mixer *A*, operated by compressed air, the oil, air and water are mixed and emulsified. In cases where the oil, or frothing agent, can be fed into the crushing or grinding machine, this mixer, or Pachuca tank, can be dispensed with, the tube mill discharging direct to the separatory cell.

The initial or roughing separatory cell *B* consists of a tank about 9 ft. long and 24 in. wide, with a bottom inclined at from 3 to 4 in. to the foot. It is 20 in. deep at the shallow end and 15 in. deep at the other end. It may be built of either steel or wood, but wood is preferable. Fig. 3 shows the cell in detail. The bottom of the tank consists of a porous medium made of four thicknesses of loosely woven canvas twill, properly supported by a backing of perforated metal to prevent its bulging when under air pressure. Through this porous medium compressed air is forced by a blower. Porous brick or any other ceramic material that will give the necessary fine subdivision to the air may also be used. Some of these have been tried out, but for practical and mechanical reasons the loosely woven canvas twill seems to serve all purposes better than anything else.

The space underneath this porous bottom is divided into eight compartments, each connected by an individual pipe and valve with the main air pipe. By this means the air pressure to each compartment can be regulated (by throttling the valve) to correspond to the varying hydraulic head within the tank, and so as to discharge a uniform amount of air throughout the length of the bottom. A pressure of from 4 to 5 lb. is commonly used, each square foot of porous medium requiring from 8 to 10 cu.ft. of free air per minute.

Each longitudinal edge of the tank is provided with a lip and an overflow gutter for the reception of the froth discharged. The lower end of the tank is furnished with a spigot discharge fitted with a plug valve operated by a float, to maintain a uniform water level within the tank

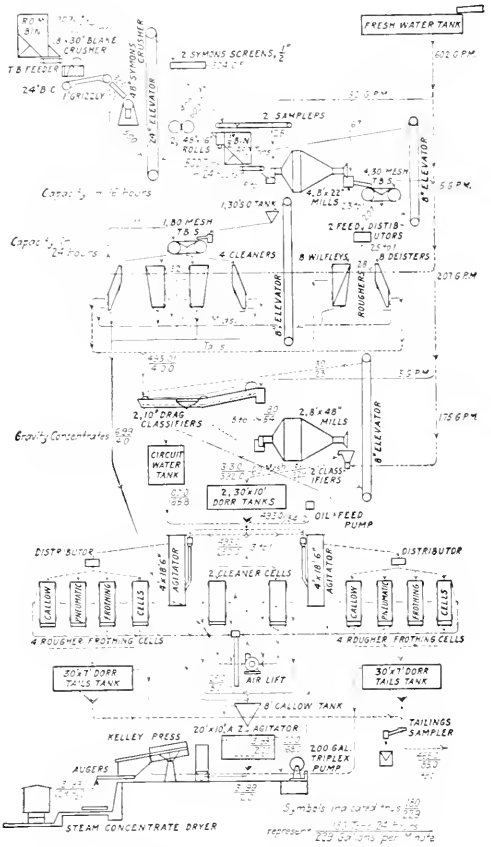


FIG. 1. NATIONAL COPPER MINING CO'S MILL

and thus, in turn, maintain a uniform and constant discharge of froth under all the varying conditions of feed supply incident to practical milling operations. The water level may of course be varied, but is usually maintained at about 10 to 12 in. below the level of the overflow lips.

The tailings are discharged through the spigot, and the frothy concentrate is conveyed to the cleaner separatory cell *C*. This cleaner cell is a machine of the same construction as the rougher. In operation, however, it

*Excerpts from a paper by J. M. Callow, Salt Lake City, Utah, to be presented at the February, 1916, meeting of the American Institute of Mining Engineers at New York.

usually has a lower air pressure. The tailing from the cleaner is returned to the original feed, a closed circuit thus being maintained. The concentrate from the cleaner is the finished product.

The machines may be run either in parallel or in series without any sacrifice in the capacity for a given number of cells. Recent experience goes to show that on some ores the series treatment gives slightly cleaner tailings; on others it does not. It is not necessary to extend this arrangement of cells beyond two cells in series. In a heavily mineralized ore this arrangement is decidedly advantageous, and in such a case the rougher concentrate might be of high enough grade to dispense with the cleaning operation. The froth from the second cell in the series might be returned to the original feed, in the same way that the tailings are returned from the cleaner when practicing a roughing and cleaning operation. A number of such combinations are possible.

At the mill of the Inspiration Copper Co., Fig. 4, the feed goes to 12 primary roughers, the tailings from which are classified into sand and slime, the sand going to tables and the slime to 12 secondary roughers. The concentrate from both the primary and secondary roughers goes to four cleaner cells, and the tailings from the cleaner cells are pumped back into the circuit.

Froth Formation and Pulp Density

The froth is generated as the result of injecting the finely divided air into the bottom of the already emulsified pulp; it continues to form and to overflow as long as it is furnished with pulp of the proper consistency, adequately mixed with the right quantity and kind of oil or frothing agent. Measured from the water level within the tank, the froth produced may be from 14 to 16 in. thick and will be more or less voluminous, coarse or fine-grained, dry or watery, according to the character of the ore and the kind and quantity of oil introduced. The condition of the froth may be varied, therefore, by changes in the kind and quantity of oil used and the quantity of air injected. In some ores rich in sulphides, and where a comparatively low-grade concentrate will suffice, the cleaning cells may not be necessary, but on low-grade ores having a high ratio of concentration and when a concentrate of extreme cleanness and of maximum grade is required, a cleaner is desirable.

The pulp to be treated may be of varying density, from 2½ of water to 1 of ore, up to 5 or 6 to 1. For a mixture of sand and slime, the former ratio is preferable, but for pure slime, minus 200-mesh, the larger proportion of water is allowable. The particular density is not a matter of so much importance as the supplying of pulp of uniform density, since each variation in the density of the pulp requires a readjustment of the oil supply, the quantity of oil increasing in proportion to the increased volume of the pulp, independent of its solid contents.

The Oils Used and Froth Character

The oils used may be broadly divided into "frothers" and "collectors." The pine oils are good frothers, and coal tar and its various subdivisions are good collectors. On some ores crude pine tar will in itself combine the properties both of frothing and collecting; on others, this may have to be enriched by the addition of some one of its more volatile constituents, such as refined pine oil, turpentines, or wood creosote.

Generally speaking, the coal-tar products are poor frothers, and to get a sufficient volume of froth to insure a high recovery, it is often necessary to add refined or crude pine oil, creosote, etc. At the Inspiration mill, for instance, the mixture is 80% crude coal tar, 20% coal-tar creosote; at another plant on similar ore, 45% El Paso coal tar, 40% coal-tar creosote, 10% creosol and 5% pine oil. At Daly-Judge a mixture of 40% crude coal tar, 40% creosote and 20% pine oil was used. In the Cœur d'Alenes on zinc ore straight wood creosote was used; on the ore of the National Copper Mining Co., plain turpentine will work, but pine oil is better.

At Inspiration, from 1½ to 2 lb. of the mixture per ton of ore was used; at Daly-Judge, 1 to 1½ lb.; and at the National, $\frac{3}{10}$ lb. of oil is sufficient. In the experimental work at another plant the oil consumption was approximately 1 lb. of mixture per ton; but since the entire plant has been in operation, and the circuit water reclaimed and used over again, the oil consumption has dropped to 0.35 lb. At present the proper kind or kinds of oil and the quantity requisite can be determined only by experiment; no scientific way has thus far been found.

The stability of the bubbles depends to some extent upon the oil used and the nature of the gangue in the pulp

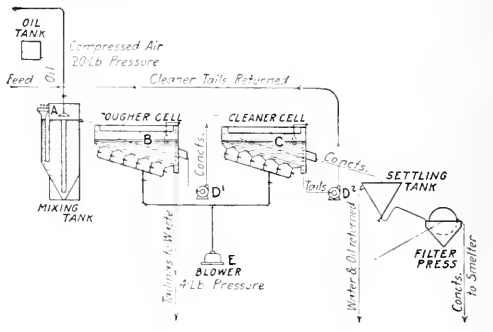


FIG. 2. CALLOW PNEUMATIC PROCESS

treated. Pine oil makes a brittle froth, which dies immediately on arriving at the surface. Creosote and light oil make a more elastic envelope, which at times will expand into bubbles 3 or 4 in. in diameter before bursting. Pine-oil bubbles are rarely over ¼ or ½ in. in diameter. Castor oil, olive oil, candle-makers' oil (oleic acid), palm oil, sperm oil and other oils of a lubricating nature have in general been replaced by oils more or less soluble or miscible in water—such as turpentine pine oil, and all the coal- and wood-tar distillations. The extremely volatile hydrocarbons, as naphtha, gasoline, ether and alcohol, seem to be of little use except as means for making the pitchy ingredients of coal and wood tars more soluble or miscible. A large, coarse and elastic bubble seems necessary to the recovery of coarse-grained mineral, but for the very fine and colloidal mineral, a small and comparatively brittle bubble is necessary.

The National Copper Mining Co., using approximately 950 cu.ft. of air at 4 lb. pressure, and treating 500 tons per day on eight roughers and two cleaners, required 35 hp.; this shows a requirement of 3.5 hp. per cell, equivalent to 12.53 tons per hp., or 1.25 kw.-hr. per ton.

Another company using approximately 9,600 cu.ft. of air at 5 lb. pressure and treating 2,100 tons per day on 48 roughers and 12 cleaners, requires 240 hp., equivalent to 3.5 hp. per cell, 11.45 tons per hp., or 1.56 kw.-hr. per ton. The experimental plant of the Inspiration Copper Co., using approximately 950 cu.ft. of air at 5 lb. pressure and treating 200 tons per day with four roughers and one half-size cleaner, required 24 hp.; deducting 4 hp. for two 2-in. centrifugal pumps, the figures become 4 hp. per cell, 10 tons per hp., or 1.79 kw.-hr. per ton. A maximum figure would be 2½ kw.-hr. per ton of feed, using 5 to 5½ lb. air pressure, generated by Roots or Connersville positive blowers.

The oil mixtures in use cost from 1.25c. per lb. up to 3c. per lb., depending on the percentage of creosol and other high-priced oils used; on most ores, 1½c. per lb. is a safe average figure, and a consumption of 1 to 1½ lb., or from 1.25c. to 1.5c. per ton of feed, averaging 2½c. would be a safe estimate.

Labor will vary, of course, with the size of the plant. At one plant consisting of 60 cells, two men per shift operate the entire plant, equivalent to a cost of 1¼c. per ton. One man per shift on a 250-ton plant means a cost of 5.4c. per ton. Assuming a life of three months per blanket, a capacity of 50 tons per cell, and an allowance for repairs to blowers, motors, pumps, etc., we have ½c. per ton as a liberal allowance.

With power at 1c. per kw.-hr., and a consumption of 2½ kw.-hr. per ton, the cost would figure 2.5c. per ton of feed. The estimated cost on a 2,000-ton flotation plant, or larger, would be approximately as shown in the table.

FLOTATION COST ON A 2,000-TON PLANT

	Per Ton, Cents
Labor	1.25
Oil	2.50
Maintenance	0.50
Power	2.50
Total	6.75

On a plant of 250 tons the extra labor costs per ton would bring it up to approximately 10c. per ton of flotation feed. Actual figures from a large plant treating over 2,000 tons by flotation gave 6.1c. per ton. The flotation feed in this case represents 60% of the crude-ore tonnage, making the cost 3.5c. per ton of crude ore treated.

The Reasons for Flotation Phenomena

So far no satisfactory explanation of flotation phenomena has been advanced. At my instigation and under my direction, a large amount of research work has been done in an endeavor to formulate some logical explanation of the phenomena, and perhaps to find some scientific way of conducting flotation experiments in place of the empirical methods now in vogue. Although the latter object has not yet been attained, still these experiments have resulted in the formulation of a theory that appears to be well grounded and that may prove of interest and value to others engaged in this art. This theory refers flotation ultimately to electrostatic action.

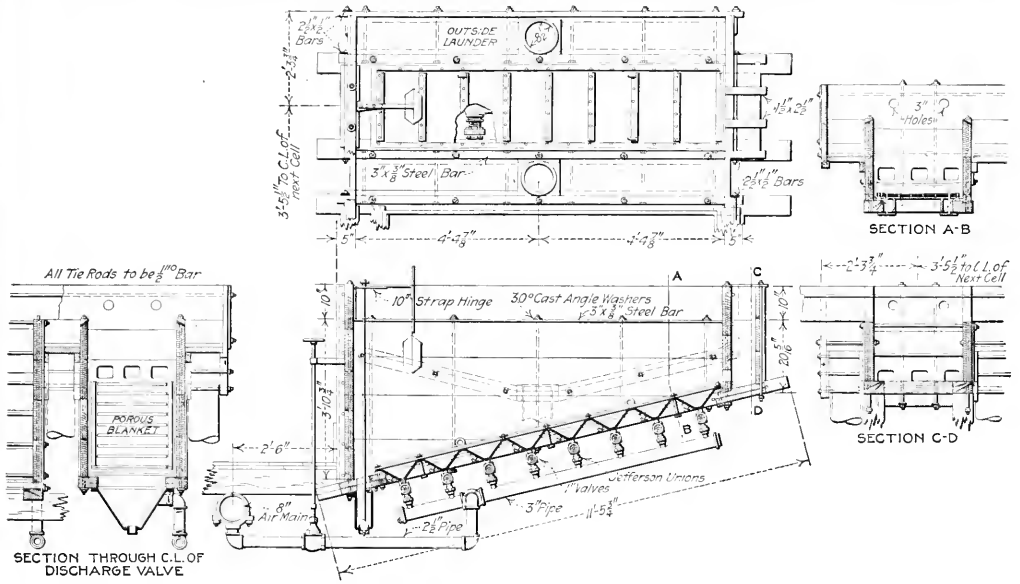


FIG. 3. DETAILS OF THE CALLOW FLOTATION CELL

Much work has been done at the Mellon Institute, at Pittsburgh, under the direction of Dr. Raymond C. Bacon, and lately by James A. Block at the station of the United States Bureau of Mines in Salt Lake City. The result of all of this work is summed up in the following statement:

In considering the connection between flotation phenomena and the physical properties of the minerals concerned, there are two parallelisms:

First—It has been noticed for some time that the minerals that floated were not easily wetted by water, while those that were easily wetted did not tend to come up with the froth.

Second—There is a parallelism between certain electrostatic characteristics and the flotation properties of ores.

In the first-mentioned theory, surface tensions and contact angles should be considered. Certain minerals, such as galena, will float on the surface of still water, while gangue particles, since they possess a greater adhesive attraction for the water than the water's cohesive attraction for itself, will be drawn through the surface film into the interior, and sink because of their greater specific gravity. These properties of floatable minerals and gangues are increased by the presence of oil and acid. Oil sticks to galena with greater tenacity than it does to silica, and an oil surface is still less easily wetted than a galena surface. The acid in the water causes a still greater

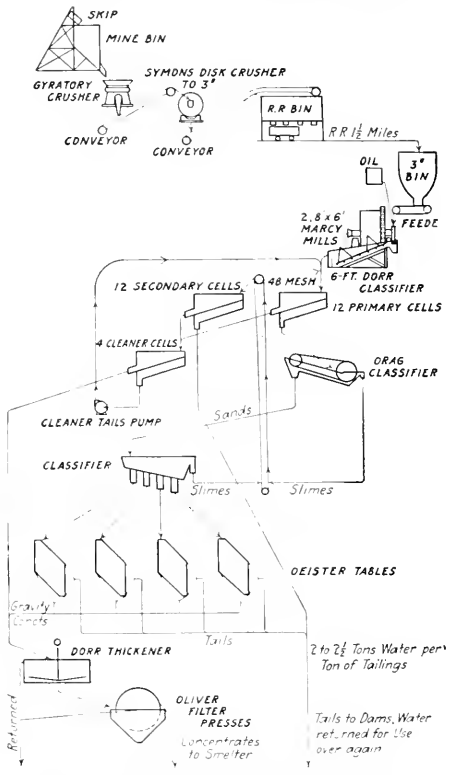


FIG. 4. INSPIRATION COPPER CO.'S MILL

difference in the various surface tensions. This, it seems, is without question the explanation of the action in the Macquisten process, in which the ore particles are lifted to the surface where they can be removed by skimming off the surface layer of the liquid.

With reference to the second parallelism, it has been noticed that extremely small amounts of certain colloidal impurities, such as saponin or tannin, were detrimental to flotation; while others, such as Congo red and methylene blue, did not interfere and were, if anything, beneficial. In classifying these, the injurious ones generally came under the head of what physical chemists call electronegative colloids, while electropositive colloids were not harmful. Suspended particles will generally migrate when placed in an electric field, and this classification comes naturally from the direction of their migration. This migration is called electrophoresis, or electrical endosmose, and is the result of the formation of contact layers around the particles by the liquid containing them, very similar to the formation of surface films when liquids come in contact with air. These contact films almost invariably have a difference of potential between their inner and outer surfaces. An air-water contact film has, for instance, a difference of 0.055 volt, and other contact films have similar charges. This causes the particles to act like charged solids and to be attracted by electric charges of opposite sign.

The charges on solids and nonmiscible liquids can be conveniently studied on the stage of a microscope.

This work naturally led to the study of the charges exhibited by various ores and minerals, and in that work an interesting parallelism was observed—namely, that floatable minerals seemed to have positive charges and non-

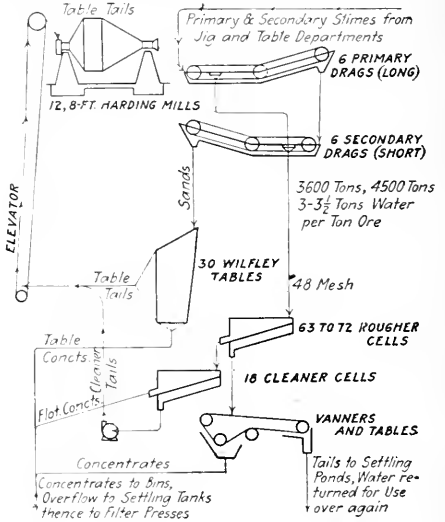


FIG. 5. ARIZONA COPPER CO.'S MILL

floatable gangues, negative charges. Some gangues were found with positive charges, but they were characteristically hard to handle, having a tendency to come up with the froth. These charges sometimes vary with the acidity or alkalinity of the liquid, and this variation is not inconsistent with the effects of acidity or alkalinity on the flotation of ores.

It has been noticed that these electrostatic properties depend on the condition of the surface of the particle and not upon the composition of the mass. For instance, lead oxide, which is ordinarily negative or neutral, when covered with a sulphide coating takes upon itself a positive charge.

Effect of Contact-Film Charges

Recent investigations on the coagulation and deflocculation of slimes, on the coagulation and dispersion of colloids and along similar lines show that these contact-film charges, although small, have an important bearing on the dispersion or coherence of particles suspended in liquid mediums. In fine suspensions and in colloidal solutions, these charges may often be neutralized by the introduc-

tion of oppositely charged ions, precipitation generally taking place whenever these charges fall below certain limits. Oppositely charged contact films have a general tendency to coalesce, while similarly charged films, if their charges are great enough to overcome natural cohesiveness, do not seem to coalesce, but to repel each other, and if the weight of the particles is small enough in relation to their size and surface, permanent dispersion will take place, the particles distributing themselves through a liquid in much the same manner that gas will fill a container.

In view of the above observations, it seems possible that flotation is the result of difference in polarity in the

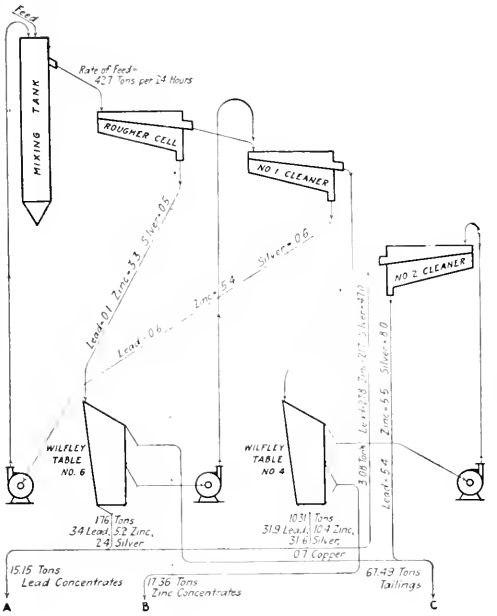


FIG. 6. FLOTATION AT THE DALY-JUDGE MILL

A	B	C
27.8 Pb = 84.95% total lead	3.9 Pb = 13.82% total lead	0.1 Pb = 1.37% total lead
12.1 Zn = 18.07% total zinc	42.4 Zn = 72.61% total zinc	1.4 Zn = 9.32% total zinc
31.4 Ag = 47.27% total silver	27.8 Ag = 48.02% total silver	0.7 Ag = 4.71% total silver
18.5 Fe	1.95 Cu	
4.0 Insoluble	7.9 Fe	
	3.2 Insoluble	

charges on the various ore particles and on the bubbles. Since oil contact films and air contact films have both been proved to have negative charges, the positively charged minerals will adhere to either. The bubble mantles in a flotation machine are undoubtedly composed of oil or of oil in emulsion, since pure water alone will not froth. The same forces, then, that cause oppositely charged colloids to agglomerate and precipitate, cause the minerals to adhere to the oil-covered bubbles; and the same forces that keep the particles of an oil emulsion dispersed, keep the gangue particles repelled from the bubbles

Expressed briefly, the theory is as follows:

That oil flotation is an electrostatic process. It is a scientific fact that when a solid particle is suspended in water, the water will form around the particle a contact film which generally possesses an electric charge, the amount and polarity depending upon the nature of the surface of the particle and the electrolyte in which it is suspended. The presence of these charges can be demonstrated by the fact that the particles possessing them will migrate when placed in an electric field. It has been demonstrated that floatable particles have charges of one polarity (positive), and that nonfloatable particles have charges of the opposite polarity (negative); that the froth is charged negatively and so attracts the positively charged or floatable minerals and repels the negatively charged or nonfloatable ones. It is this, it is believed, that causes the floatable minerals, galena, sphalerite, etc., to adhere to the froth, and the gangue minerals, silica, etc., to remain in the liquid where they can be discharged as tailings.

A Word from Russia*

I finally left London on Apr. 5. I had been prepared to start on Mar. 19, but a few days before that, the wound in my leg, which I had received in the Caucasus, began to trouble me. It grew a little more painful every day, until on the 18th I consulted a surgeon, who said that an abscess was forming where the bullet was still lodged Consequently, I had to go into a hospital for an operation to have the bullet removed. This delayed me practically two weeks.

After I had reached Petrograd, I stayed there 10 days on business and then went to Moscow for a two-day visit. From there I went to Batoum and thence to our establishment at Danzoul, 40 mi. farther south. The Turks had voluntarily retired from the vicinity of our property early in March, on account of their rear being threatened. Much to my surprise, they had done no great material damage to the works. It is nothing short of marvelous that they had not done so. The local natives, however, had looted all of the private houses and had stripped them absolutely bare. The upholstered furniture and mattresses, which they did not wish to carry away with them, had had their coverings torn off. The only personal belonging that I recovered was the Brunton compass presented to me by the boys at the Braden mine. This had been found by a Russian soldier on a mountain side several miles distant from my house, where it had evidently been dropped unintentionally.

Besides looting the houses, the natives had done much willful damage to them—some not having even a door or window left. At the mine, as well as the reduction works, the warehouses had been looted. They had taken about 10 tons of explosives, all hand tools and instruments of every description, in addition to such material as leather and vanner belts. But this is all as nothing compared to what they might have done with a few matches or with a few boxes of dynamite. It is true that before going away they placed several mines, including two under my house; but these were probably for future use.

The collecting again of a staff and the making of the necessary repairs will be a big undertaking. However, nothing can be done until the Dardanelles is opened and the war with Turkey as good as settled. Fortunately, all of the old staff members whom I would want to re-

*Excerpts from a letter from R. T. White, of the Caucasus Copper Co., reprinted from "Teniente Topics." The letter is dated May 16, 1915, and sent from Tiflis.

engage, are anxious to return; but now there is very little labor available, and besides, general conditions are not such that we could do anything at the present moment.

Two weeks ago the commandant of the province of Batoum issued orders that all foreigners should be excluded from the district; so for the present I am obliged to stay in Titlis, where I am simply waiting to see what is going to turn up next. I am in hopes that the order will be sufficiently modified within a few days so that I can return to Danzoul.

The St. Paul Electrification

C. A. Goodnow, assistant to President A. J. Earling, of the Chicago, Milwaukee & St. Paul Ry., in charge of the electrification work, states concisely the following advantages to be expected from electrification:

Our new electric locomotives have a capacity for hauling 3,200 tons on a 1% grade, while the maximum capacity for one of our steam locomotives on a 1% grade is 1,900 tons. In other words, our trainloads can be increased about 68% by electrical operation.

A Mallet steam engine costs 15c. to 25c. per mi. for repairs, while repairs to our electrical engines, so far as we can judge, will approximate 4c. per mi.

The first stretch of track on which electric engines will be put in service Dec. 15 comprises only one division—from Deer Lodge, Mont., to Three Forks. When the second division—from Three Forks to Harlowton, Mont.—is completely electrified we shall be able to judge how much the company will save from the reduction of interdivision expense. This will be a very considerable item. A steam locomotive, in common railroad practice, is not run through from one division to another. At the end of the division a steam engine must be cleaned and overhauled. The flues may be leaking, a cylinder may be hot or the firebox may be out of order—all reasons why it is impractical to run a steam engine from one division to another. An electric engine, on the contrary, may safely be run indefinitely without being laid up at division points.

Through what is called regenerative braking, moreover, a train on the down-grade is made to return for subsequent use 21% of the electric power required to move a train of similar tonnage up the same grade. This was proved in tests which I witnessed on the Butte, Anaconda & Pacific electrified railroad.

By electrification we eliminate fuel trains carrying company coal, and we do away with the necessity of maintaining wayside coal and water stations and cinder-pit expense.

Flotation at Idaho Springs

The Oneida-Stagg Mining and Milling Co., of Idaho Springs, Colo., is planning additional development calculated to open up more ore and facilitate the handling of orebodies now available. The mill, which was originally designed to treat ore by the continuous-decantation system of cyanidation, has been remodeled and is now equipped to treat 50 tons a day by oil flotation. It is estimated that the milling cost is about 85c. per ton. The cost of the oil is reported to be about 3c. per ton of ore treated.

The ore is delivered to a grizzly, the fines passing to the mill bins and the coarse to a Beales crusher and thence to the bins. The ore is delivered automatically to the stamps, and the pulp from the stamps passes to the concentrating tables. The concentrates are delivered to storage bins by a screw conveyor. The middlings pass to a Dorr thickener. Slimes and sands are delivered to a Dorr classifier, from which the sands go to waste and the slimes to a Dorr thickener.

The feed for the flotation machine is taken from the thickener, and the oil is added before the feed reaches the machine. The concentrates from flotation join the table concentrates on the screw conveyor. The surplus water from the conveyor and the tailings from the flotation machine are returned to the Dorr thickener. The concentrate bin is provided with a steel floor covering steam pipes, so that the concentrates may be relieved of moisture before shipping.

Revision of Mining Laws

The Utah chapter of the American Mining Congress has recently proposed that mining men of the West who are unable to visit Washington on Dec. 16 should ask the heads of their companies in New York to send somebody to represent them.

E. B. Kirby has made the excellent suggestion that mining men who are unable to attend should send brief telegrams expressing their opinion, to be read in the convention. Such telegrams, if sent on Dec. 14 or 15, should be addressed to F. F. Sharpless, secretary, in care of the U. S. Bureau of Mines, Washington, D. C.

Both the secretary of the Mining and Metallurgical Society and the Director of the United States Bureau of Mines have received many inquiries from oil men and coal men with regard to consideration of revision of the laws pertaining to oil and coal lands. The purpose of the forthcoming convention is especially to urge revision of the laws applying to metalliferous deposits. However, the position of the mining societies is that the mining laws should be revised in whole, not merely in part, and if it be shown that the laws governing coal lands, oil lands, etc., should be correlated with those governing metalliferous deposits, the contention will probably receive a hearing.

The headquarters of the convention will be in the Raleigh Hotel. The management of that hotel has granted special rates to members of the convention. Representatives attending should establish their membership by registering promptly.

It has been impracticable to secure any special railway rates on account of the small number attending from any one city, but a special Pullman will be run from New York over the Pennsylvania R.R. for the accommodation of members and delegates. This will leave the Pennsylvania Station, New York, at 12:30 night, Dec. 15, arriving in Washington at 7:10 a.m. The car will be open after 10 p.m. The corresponding Pullman will leave Washington at 12:30 night, Dec. 16, arriving in New York 7:13 a.m., Dec. 17. Anyone desiring reservations on either of these trains is to notify the secretary, F. F. Sharpless, 52 Broadway, as soon as possible.

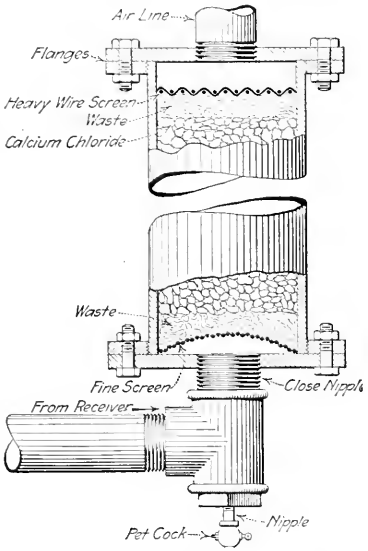
Coal Deposits on the Danish Island of Bornholm are being investigated by Danish and Swedish engineers with a view to their commercial exploitation.

Details of Practical Mining

Dryer for Compressed Air

By Charles Labbe*

Trouble is sometimes experienced with the moisture contained in compressed air. It rusts pipes, joints and valves and results in the latter frequently sticking and freezing. This trouble can be eliminated if the air be passed through a dryer containing calcium chloride or some other deliquescent material. A simple installation is the following, which may be made entirely of pipe fittings, available at nearly every mine: Use a piece of 6- or 8-in. pipe 3 or 4 ft. long (I used a 6-in. pipe, 4 ft. long, for a 10x12-in. compressor) and on each end screw



DRYER FOR COMPRESSED-AIR LINES

a flange to which is bolted a 2-in. flange or other size to fit the air main. At the bottom of the main chamber (the 6- or 8-in. pipe) place a concave wire screen (I used a 24-mesh screen over which was placed about 1 in. of cotton waste to keep the calcium chloride from running through). Next fill the chamber with calcium chloride to within about 3 in. of the top, then 1 in. or less of cotton waste, so that none of the salt will be carried into the piping, and place a heavy wire screen (about $\frac{1}{4}$-in. mesh) over the waste to keep it in place. At the lower part of the dryer a tee is connected by means of short nipples to the dryer flange and to a pet-cock which may be used as often as desired for draining. The dryer should be connected on the outgoing pipe of the air receiver. The calcium chloride has to be replaced from time to time, but this may be readily done by removing the flanges.

*Nelson, Nev.

Tempering Piston-Drill Bits

In a series of comparative tests of piston-drill bits made at the School of Mines, University of Missouri,[1] the following method was tried for tempering drill bits, and better results were secured than with any other method.

The graphite crucible containing a small quantity of salt (NaCl) was placed on the forge and the salt melted. The melting point of salt is about 800 deg. C., which is slightly above the critical temperature of the drill steel used. The steel to be tempered was placed on end in the crucible, the molten salt covering the bit to a depth of about $1\frac{1}{2}$ in. The steel was left in the salt until, on removing, the salt no longer clung to it; in other words, until the steel had reached the temperature at which salt melts. The salt itself got considerably hotter than its melting point, but by watching the steel carefully, it was possible to remove it almost immediately after it had attained the proper temperature.

The steel was plunged directly into a bucket of freshly drawn water. The temper obtained in this manner was believed to be as nearly uniform as it would be possible to get with any method without the use of much more elaborate apparatus. The bits were hard and tough and stood up remarkably well. It was not uncommon to drill from 12 to 15 ft. in hard granite with one piece of steel which certainly indicated a good temper for the bit.

Getting Powder to the Miner

Different schemes have been observed for furnishing the miner with powder. In some mines a special blasting shift is put on. Undoubtedly powder can be saved in this way, as the greater experience these men get in treating the ground in question fits them to judge more accurately the minimum amount of powder necessary.

It is less complicated, though more wasteful of powder, to have a man find out from the miners at the beginning of the shift the amount of powder and primers they will need. This information he sends to the surface where the various orders are made up in the powder house. Toward blasting time the orders are sent below in gunny sacks to an underground magazine where each miner or his helper can get his own as shown by his employee's number on the sack.

Sometimes enough powder is kept underground and each miner sends his helper to the magazine for what he needs.

The Kv.-A. Convention

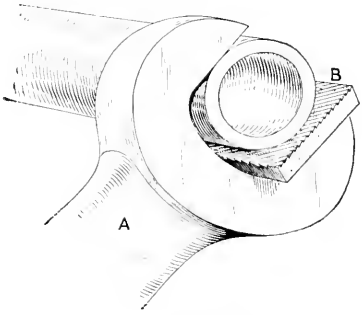
In alternating-current work there is generally a lag between the current and the voltage, so that multiplying the amperage by the voltage does not give the correct power in watts. For a three-phase current, amperage $\times$ volts $\times \sqrt{3}$ = kv.-a, called kilovolt-amperes. If this

[1]Bulletin of the School of Mines and Metallurgy, University of Missouri, August 1915.

kv.-a. is multiplied by the power factor the result is the power in kilowatts (kw.). This can be represented by a triangle of which the kv.-a. is the hypotenuse and the kw. the long horizontal length, in which case kw. $\times$ cos $\angle$ = kv.-a. Whenever the kv.-a. or the kw. are specified, the power factor should always be given to obviate any chance of misapprehension.

Emergency Pipe Wrench*

While doing erection work a considerable distance from where tools could be obtained it was discovered that no pipe wrench large enough to handle a 2-in. pipe could be found on the job. The difficulty was overcome, however, as shown in the illustration. A solid wrench *A*, slightly larger in the jaw than the diameter of the pipe, was secured. The space between the pipe and the jaw was



A PIECE OF FILE FORMS THE GRIP

then filled by inserting a short piece of file *B*. The wrench was then operated in the direction of the arm, the file teeth taking hold as well as a pipe wrench, and the work was quickly completed.

Draftsman's Erasing Knife†

A rather clever and efficient little scratcher for the draftsman's use can be made from an old safety-razor blade and a 5- or 6-in. piece of $\frac{1}{8}$-in. copper wire. The wire should be split longitudinally for about $\frac{1}{8}$ in. by a jeweler's hacksaw, and a portion of the blade soldered into position in this slit, using a small blowpipe with a candle as source of heat, or a blue gas flame.

Any soft solder and its appropriate flux, as tin and muriatic acid, will work, but the most convenient solder and flux is "Solderall," which is a pure tin, finely ground, mixed with flux and put up in tubes ready for use. After soldering, the steel may be ground to any desired shape, giving a very thin, sharp edge, which will remove an inked line without cutting the paper or tracing cloth.

Incidentally it may be mentioned that "Solderall" is part of every chainman's equipment in the surveying district of Arizona, it being supplied by the surveyor-general, together with a number of sleeves just fitting the tape used. If a break occurs in the field, the men fit the broken ends into a sleeve, put "Solderall" at both ends of the sleeve and hold a match under it.

*G. H. Plaine in "American Machinist," Nov. 4, 1915.

†H. N. Bradstreet, Phoenix, Ariz., "Engineering News," Oct. 21, 1915

The Hoisting Rope Question*

The matter of governing the use of hoisting ropes is one of great importance, inasmuch as in most mines the lives of many men for several hours in each day depend on the reliability of the ropes used to hoist the cages. This is well recognized, and in general the greatest care is exercised in inspecting the ropes and maintaining them in good condition. It is furthermore true that inspection of a rope is relatively simple, that the precautions against accident are easy to take and, particularly, that a good wire rope gives ample warning of being unsafe.

Nevertheless, distressing accidents do occur from failure of ropes, and practice in the methods of caring for, inspecting and retiring hoisting ropes varies greatly. Standardization is highly desirable in regard to the methods of rope fastening, to the ratio between rope and sheave diameters, to safety factors and the method of determining them and to the basis on which a rope should be retired from service. However, there were not obtainable, in this country at least, sufficient accurate data on which regulations as specific as desirable might be based.

In order to obtain technical information as complete as possible on this question of hoisting ropes, the leading rope manufacturers of the country were consulted and finally a conference was had at which representatives of the several manufacturers met with the chairman of the committee and discussed the matter in detail. Some of the most perplexing points were then referred to a committee of the manufacturers for further consideration. The general discussion and the report of this committee have brought out facts that are of great interest and technical value aside from their bearing directly on the question of safety.

Safety Factor

In considering first the matter of safety factors, questions arise as to what safety factor to require, what stresses to include in the divisor in determining such factor, and how to ascertain the dividend, or ultimate strength of the rope. As regards ascertaining the ultimate strength of the rope, the committee is convinced that it is both safe and economical to rely on the tables furnished by manufacturers in their catalogs or elsewhere. Since the strength of the material in the wire and the method of assembling the wires into the rope both have a bearing on the rope's strength, it is plain that there is much opportunity for variation. Nevertheless the product turned out is remarkably uniform and reliable. Each individual rope is not tested, but tests are made on ropes of the several constructions and classes of material, and these are constantly checked. The tables in the catalogs perhaps rather understate than overstate the strength of a rope, but the error is slight, is on the right side so far as safety is concerned and is not of enough consequence to affect seriously the matter of costs.

The total stress in a hoisting rope is made up of several factors. The most important of these is the dead load of the vehicle, its contents and the rope itself. Added to this is the stress caused by starting and acceleration; this may be extremely high if the hoisting engineer is reckless, careless or ignorant; the practice of starting with a slack rope, sometimes followed where the hoist is under-powered for its work, may put extraordinary tension on the rope.

*Abstract from "Rules and Regulations for Metal Mines," by Ingalls, Douglas, Finlay, Channing and Hammond; Bulletin 75, United States Bureau of Mines.

Then there is the bending stress when the rope takes the curve of the sheaves, drum or reel or straightens out when leaving it. These three stresses are more or less calculable. Finally there are extraordinary stresses, such as those that occur when a shaft vehicle is pulled at full speed into a constriction of the shaft or when it is overwound. These of course may be of such magnitude that no rope could be expected to withstand them. It is also true that high-speed hoisting is harder on a rope than low-speed and causes more rapid deterioration—a consideration of importance in determining safety factors.

Permissible Hoisting-Rope Safety Factor Difficult to Figure

What stresses shall be considered in calculating the rope safety factor? While those due to acceleration and bending are determinable, they are not easily so, and it seemed to the committee that it was desirable to make the provisions of this code easy of analysis and enforcement. It was therefore decided to calculate the safety factor on the basis of dead load only and make it proportionately greater.

It is evident that with so many different elements affecting the service of a rope, no single safety factor could be selected that would be effective and fair for all cases. It was the sense of the majority of the manufacturers' representatives that the service of ropes should be classified, taking account of the depth of the shaft, whether it be vertical or inclined, wet or dry, whether the hoisting be fast or slow, whether the water be "acid" or not, etc., and that the safety factor and other requirements should be varied to suit these several classifications. Such a course would be theoretically correct, but would result in provisions too complicated for a code such as this. The code therefore imposes a minimum safety factor for all installations and another below which no rope shall fall and remain in service; very deep shafts it exempts altogether.

However, the manufacturers' committee, of which mention has been made, went carefully into some phases of this matter and compiled some tables that represent good practice and constitute excellent rules for mining operators to follow. In the first place, the safety factor is varied according to the depth of the shaft, one is specified for new ropes and another below which no rope shall be allowed to fall. The factor is to be determined by dividing the manufacturers' figures for breaking strength by the dead load.[1]

TABLE 1. HOISTING-ROPE SAFETY FACTORS FOR VARIOUS DEPTHS OF SHAFTS

Length of Rope, Feet	Minimum Safety Factor for New Rope	Minimum Safety Factor When Rope Must Be Discarded	Percentage Reduction
500 or less	8	6 4	20
500 to 1,000	7	5 8	17
1,000 to 2,000	6	5 0	16⅔
2,000 to 3,000	5	4 3	14
3,000 and over	4	3 6	10

The several factors given in Table 1 are based on an actual safety factor of four and are made greater for the shallower shafts because in them the acceleration stresses and a good many of the possible extraordinary stresses are normally greater. In deep shafts it is well recognized that the spring of the rope acts to eliminate the shock of starting and to decrease the stresses of acceleration.

Then for the several depths of shaft, or lengths of rope in the shaft, maximum permissible hoisting speeds are specified. These are given in Table 2.

TABLE 2. PERMISSIBLE HOISTING SPEEDS WHEN SPECIFIED SAFETY FACTORS ARE USED

Length of Rope in Shaft, Feet	Maximum Hoisting Speed, Ft. per Min	Length of Rope in Shaft, Feet	Maximum Hoisting Speed, Ft. per Min
500 or less	1,200	2,500 to 3,000	2,500
500 to 1,000	1,600	3,000 to 3,500	2,750
1,000 to 1,500	2,000	3,500 to 4,000	3,000
1,500 to 2,000	2,000	4,000 to 4,500	3,250
2,000 to 2,500	2,250	4,500 to 5,000	3,500

Permissible Acceleration of Hoisting Speed

Finally, a table of permissible accelerations is given for various hoisting speeds which are not to be exceeded with the safety factors specified. These are shown in Table 3.

TABLE 3. PERMISSIBLE RATES OF ACCELERATION FOR CERTAIN HOISTING SPEEDS AND SAFETY FACTORS

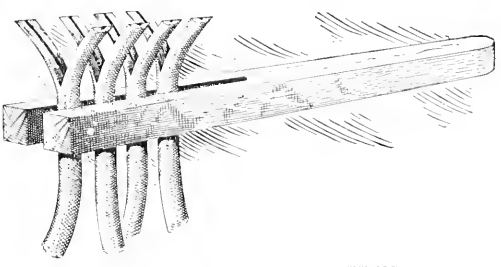
Speed, Ft. per Min.	Maximum Acceleration, Ft. per Sec.	Minimum Time of Acceleration in Which to Attain Speed Corresponding Thereto, Seconds	Speed, Ft. per Min	Maximum Acceleration, Ft. per Sec.	Minimum Time of Acceleration in Which to Attain Speed Corresponding Thereto, Seconds
500 or less	4 16	2	2,000	8 33	4
750	4 16	3	2,500	8 33	5
1,000	5 55	3	3,000	8 33	6
1,250	5 95	3½	3,500	8 33	7
1,500	6 25	4			

Device to Aid in Fuse-Spitting

By Lowe Whiting*

The device illustrated herewith is used in some of the iron mines of Michigan as an aid in blasting.

It consists of a slotted stick, 6 or 8 in. long, whittled from a piece of powder box. The ends of the fuses are



DEVICE TO AID IN FUSE SPITTING

forced into the slot, then split in the usual manner, ignited, and the stick snatched away to be used again.

It is found to be a considerable help in wet places, where the miner holds the ends of the fuses close to his body, bending over to protect them from the dropping water.

A Wire Rope "Don't"

Do not allow a wire rope to be pulled around a tree, stump or column, as such treatment tends to cause the strands to untwist and to curl up like a watch spring.—*Leschen Bulletin.*

[1]The factor of safety of all such ropes or cables when newly installed in shafts less than 3,000 ft. deep shall in no case be less than six, and shall be calculated by dividing the breaking strength of the rope, as given in the manufacturers' published tables, by the sum of the maximum load to be hoisted, plus the total weight of the rope in the shaft when fully let out.

*Manager, Whiting Engineering Co., Iron River, Mich.

Details of Milling and Smelting

Oxyacetylene Welding at Braden

By Alma Ek* and J. R. Thill*

An acetylene generator of the portable type arrived at the Braden mechanical shops in December, 1913. The machine came to Chile without any instructions as to its operation. No one then at the plant understood much about acetylene generators, and the lack of necessary instructions caused a great deal of work, worry and a few narrow escapes from serious injury. However, it was soon operated in such a way as to be a great help in the cutting of plates and structural steel. This was considered good progress, taking into account the manner in which it had been attained.

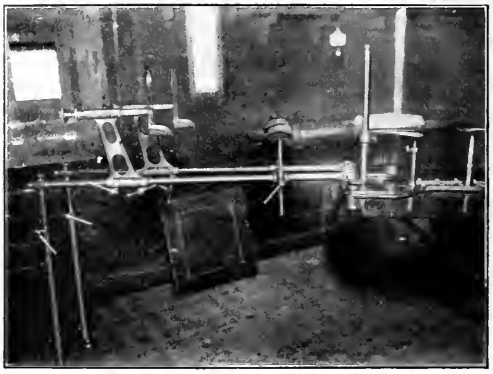
Welding was attempted under great difficulties, but was nevertheless tried because there was an enormous field for this class of work at the Braden plant. The first attempts at welding were made on blast-furnace water jackets. A number of these jackets were lying around, being perfectly good except for the last few inches near the top on the inside. Here the action of the acid in the wet concentrates charges ate away the metal until it finally gave out. To patch such a jacket in the shops with the previous equipment was costly, and at the same time a perfect job was almost impossible.

Having no one who understood the art of making a good weld, or even the proper flame to be used, it was necessary to do a lot of experimenting. The first attempts consisted of welding together two small pieces of steel plate and then breaking the weld by bending, and this naturally gave poor results. It was by this method, however, that the proper flame was discovered. After many trials a weld was made that was stronger than the original metal, being slightly heavier. An attempt was then made at welding a patch on the most worthless jacket at hand. Here the problem of expansion and contraction of metals was encountered.

The bad part of the jacket was first cut out, after which a plate was laid on top. The first three edges made a fairly successful weld, but the last seam continually cracked while cooling. After several experiments a jacket was welded successfully by first cutting away the worn portion and also including several inches of the flange and then taking a ⅜-in. boiler plate and welding first the seam across the face of the jacket. This was then heated with the torch and flanged into place, after which it was trimmed with the cutting torch and the other three seams welded. Since then all our jackets have been patched by cutting out the worn portion and flanging a plate, as shown in Fig. 1, and then welding by first doing the seam across the face of the jacket. Fig. 2 shows a number of blast-furnace jackets all welded, tested and ready for use. These have since been in service for almost one year and have stood up under such severe conditions that they may be pronounced an entire success.

*Master mechanic and assistant master mechanic, Braden Copper Co., Rancagua, Chile.

The first welding of cast iron was done under the most trying conditions. A nut fell from the safety air-discharge valve into the impellers of a No. 7 Roots rotary blower, cracking one impeller for a distance of 15 in. and the other for a distance of 9 in. This threw the faces out of line so badly that the machine was unable to run. This job was a difficult one. The impellers were first wedged so that they would come in line. They were then heated with a crude-oil torch to a dull red and welded, after which they were again thoroughly heated and allowed to cool slowly. The rough weld was then chipped and filed to a neat fit, and in 27 hr. from the time the blower was disabled it was again in first-class condition and has been running continuously ever since. Had this weld failed or been unsuccessful, the blower would have gone to the scrap heap. Since then many cast-iron welds



APPARATUS MADE FOR BRADEN HOSPITAL

This is used in connection with the X-ray machine in setting bones and dislocations of the lower extremities. It would have been very difficult to have made the apparatus in the Braden shops without the oxyacetylene flame.

have been made on hoisting-engine frames, large and small pulleys, cylinders, etc.

Figs. 3 and 4 show a broken motor frame. This motor is used on the blast-furnace charge cars. The bearing *A* was broken off completely, and *B* had two sections broken out. The most difficult part of this job was to keep the two bearings in line, owing to the position of the break, but by clamping a mandrel in the bearing *B* to hold the broken part *A* in position, little trouble was experienced.

After being successful with steel and cast-iron welding, we turned to copper, which offered many obstacles not previously encountered. The thermal conductivity of copper is high, therefore heat is much more rapidly dissipated than in either iron or steel. Copper also oxidizes rapidly. The oxide will dissolve in the molten metal, and unless the greatest care is exercised the mechanical properties will be changed materially. The molten metal will also dissolve gases from the welding flame, principally carbon monoxide and hydrogen. These gases will

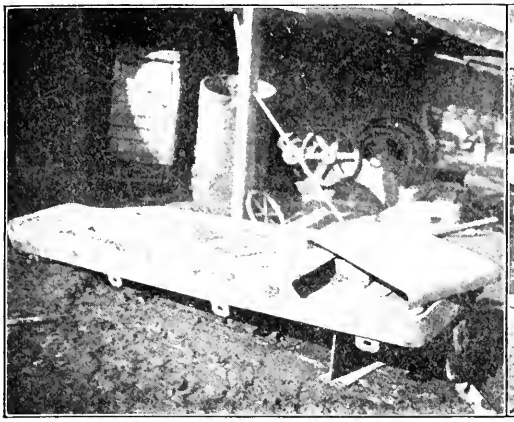


Fig. 1—Water jacket and patch ready to be applied

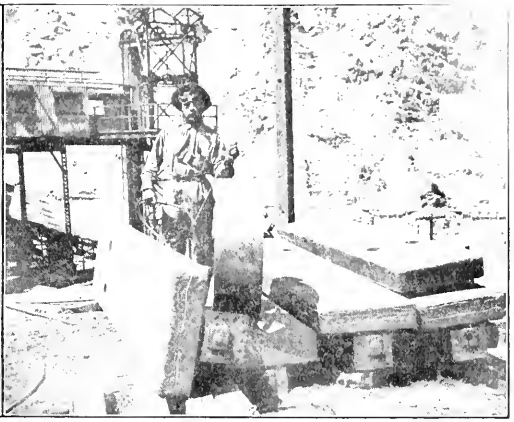


Fig. 2—Furnace jackets repaired by oxyacetylene welding

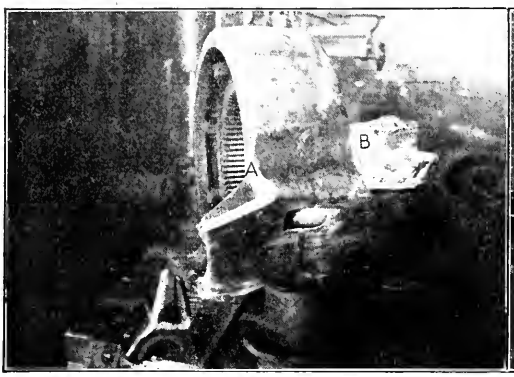


Fig. 3—Motor frame broken through bearings

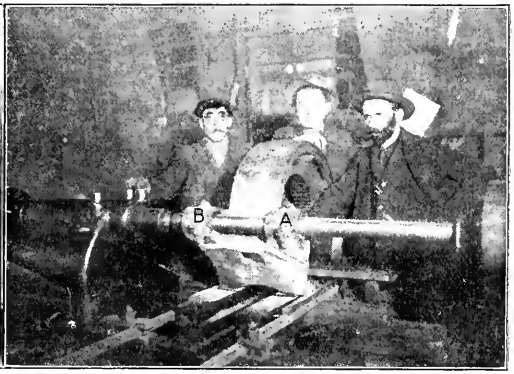


Fig. 4—Motor frame restored by oxyacetylene welding

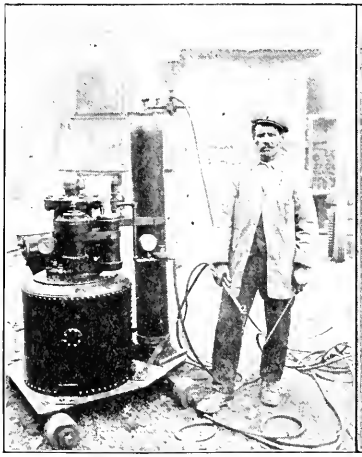


Fig. 5—First portable generating apparatus

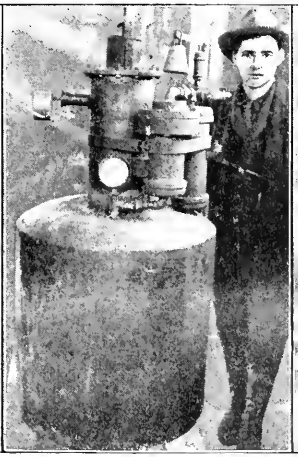


Fig. 6—Present standard portable generator

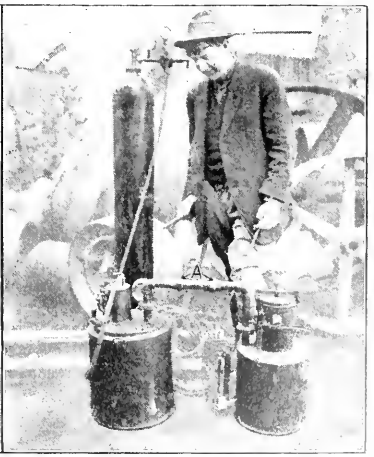


Fig. 7—Small portable outfit

OXYACETYLENE WELDING AT THE BRADEN COPPER CO.'S WORKS IN CHILE

produce blow-holes in the metal while cooling. Several attempts were made that were unsuccessful, owing mainly to blow-holes in the weld, but since obtaining a suitable flux to offset this difficulty, a number of copper cylinders used for electric heaters have been successfully welded and it is expected that all the blast-furnace water-cooled copper spouts will be repaired as they become worn.

The design and building of acetylene generators that could be more easily taken to remote parts of the Braden works were then undertaken. The result was the machine shown in Fig. 5, later the one in Fig. 6, and finally the small portable machine in Fig. 7. As they are all successful, a brief description may be interesting. The machine shown in Fig. 5 is built on the principle that the fine carbide drops from the hopper above into the water. The gas thus generated passes through a felt strainer, then through the water safety chamber, then through the reducing valve and into the service hose. The machine is not fitted with all the so-called automatic safety devices that are to be found on the high-priced portable or stationary generators. A good operator is mainly depended upon for safety, and without a good operator no machine is safe. The machine is also equipped with a good safety valve, which has never been necessary because of a feeding device developed at this works. The feeding arrangement deserves special mention. It consists of a hinged gate with the operating rod passing through the carbide to the top of the hoppers, where it is connected to the arm of the operating lever, which is so counterbalanced that the gate is closed automatically. This gives a positive feed, as the operating rod passing through the carbide acts as an agitator and prevents the carbide from arching over the opening. Trouble is experienced frequently with the more expensive slide-valve arrangement, which operates so slowly that the carbide often bridges and refuses to drop; on being loosened by shaking or jarring the machine, the carbide drops so quickly that the valve cannot be closed in time to prevent a dangerous pressure developing. The locally developed device has proved so successful that the hoppers of two factory-made machines have been changed to this arrangement.

The machine shown in Fig. 6 is the same as that in Fig. 5, with the exception of being a little larger and with all joints oxyacetylene-welded. Fig. 7 shows an acetylene generator designed especially to produce gas enough to do small jobs of cutting or welding in some place where too much time or expense would be involved in transporting a larger machine. It can be disconnected at *A* and each half carried by a man up a ladder if necessary. It can then be set on a flat place, connected and filled with the necessary water and carbide. It is not claimed that this machine is foolproof, but it is safe when used by an intelligent operator.

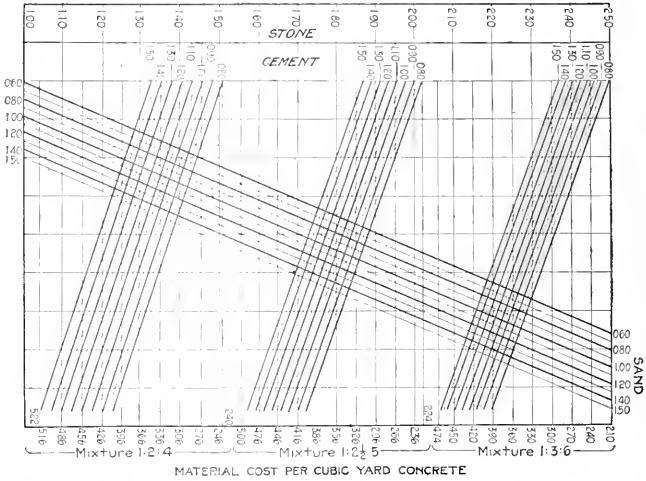
With the number of generators at hand the Braden company can now handle any piece of work that it pays to do by this method. It is found that not only can repair work be done more cheaply by this method, but also much new work, such as pipes, oil heaters, tanks and boilers. Joints can be made to stand a pressure of 100 lb. per sq.in. when required. This work is being done with a saving in both time and money.

The small engraving shows an apparatus that was made in the company shops for use in the Braden hospital, in connection with the X-ray machine, in setting bones or dislocated joints of the lower extremity of the body. It would have been a difficult piece of work for the Braden shops without the use of this process.

The Braden Copper Co. at present has three generating plants in operation—one in the machine shops, one at the smelting plant and one in the mill. There are also ready for immediate use two of the small portable generators.

Concrete Cost Computing Chart

A chart from which the cost of a cubic yard of concrete may be readily traced for different variations in mix and cost of material has been prepared by A. Pearson Hoover, contracting engineer with the John W. Ferguson Co., building contractors, Paterson, N. J., and New York City.



Begin with the cost of the stone on the left-hand scale; read along the horizontal line to the intersection with the long oblique lines representing the cost of sand; follow this proper cost line to its intersection with the inclined lines representing the cost of cement; from whence read horizontally to the right and obtain the total material cost of the concrete per cubic yard.

Cyaniding Concentrates

The application of flotation concentration brings up again the question of the cyanidation of concentrates. It is well to remember that former practice applies with the one difference of oil elimination. Roasting the concentrates is one procedure, but it has the disadvantage of leaving an objectionable carbon deposit. An alternative is in washing the concentrates with a hot alkaline solution—in other words, saponifying the oil and washing it out. The method may be of value in some cases.

Company Reports

Oriental Consolidated, Chosen

The Oriental Consolidated Mining Co., Usan District, Chosen, reports a profit of $660,095 for the year ended June 30, 1915. The mines produced 297,889 tons of ore having a gross value of $1,951,588, or $6.54 per ton. The following table gives a summary of the operating record for the year:

Receipts:	Per Ton Ore
From bullion	$3.29
From concentrates	2.16
From store profit	.04
From interest and other receipts	.12
Total	$5.61
Expenditures:	
Mining costs	$1.91
Milling costs	.48
Concentrate expense	.21
Transportation of ore	.01
General expenses	.48
Total operating and general expenses	$3.09
Development of outside mines	.07
Construction expenses	.24
Total expenses	$3.40
Surplus for year	2.21
Total to balance with receipts	$5.61

Mining costs consisted of 83.273c. per ton for supplies, 0.608c. for assays, 1.347c. for shops, stables, etc., 12.689c. for salaries and board, 78.726c. for payrolls and 14.661c. for electric light and power. The principal items of mining supplies were: Cordwood, 10.471c. per ton; mining timber, 26.498c.; lumber, 8.968c.; charcoal, 1.401c.; dynamite, 0.884c.; detonators, 1.512c.; candles, 7.573c.; fuse, 3.132c.; oils and lubricants, 0.855c.; drill steel, 1.682c.; iron, steel and rails, 2.291c.; tools and hardware, 0.909c.; miscellaneous supplies, including pipe and fittings, pump parts, etc., 7.267c.; and electrical supplies, 0.830c. per ton of ore.

The report gives the following quantities of supplies used: Cordwood, 8,042 cords; mining timber, 125,664 pcs.; dynamite, 168,040 lb.; detonators, 921,719 pcs.; candles, 172,560 lb.; fuse, 180,625 ft.; kerosene, 460 gal.; cylinder oil, 1,105 gal.; engine oil, 2,915 gal.; lubricants, 3,101 lb.; drill steel, 59,302 lb.; iron bar, 21,194 lb.; iron sheet, 14,568 lb.; steel, 784 lb.; and nails, 29,725 lb.

The principal items making up the milling cost of 48.207c. per ton treated were: Supplies, 14.907c.; assays, 0.615c.; shops, etc., 2.567c.; electric power, 16.340c.; salaries and board, 7.27c.; and payroll, 6.508c. per ton.

The following supplies were used in milling operations in the quantities stated. Cordwood, 3,239 cords; battery shoes, 586 pcs.; battery dies, 438 pcs.; bosses, 26 pcs.; tappets, 18 pcs.; cams, 12 pcs.; stems, 24 pcs.; cam shafts, 19 pcs.; crusher shoes and dies, 2 each; iron bar, 9,984 lb.; iron sheet, 12,889 lb.; steel, 3,209 lb.; candles, 1,200 lb.; kerosene, 655 gal.; cylinder oil, 140 gal.; engine oil, 770 gal.; lubricants, 1,292 lb.; quicksilver, 30,554 oz.; and nails, 3,589 lb.

The assay office ran 36,898 assays at a cost of 12.75c. per assay.

The ore reserves of the various mines operated by this company are estimated to contain 841,000 tons having a gross value of $1,841,085. The Kuk San Dong reserves were exhausted, and the property has been closed down. The company ended the year with $463,410 in cash after paying dividends aggregating $858,780. Current debts amount to $52,189. The company's store carries about $266,688 of supplies on hand.

American Smelting and Refining Co.

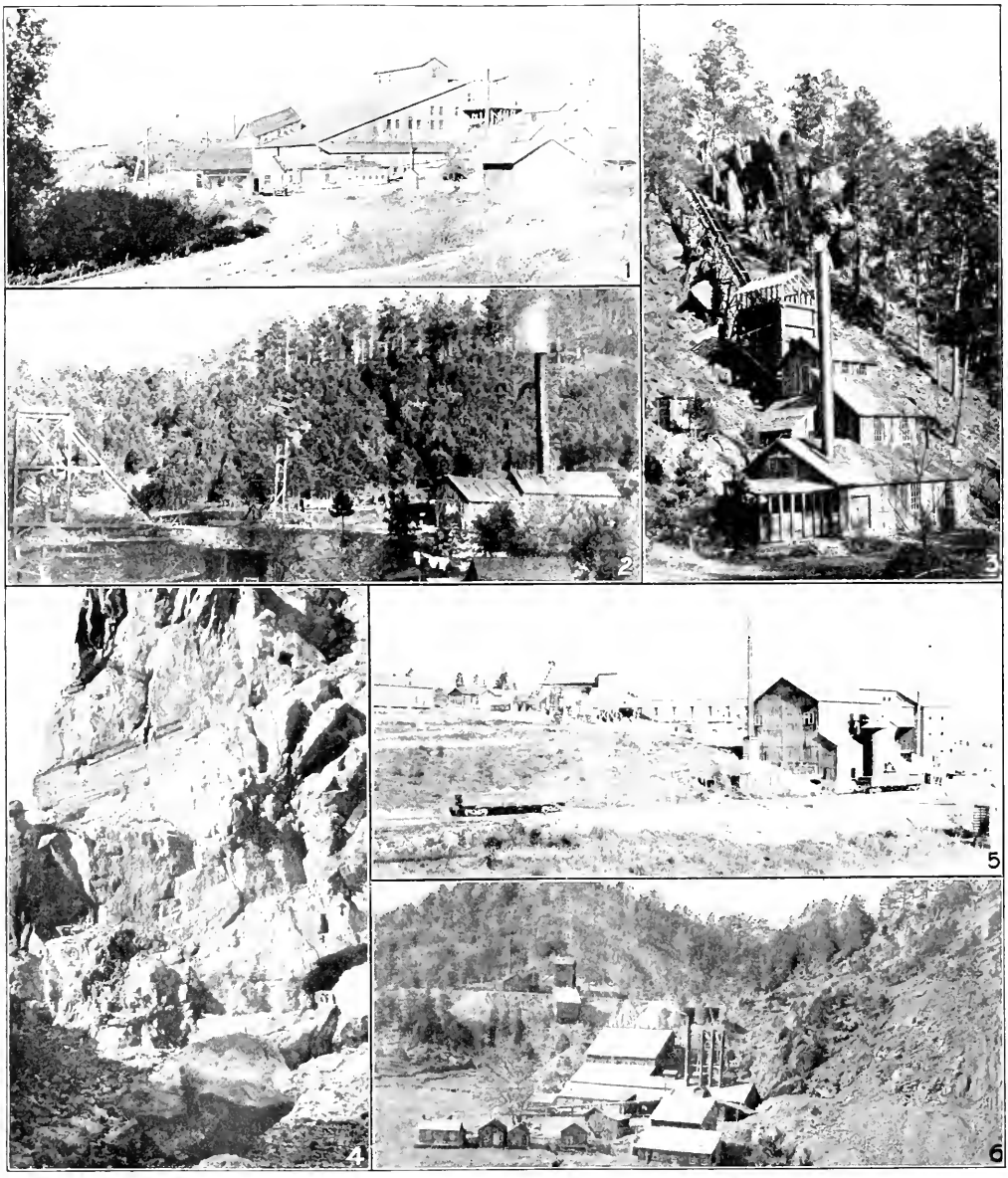
The American Smelting and Refining Co. reports a profit of $5,019,982 for the six months ended June 30, 1915, an increase of $53,290 over the same period in 1914. Dividends aggregating $3,004,900 were paid. The accompanying summary of income and profit and loss for the American Smelting and Refining Co. and the American Smelters Securities Co. gives a comparison for the first half of 1914 and 1915.

	Six Months Ended June 30, 1915	Six Months Ended June 30, 1914
Net earnings of smelting and refining plants and industries dependent thereon	$5,234,925.47	$5,462,094.17
Net earnings from mining properties	767,469.09	614,727.19
Total net earnings of operating properties	$6,002,394.56	$6,076,821.36
Other Income—Net: Interest, rents, dividends, commissions	754,958.68	705,432.78
Gross income	$6,757,353.24	$6,782,254.14
Charges Against Gross Income:		
Administration expenses	$449,105.75	$470,924.96
Research and examination expenses	23,492.23	30,390.31
Corporate taxes, including accrued income tax	71,480.03	74,378.83
Interest on debenture bonds	388,680.61	450,000.00
Amortization of discount on bonds	25,000.00	25,000.00
Depreciation	779,612.60	764,918.13
Total charges	$1,737,371.22	$1,815,562.23
Net income for six months	$5,019,982.02	$4,966,691.91

The company purchased and improved a zinc plant situated at Sand Springs, Okla. The total expenditures for property, additions, new construction and improvements was $860,212, of which $779,612 was charged off as depreciation. Cash on hand and in transit increased $11,114,600 during the period. Better conditions in Mexico are expected to help the company's showing in the near future.

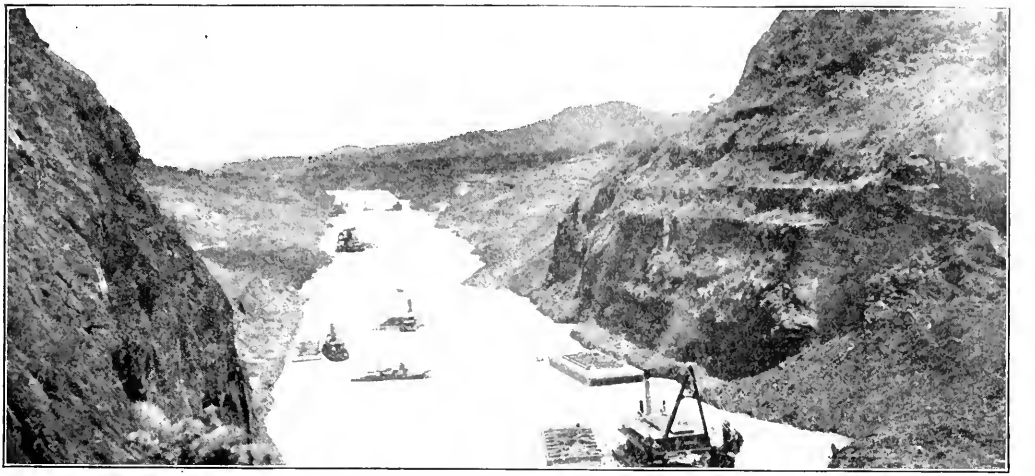
The American Agricultural Chemical Co., New York, reports a net profit of $3,675,145 for the year ended June 30, 1915. Dividends amounting to $1,654,176 were paid on the preferred stock and $737,236 on the common stock. The profit stated was after charging off $890,393 for depreciation of plants and mines and $821,488 for freight, losses and contingencies. The report shows a total profit of $34,576,102 since the organization of the company, of which $24,799,401 has been paid out in dividends. Current assets total $35,359,732, of which $15,444,628 represents accounts and $8,795,492 bills receivable. Cash on hand aggregates $2,109,559. Current liabilities total $6,541,837, which includes $4,835,080 of notes payable. There are $9,428,000 of first mortgage 5% bonds and $7,500,000 of debenture 5% bonds outstanding. The sum of $157,408 was deducted from the year's profit to cover bad debts.

Photographs from the Field



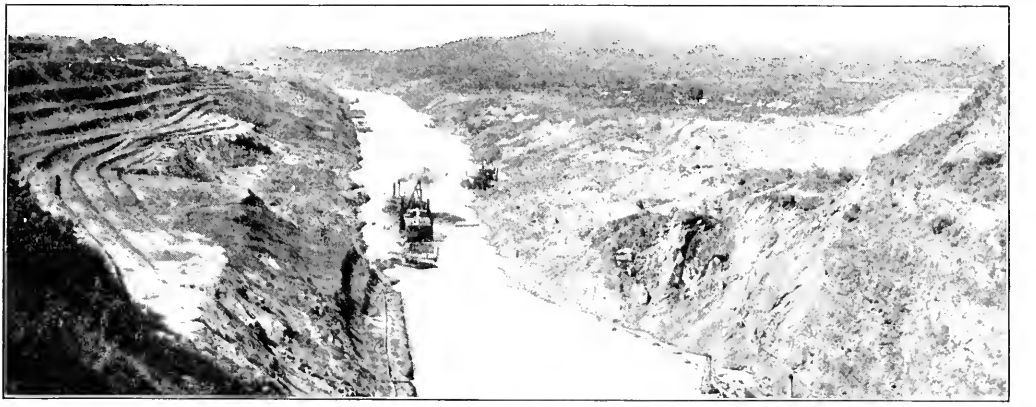
SOME VIEWS OF MINING IN THE BLACK HILLS GOLD DISTRICT, S. D.

1—The Golden Reward Con. Gold Mining and Milling Co.'s cyanide mill, 200 tons' capacity, at Deadwood. 2—The Columbia mine, at Keystone, where Superintendent Blackstone, of the Homestake, is sinking a 300-ft. shaft on a promising prospect. 3—Mizpah No. 1 stamp mill at Keystone. 4—Immense spodumene crystal at the Etta mine, near Keystone. 5—The Golden Reward Co.'s roaster at Astoria mine in Ruby basin. Here 75 tons daily of blue ore are roasted in a Wedge furnace, preparatory to cyanidation at the Deadwood mill. 6—The Keystone-Holy Terror mill, at Keystone

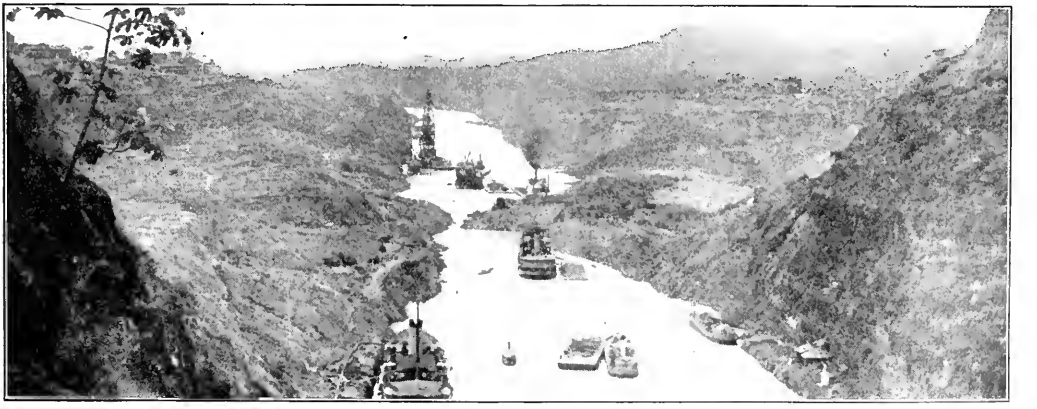


VIEW NORTH BETWEEN CONTRACTORS HILL (LEFT) AND GOLD HILL (RIGHT), SHOWING CULEBRA REGION OF THE PANAMA CANAL

Small slides on both banks caused by admission of water to canal. The great slides came later



THE CULEBRA SLIDE IN AN EARLY STAGE; SLIDE FROM EAST SIDE ONLY, OCTOBER, 1914



FULLY DEVELOPED CULEBRA SLIDE, AFTER AUGUST, 1915, WHEN BOTH BANKS SLID

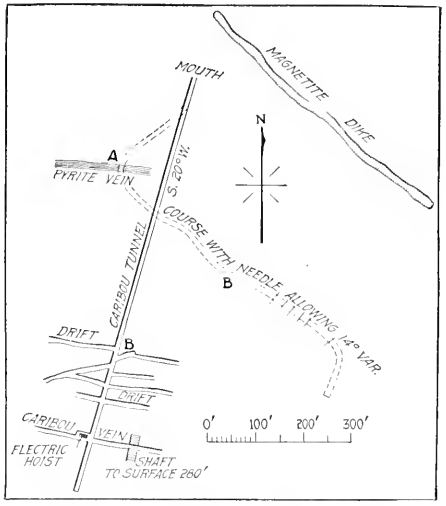
Correspondence and Discussion

Peculiar Magnetic Phenomenon

I wonder if any of the "Wise Men of the East" can explain the following uncanny magnetic freak. It has annoyed me much in not being able to solve it myself.

Last winter I had occasion to examine the old Caribou mine in Boulder County, Colorado, once a famous rich silver mine and now being opened up again by Henry P. Lowe. My attention was called by Norton H. Brown, superintendent of the mine, to certain magnetic disturbances. I hardly knew whether to take him seriously until I had verified every statement he made. The facts are as follows and were determined by me with a Brunton compass.

First: The Caribou crosscut tunnel is 900 ft. long, true course S20W. It cuts six veins all within a space of 200 ft., on which drifts are driven. Allowing the proper Colorado variation of 11° E and taking bearings



MAGNETIC COURSE IN CARIBOU TUNNEL

every 50 ft. in the tunnel gives the remarkably crooked course shown on the map by dotted lines, the two ends of the tunnel registering the right course, but all out of joint in between.

Second: At any of the drift and tunnel intersections, the needle reading of the tunnel is about S50°E, as per sketch, but if one goes 10 ft. or so into any of the 10 drifts, the needle reads all right, and one would think the "Tommyknockers" had possession of the mine when, holding a compass in one's hand in the tunnel, with the needle pulled around 70° from its proper course, one can back off into any of the drifts and watch the needle gradually swing around 70° to its proper North-Pole habits.

Third: Walking over the tunnel line on the surface, which rises 20°, and taking needle readings every 50 ft., as in tunnel, shows no such freakiness, but a uniform needle disturbance of 10° or S10°W in place of S20°W. The only observable geological condition that might affect the needle is the existence of a strong magnetite dike 10 ft. wide, standing vertical and running S50°E, which, strange to say, is identical with the tunnel readings for 600 ft. of its length and may give a clue to the mystery. At *A*, where tunnel readings change 90° from NE to SE, there is nothing but a small iron-pyrite vein crossing at right angles. It has no magnetic qualities, but I have thought possibly to one side of the tunnel it might change to magnetite and account for the unusual disturbance at that point.

One would naturally attribute the whole matter to the magnetite dike, but why does the needle read true at the mouth and face of the tunnel, which are two points the nearest and most remote from the dike? Also what influence can account for the needle reading O.K. only 10 ft. away from tunnel in any of the drifts? Why does a set of readings over the tunnel line at surface not agree with those taken in tunnel? Can the bore of the tunnel itself be magnetic? If so, why does it not act uniformly and who ever before heard of a tunnel hole acting as a magnet? Insulated wires of 250 voltage extend from *B* to the hoist, and I was working up a theory along that line until Mr. Brown told me the same conditions prevailed before the power line was installed. The rock formation is granite and schist.

If I had not observed this myself, I should be inclined to question if the author had not been out to a banquet the night before. The tunnel, however, is still there to back me up, and the Brunton compass will ordinarily do fine work, but it is sure locoed in Caribou tunnel.

Denver, Colo., Dec. 2, 1915. EDWIN E. CHASE.

NEW PATENTS

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

AIR-HOSE COUPLING. William Engle, Taylor, Wash. (U. S. No. 1,161,641; Nov. 23, 1915.)

ALKALI HYDROXIDES—Process for the Simultaneous Production of Soluble Alkali Hydroxides and Cement-Making Material. Arthur William Heyman, Northampton Borough, Penn. (U. S. Nos. 1,160,171 and 1,160,172; Nov. 16. 1915.)

ALUMINA—Crystalline Fused Alumina and Method of Making the Same. Leonard B. Coulter, Niagara Falls, N. Y., assignor to The Carborundum Co., Niagara Falls, N. Y. (U. S. No. 1,161,620; Nov. 23, 1915.)

ALUMINUM—Process for Producing Aluminum from Clay, Kaolin, and Other Aluminum Silicates. Grenville Mellen, East Orange, N. J., assignor of one-half to United Aluminum Ingot Co. (U. S. No. 1,160,431; Nov. 16, 1915.)

ALUMINUM—Process of Melting Aluminum or Aluminum Alloys. Grenville Mellen, Mount Vernon, N. Y. (U. S. No. 1,-160,130; Nov. 16, 1915.)

ALUMINUM—Solder. Joseph Cayocca, Sacramento, Calif. (U. S. No. 1,161,612; Nov. 23, 1915.)

AMALGAMATING MILL—Abrasive Amalgamating Mill. James B. Shackey, San Francisco, Calif. (U. S. No. 1,161,418; Nov. 23, 1915.)

The Juneau Gold Lode

F. W. Bradley, president of the Alaska-Juneau Gold Mining Co., in the application for the listing of the shares of that company on the New York Stock Exchange, gave the following succinct description of the Juneau gold lode:

The vein consists of slate carrying gold-bearing quartz irregularly distributed through it in the form of veinlets, stringers and masses. Dikes of metagabbro have intruded themselves into the vein, and these dikes in turn carry quartz similarly distributed. In some places the quartz is sparingly distributed, while in others it is more or less concentrated. It seems highly probable that this quartz can, to a considerable degree, be sorted from the inclosing vein matter, thus yielding a materially higher mill feed than the average of the mass.

From 1896 to 1914 a 30-stamp mill was operated upon the Alaska-Juneau property with the result that 295,807 tons of ore were milled, yielding $669,589.31, or at the rate of $2.26 free gold per ton. This yield was obtained by milling about 63% and rejecting about 37% of the ore mined. If the whole 472,783 tons had been milled, the free-gold recovery would have been about $1.50 per ton, as the rejected vein matter is also gold-bearing. No attempt was made to save the values in the sulphides which, if saved, would have added about 20c. per ton. A tailing loss of an equal amount is definitely known, so that the total value per ton would approximate $2. All of the ore was from selected surface workings scattered over the best known portions of the vein.

The main working tunnel, known as the Gold Creek tunnel, at an elevation of 425 ft. above sea level, has been driven since the aforementioned surface mining and milling work, and at a point 6,450 ft. from the portal an incline raise has been put through to the surface. In driving the Gold Creek tunnel, a portion of the vein on the west side of what is known as the Silver Bow fault was crosscut diagonally for a distance of 650 ft., disclosing bodies of ore the assay values of which average slightly less than $2 per ton. The ore extracted from both the Gold Creek tunnel and the intermediate level opened from the incline raise at an elevation of 495 ft. above the Gold Creek tunnel has been milled in the new mill erected on Gastineau Channel. Because of the mixture of waste with the ore, due to opening up these two levels preparatory to stoping, the mill-feed assay value of 50,000 tons milled up to Dec. 1, 1914, averaged $1.36 per ton.

The cubic contents of the vein above the Gold Creek tunnel level and between the eastern and western ends of the Alaska-Juneau property, totals approximately 500,000,000 tons of slate, metagabbro and quartz. From this there should be mined, from selected places, 80,000,000 to 100,000,000 tons of vein matter and quartz suitable for milling that should yield a net profit of from 70c. to $1 per ton, depending upon conditions of mining that cannot at this time be estimated within closer limits of ultimate profit. Areas will probably be found in which mining may profitably be conducted by sorting, leaving two tons in the stopes for every ton milled. Other areas will probably be found, all of which may be mined without the necessity of mine sorting, but on this there is nothing definite known.

The mining chances below the Gold Creek tunnel level promise an addition of twice as much tonnage of the same value as it is believed the vein will yield above the tunnel. These mining chances are based upon the fact that in a parallel vein two miles away, on Douglas Island, the orebodies are now being mined at a depth of 2,900 ft. below sea level. At that depth the Douglas Island orebodies still hold their size and average values.

First Steel Billets Made in Lake Superior District

DULUTH CORRESPONDENCE

On Wednesday, Nov. 24, the fires were lighted under one of the 500-ton blast furnaces of the Minnesota Steel Co., at Duluth, and the following day, Thanksgiving, the first steel billets ever manufactured in the Lake Superior district, where iron ore has been mined for about 65 years, were turned out. The other blast furnace will be ready to go into blast within a few days. Seven of the 10 open-hearth furnaces have been finished, and several of them are now in use. It will not be many weeks before all of the 10 will be ready.

There was quite a gathering of officials of the company and prominent men of the district in attendance when the first steel was turned out. The starting of this big plant marks an important epoch for the region where iron ore has been king for so many years and where steel has never been manufactured before. There are a number of blast furnaces manufacturing charcoal pig iron, but this is the first time that high furnaces, utilizing coke for fuel, have been tried. The steel billets will be shipped East to the United States Steel Corporation, the parent company. The rail mill and other mills will not be ready for some time, probably next spring, when another great step will have been taken in the steel business in the Northwest.

Most of the iron ore that has been delivered at the plant has come from the underground mines of the Oliver Iron Mining Co. in the Chisholm district, and steady shipments are now being made. The storage yards for fuel, limestone and ore are extensive, but it will not be necessary to load up in the fall with ore, as must be done in the East, as there is plenty of the raw material close by that can be hauled to the works at any time.

When fully completed, the Duluth plant will represent an expenditure of about $25,000,000. Employment will be given to a large force of men, and Duluth will be greatly benefited by having such a plant at its door.

Australian Gold Production

The gold production of the several states of the Australian Commonwealth for the eight months ended Aug. 31 is reported as follows, in fine ounces, South Australia being estimated:

	1914	1915	Changes	
Western Australia	$13,221	$04,256	D.	$ 965
Victoria	285,069	215,763	D	69,306
Queensland	157,289	171,467	I.	14,187
New South Wales	92,852	99,833	I.	7,981
Tasmania	17,500	11,360	D.	6,140
South Australia	4,000	4,000		.....
Total	1,359,922	1,297,679	D	62,243
Total value	$28,109,588	$26,823,025	D	$1,286,563

The small increases in Queensland and New South Wales were not sufficient to counterbalance the losses in the other states. Victoria showed the largest decrease.

while that in Western Australia was comparatively small. The general result shows a decrease of 4.6% in production and points to an approximate total of $40,000,000 as the contribution of Australia to the gold supply of the world in 1915. New Zealand has not made public the usual monthly statements of production this year. So far as can be estimated, it will show a decrease at a rate equal to, if not a little greater than, that of the Australian Commonwealth.

Willow Creek Gold District*

The Willow Creek gold district lies in south central Alaska, 10 mi. north of the head of Knik Arm, the farthest inland projection of Cook Inlet and the northernmost extension of Pacific Ocean waters in Alaska. This district is an area of rather indefinite boundary, lying in the southwestern part of the Talkeetna Mountains, and has gradually come to include not only the basin of Willow Creek, but all the mountainous portion of the little Susitna River basin.

The district lies along the contact zone of a great series of granodiorite intrusives that form much of the Talkeetna Mountains. As has been repeatedly pointed out, a large part of the gold deposits of Alaska occur in such contact zones. This is the condition in southeastern Alaska and in the Fairbanks, Chandlar, Iditarod and other inland districts. The geology of the Willow Creek district is therefore favorable to the occurrence of gold deposits. Were it not for the intense glaciation of this field, it would probably yield rich placers. As it is, the preglacial gravels that are most likely to contain the gold of placers have been swept away by glacial ice. The placers now found are chiefly post-glacial concentration, which are not likely to be so rich as the older gravels. In the absence of such rich placers and under the primitive conditions of transportation that existed until recently, there has been little to attract the prospector, and hence the region has not been so carefully examined for mineral deposits as its geological features would justify.

Though the Willow Creek district is the only part of the Talkeetna region in which commercial gold deposits have been found, other positive evidence of mineralization has not been lacking. Thus many of the northern tributaries of Matanuska River that cross the granodiorite contact carry some gold in their gravels, and the same is true of some of the eastern tributaries of the Susitna. All this evidence, together with what is known of the bedrock geology, makes it probable that other gold-bearing districts will be found in this province. In any event, the region in which the granodiorite intrusives occur is well worth prospecting.

The veins of the Willow Creek district occur in well-defined fissures, and there is no reason why they should not extend to considerable depth. Surface alteration is limited to a few feet, so that the present shallow workings can be regarded as evidence of the character of ore that deeper mining may reveal. The outlook for a permanent district is therefore hopeful.

Mining costs are now high, owing to the isolation of the district and the high price of fuel. The district, however, lies close to the line of the government railroad from Seward to Fairbanks, on which construction has now begun. Moreover, this railroad is also projected into the Matanuska coal field. When this project is completed, the district will be assured of an adequate transportation service and fuel at reasonable cost. Under these conditions, larger mining operations will undoubtedly be undertaken.

*From Bulletin 607, "The Willow Creek District, Alaska," by the United States Geological Survey, 1915.

Searles Lake Potash in 1916

At the recent annual meeting of the Consolidated Gold Fields of South Africa in London, Lord Harris in reviewing the company's American investments said:

Of course the interesting question there is, What is the American Trona Corporation going to do? We experimented first of all with a process which proved after a fair trial to be unsuccessful, or, rather, too expensive and wasteful for adoption, and we have now reason to believe that the process which has been substituted will be entirely successful, besides being more economical. It is not a difficult process and has only to be adapted to the special climatic conditions of the country. A very elaborate trial of the brine was carried out during the summer by an independent firm of chemists, and the results have been reported on by capable referees so encouragingly that the company felt justified in ordering the plant, which, I am happy to say, is of a standard type, and at present it is anticipated that potash will be produced next year—the most optimistic hope in the earlier months—when we shall most probably still have the advantage of the high price obtainable for potash at the present moment. All the work necessary to secure the company's title to the area located in accordance with the mining laws of California is being carried out, with a view to obtaining an indefeasible title from the United States authorities. These proceedings necessarily take time, but our legal advisers inform us that they have no doubt that such title will be granted us in due course.

The process developed by Charles P. Grimwood has been adopted for the recovery of the salts from the Searles Lake brine. For reasons of economy of operation and better shipping facilities for the refined products, it has been decided to produce at Trona (Searles Lake) only mixed salts from the first part of the process and to refine these mixed salts at the port of San Pedro, Calif., where a site has been leased from the Southern Pacific Co. Construction is now under way both at Trona and at San Pedro. The initial units are expected to produce daily 100 tons of potash and 30 tons of borax. No other salts will be produced at first. Pending the completion of the refinery at San Pedro, a crude potash-borax salt may be marketed.

Humphreys & Miller, employed in connection with the adoption of the Grimwood process, state that there should be a recovery of at least 85% of the potash and 60% of the borax. Production costs at tidewater are estimated at $19 per ton for the first few months, at $12.87 per ton when the triple-effect evaporators are working and at $8 per ton with an enlarged plant. With a freight charge to the Atlantic seaboard (via the Panama Canal) of $7.78 per ton, this would make a cost of approximately $20 per ton with the first plant and $16 per ton for an enlarged plant having a daily capacity of 400 tons of potash and 120 tons of borax.

The Trona Ry. has been in operation since October, 1914, and early in 1915 the construction of a pumping plant and 10-in. brine pipe line from the center of Searles Lake to the site of the Trona plant was begun. Additional supplies of fresh water, for the village of Trona and the operation of the plant, have been obtained from the mountains north of Trona and right-of-way secured from the Government for pipe lines over lands withdrawn from entry.

Editorials

Blast-Furnace Capacity

The estimated production of pig iron in the United States in the month of October was 3,159,500 long tons, the largest quantity ever reported in a single month. The number of furnaces in blast indicates that the November make of iron will be quite as large as the October. The production at present is at the rate of nearly 38,000,000 tons a year, or 7,000,000 tons more than was made in 1913, the year of greatest output. That is, the blast furnaces of the country are running rather close to what is practically their maximum capacity. The statistics of the American Iron and Steel Association show that at the opening of the present year there were 451 blast furnaces, with a total yearly capacity of 44,405,000 tons. To this must be added five furnaces, then under construction but now completed, which raise the total number to 456, with a capacity to make 45,265,000 tons a year. At the present time, therefore, there is about 85% of the blast-furnace capacity active, and it is hardly to be expected that this proportion can be exceeded.

It must be remembered that a blast furnace cannot run forever without repairs; and at least 10% of the existing stacks must be out of blast at a time for relining and rebuilding, no matter how great the demand for iron may be. The list of existing furnaces has been rather strictly revised in the last two or three years, and a number of old stacks have been abandoned and dismantled. There still remain some that, on account of antiquated construction and equipment or unsuitable location, cannot work at a profit unless the demand is great and prices high. If we take these into account, 85% of the rated capacity comes very near to full employment. Moreover, a furnace will not run up to its full rating every day in the year, and its production will not be 365 times the daily rated capacity, even if under favorable conditions it may be speeded up to an excess for a few days. With a nominal yearly capacity of 45,000,000 tons, a yearly production of something under 40,000,000 is the greatest that can be attained.

The year 1915, however, will not approach that total. Early in the year demand was at a low ebb, and the officially reported make for the first half of the year was only 12,233,791 tons. Since June the production has been gradually climbing until it has reached its present high point. The first rush came in the make of the steel companies' stacks, and almost up to the present time we have heard complaints from the merchant furnaces. These have gradually disappeared, however, as more and more have gone into blast and steel interests have been obliged to go into the market for pig iron to supplement the make of their own furnaces. The first demand in the market, and the strongest at the present time, is for steel in various finished forms, though foundry work is gradually catching up with the rush.

We hear from all quarters just now, as in most boom periods, of additions and improvements at various steel works to enable them to keep up with the demand. Much work of this kind is under way or projected. Not much is heard, however, of new furnaces or of increasing pig-iron capacity. Iron men apparently believe that the present blast furnaces will be able to furnish all the iron that may be needed in the next year or two and are not yet ready to undertake additional construction of blast furnaces. It must be remembered also that the building of a new blast furnace on modern lines is a slow and expensive work, much more so than an addition to a steel plant, necessary as the blast furnace may be.

The Alaska Gold Mines

The slump in the shares of the Alaska Gold Mines Co., which, through the Alaska-Gastineau Mining Co., operates the Perseverance mine, near Juneau, Alaska, has excited a good deal of apprehension among the stockholders, who are widely scattered throughout New England and the eastern part of this country, the Alaska Gold Mines Co. being the latest promotion of Hayden, Stone & Co. The previous promotions of that house—Nevada Consolidated, Utah Copper Co., Ray, Chino and Butte & Superior—have been phenomenally successful, without exception. The Alaska Gold Mines Co. is just entering upon the first stage of its fruition.

This company owns a portion of a great lode of gold-bearing ore known to be of low grade, but believed to be capable of yielding an enormous profit in the aggregate when exploited by modern methods on a huge scale. The company reckoned on obtaining a net yield of $1.50 per ton at a cost of 75c. per ton. In the last annual report of the company, D. C. Jackling, the managing director, estimated a minimum of fully developed, partially developed and probable ore at not less than 75,000,000 to 100,000,000 tons having a recoverable value of $1.50 per ton, and the ultimate production of this grade of ore from the entire property will unquestionably be far in excess of these figures." Four mill units designed to treat 6,000 tons per day were planned for the initial equipment, the ultimate that was in view being 30,000 tons per day, but the first four units, which are now nearly completed (and have been partly in operation for several months) have been found to be capable of treating 10,000 tons per day instead of 6,000, and it is thought that their capacity may be raised to 12,000.

Previous to the putting of this mill into operation, the greatest skepticism among engineers pertained to the claims of Mr. Jackling and his associates that they were going to be able to mine and mill gold ore in any way for so small a sum as 75c. per ton. Nothing like that had ever been attained in the Treadwell group of mines opened on a parallel lode on the other side of the Gastineau Channel. Mr. Bradley and his associates operating the Treadwell group were among the skeptics, but they became converted and undertook the development of the Alaska-Juneau property, which adjoined the Perseverance. Mr. Jackling has already showed that he can mine and mill for about 60c. per ton, beating his orig-

inal estimate by a handsome margin and thereby earning a new triumph for himself.

The recent slump in the shares of the Alaska Gold Mines Co. began with rumors that the ore was not turning out so high in grade as was expected. Mr. Jackling in an interview stated that an unexpected occurrence of low-grade "schist" (slate) had been encountered in a part of the mine from which it was hoped to draw a higher grade of ore, and this material having to be put through the mill had reduced the general average. Up to the end of October the new mill had treated about 900,000 tons of ore, assaying about $1.25 per ton instead of the $1.35 expected. The cost of mining and milling, however, had been 15c. a ton lower and the loss in tailings about 5c. a ton lower than estimated, wherefore the net return was only 30c. per ton below the estimate for the average ore.

The Juneau gold lode consists of slate carrying gold-bearing quartz irregularly distributed through it in the form of veinlets, stringers and masses. Dikes of metagabbro have intruded themselves into the lode, which dikes in turn carry quartz similarly distributed. In some places the quartz is sparingly distributed, while in others it is more or less concentrated. The nature of the occurrence of the gold-bearing quartz in this lode implies irregularities in returns, portion by portion or month by month. These irregularities have always been recognized by the managements of both the companies developing the great lode. When the lode is so opened that ore can be drawn from a great many places, which is not yet the case, such irregularities will tend to be equalized in a true general average. It is premature to jump at the conclusion that the Juneau ore is not going to yield so much per ton as was expected.

As to the value of the shares of the Alaska Gold Mines Co., opinions will continue to differ until it has been demonstrated by the milling of millions of tons of ore just about what the average yield and average cost are going to be, after which these shares, being based upon gold, which is not so much subject to market vicissitudes as copper, zinc, etc., will probably become as steady as such well-seasoned gold-mining shares as Alaska-Treadwell, Homestake and others of that class. In figuring an amortized value it is necessary to take into consideration the life of the mine. A mine with a delimited ore-body figured upon as lasting 20 years ought to pay about 9½% gross in order to afford 6% net. As the expected life rises above 20 years the necessary annual amortization diminishes rapidly. When it is a matter of 50 years' life, a gross of less than 6½% is needed to yield 6% net, which is about the basis on which our great mines sell, whether they ought to or not.

The elements for a close valuation of Alaska Gold Mines shares are not yet available. If the company possesses 100,000,000 tons of ore yielding 75c. per ton, there is $75,000,000 net to be had; if only 40c. per ton, $40,000,000. If the extraction be at the rate of 3,000,000 tons per annum, there would be 33⅓ years' life; if at the rate of 6,000,000 tons per annum, only half as much. In general, the more rapidly the ore is extracted from a mine the more profit there is, and this is especially true of a gold mine. In the case of the Perseverance mine its owners expect to get a good deal more than 100,000,000 tons of ore.

The Advance in Silver

The price of silver has been remarkably even since the drop of about 3d. per ounce in the London market, which followed the outbreak of war last year. From October, 1914, up to October of the present year the variation in the monthly averages has not exceeded 1d. per ounce. The demand for silver from the East has been lighter than usual throughout this year, the shipments to India—usually a ruling factor in the market—having been less than in 1914 by 25%, while China has not only taken practically nothing from Europe, but for part of the time has sold rather freely from its own stock. On the other hand, there has not been an excessive supply, and sellers have not pressed the metal for sale, accommodating themselves to the conditions of the market. Silver production in the United States has been about the same as last year and in Canada, rather less; while in Mexico there has been a considerable decrease. The market has also been from time to time supported by buying for the United States Mint.

Since the close of October, however, there has been a steady advance, and the price, which stood at about 24d. in London on Nov. 1, has advanced to 26¼d., showing the greatest variation since the drop at the beginning of the war. This advance seems to be firmly held, and there are indications that it may go still farther.

As usual, several causes seem to be contributing to the rise. The demand from India has been better, and there is reason to believe that Chinese stocks are low and that there will be little selling from that country for a time, and perhaps some buying. The most direct cause is found in large purchases for the British, French and Russian mints. War conditions have brought about an unusual demand for silver coins, and the mints of the several countries are busy supplying them. It seems probable that the coinage demand will continue for some time. An increase in the Indian shipments is also confidently looked for.

Direct shipments to the East from this country have shown a considerable increase this year, the total exports from San Francisco to the end of October having been 11,250,000 oz., or about 1,200,000 oz. more than last year. The total this year was about one-sixth of the exports from London, but this is a larger proportion than usual and may indicate a growing disposition to take from San Francisco rather than London. The supremacy of London in the silver market, however, is so firmly rooted in the conservative East that it will be difficult to bring about a change.

The demand for silver coinage produced by the war is something that has heretofore been overlooked, attention having been concentrated on the huge demands for steel, copper, zinc, lead, etc., but nevertheless it has been real. The millions of men in the field are probably not rich in spending money, but they have some, which in the aggregate is considerable, and they live under conditions that result in the utter loss of a good deal of it. The recent requirements for silver appear to be, partly at least, to replace such loss. Whatever be the causes for it, the rise in the price for silver is a very satisfactory event for the producers at Cobalt, who have been carrying large stocks in their vaults for a long time, while more activity in prospecting is reported from there than for years past.

BY THE WAY

According to the *Peking Daily News*, Hunan Province is full of minerals, among which are antimony deposits in the central portion, pewter deposits in the southern, and copper, lead and coal in the southwestern. Since the Kiang Wha pewter mine is later mentioned specifically, we judge that the makers of fake antiques had better get hold of this mine and turn out pewter plates while you wait.

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The following excerpt from a letter by a late resident of Morenci, now of Duncan, Ariz., needs no comment: "I have been driven from my home by the strikers. The sheriff and governor are hand in hand with them, and not only refuse to protect anyone in sympathy with the company, but go so far as to tell such people to get out of town. It is the worst state of affairs in this country when American citizens paying taxes for protection to their lives and property are not even allowed to live peacefully in their own homes."

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A correspondent in Clifton, Ariz., sends us the following under date of Nov. 26: "The strikers are prepared to hold out indefinitely. The American Federation of Labor has passed resolutions indorsing the strike, and the Miami miners' union will continue to solicit its pay-daily subscription. Several women's organizations have the subject on the anvil, and the Globe and Miami teams will play a game of football for the strikers' benefit. Since the failure of the Greenlee supervisors to authorize 300 additional deputies and in the absence of any other payroll, the business of seeing that the company doesn't blow up its own property, etc., is so rotated among the union boys as to do the greatest good to the greatest number. One serves as deputy a while and then another. W. J. Donahue, of the Duncan tent colony, head supply man for the Detroit company, spent Saturday night, Nov. 20, in Morenci and was fired on through window of his own home. The bullet sunk harmlessly in the wall, however, and Donahue fired back. It is the consensus of opinion that Donahue and an accomplice was merely taking a friendly shot at each other. Summing up the strike situation, the score is 0 and 0, union at the bat, Davies and Myers umpiring. It is thought that directly after the federal investigation is concluded, most of the shift bosses, superintendents and managers will be spent to the penitentiary."

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The scenes of the McCune-Marañon River Placers controversy have been shifted to Peru. Mr. McCune, who formerly controlled the property and later was made general manager, arrived in Peru about a month ago and in an interview in the *West Coast Leader* gives a different version of the fraud proceedings instituted in Wilmington, Del., last summer. Mr. McCune claims to have notified the directors on Feb. 8, 1915, of the failure to find bedrock and advised the abandonment of the enterprise; the directors, desiring to shift the responsibility for the fiasco upon someone else, decided to make him the "goat." Instead of an average of 80.9c. per cu.yd. and the belief that the bedrock gravel would run from $4 to $5 in gold per yd., as stated in the prospectus, subsequent drilling showed a layer of low-grade or worthless "gravel for about 20 ft. and an understratum of mud which at 100 ft. in depth showed no indication of bedrock, where it was originally believed the bonanza deposits would be found." Preceding Mr. McCune's arrival in Peru, George P. P. Bonnell, former treasurer and secretary of the company, landed at Callao in company "with an engineer by the name of Lohman and a United States postal inspector by the name of Barber." They left for the Marañon and, it is supposed, are searching for evidence. The *Leader* adds that "Mr. McCune, who has come to Peru to look after his interests in the case, is also accompanied by an engineer, and leaves for the *sierra* on Friday."

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November Mining Dividends

Dividends disbursed in November, 1915, by 27 United States mining companies making public reports amount to $6,032,264, as compared with $1,137,123 in November, 1914. Industrial and holding companies allied to mining paid $11,196,293, as compared with $8,692,022 a year ago. Canadian and Mexican companies paid $1,057,607, as compared with $634,894 in November, 1914. The report of the Anaconda dividend in the *Journal* of Nov. 6, as being in October, was an error. The stock merely went ex-dividend at that time, while payment was made in November.

The totals for the first 11 months of the year are as follows: Mining companies, $61,012,688, as against $50,-

United States Mining Companies	Situation	Per Share	Total
Ahmeek, c	Mich	$2 50	$125,000
Alaska Mexican, g	Alas.	10	18,000
Alaska Treadwell, g	Alas.	50	100,000
Alaska United, g	Alas.	30	54,060
Anaconda, c	Mont.	1 00	2,331,250
Bunker Hill Con., g	Calif.	02½	5,000
Bunker Hill & Sullivan, l s	Idaho	25	81,750
Camp Bird, g	Colo.	24	267,312
Chief Con., s g l	Utah	.05	43,838
Champion, c	Mich.	2 00	200,000
Golden Cycle, g	Colo.	02	30,000
Gobi King, g	Colo.	.01	10,000
Hecla, l s	Idaho	07	70,000
Homestake, g	S. D	.65	163,254
Lake View, z	Utah	02½	11,250
May Day, g s l	Utah	03	24,000
Miami, c	Ariz.	1 00	746,759
National Lead & Zinc, l z	Mo	.02	10,000
Nevada Wonder, s g	Nev.	.05	70,416
New Jersey Zinc, z	U. S.	2 50	875,000
Osceola, c	Mich.	2 50	240,375
Success, z	Idaho	03	45,000
United Verde, c	Ariz.	75	225,000
Wasp No 2, g	S. D.	01	5,000
Wellington, g	Colo.	02	200,000
Wilbert, l s	Utah	01	10,000
Yellow Pine, c z s g	Nev.	07	70,000
Industrial and Holding Companies	**Situation**	**Per Share**	**Total**
Cambria Steel	Penn.	$0 62½	$562,500
International Nickel, com.	U. S.-Can.	10 00*	3,803,150*
International Nickel, pfd	U. S.-Can	1 50	133,689
St. Mary's Mineral Land	Mich	2 00	320,000
United States Steel, pfd	U. S	1 75	6,304,919
Warwick Iron & Steel, pfd	Penn.	35	52,035
White Knob Copper and Dev., pfd	Calif.	10	20,000
Canadian, Mexican and Central American Companies	**Situation**	**Per Share**	**Total**
Amparo, g	Mex.	$0 03	$60,000
Dominion Steel	Can.	1 50	105,000
Granby Con., c	B. C.	1 50	224,977
Hollinger, g	Ont	20	120,000
Lucky Tiger, g s	Mex.	.09	64,380
Santa Gertrudis, s	Mex	24	364,500
Standard, s l	B. C.	02½	50,000
Steel Co. of Canada	N. S.	1 75	113,750
Touch-Oakes, s	Ont	12½	75,000

* Stock dividend

$15,223 in 1914; metallurgical and holding companies, $76,638,095, as against $78,819,124 in 1914; Canadian and Mexican mines, $8,499,315, as against $14,315,259 last year.

Hecla, which appears in the accompanying detailed table of disbursements, paid its one hundred and fiftieth dividend:

PERSONALS

C. W. Purington has returned to London from Irkutsk, Siberia.

Walter McGrath has returned to Petrograd from Central Siberia.

Thomas A. Varden is at Sault Ste. Marie, Mich., on examination work.

Sydney H. Ball has returned from a several weeks' trip to British Columbia.

H. M. Payne has returned to London from Bodaibo in the Lena Region, Siberia.

Ross Browne Hoffmann has returned to Petrograd from Tomsk; he will soon return to Siberia.

R. Gilman Brown, Deane P. Mitchell and J. P. E. Webster have just returned to London from Russia.

A. F. Gernet has returned from a visit to the Kedabeg copper mines in the Caucasus, of which he is managing director.

Diamondfield Jack Davis, and Henry Webber, both formerly prominent in Goldfield, are now operating in Oatman, Arizona.

Edmund Putnam of Parral, Mexico, and Boston, is in New York in connection with a kaolin mine near Rome, Ga., in which he is interested.

A. H. Buck is making a study of the geology of the Johnson district for the Black Prince Copper Co., and will be in Denver about Dec. 20 next.

R. H. Shields, of Houghton, Mich., president of the New Baltic and New Arcadian Copper companies has gone to Boston and New York on business.

J. P. Hutchins has returned to Petrograd after visiting the Altai region in Siberia and examining the manganese deposits of Chiaturi in the Caucasus.

Walter Straehe returned to New York on Nov. 28 from Greenland where for the last six months he has been examining mineral properties on the west coast.

Manager Bart L. Thane, of the Alaska Gold Mines Co., left Juneau for San Francisco late in November to work on a mining deal that arouses much curiosity in Juneau.

J. A. Replogle, Arthur E. Newbold and Herbert F. Black have been chosen directors of the Cambria Steel Co. in place of Theodore N. Ely, Samuel T. Modine and Childs Frick, resigned.

Benjamin Magnus, formerly general manager of the Mt. Morgan Gold Mining Co. in Australia is now practising as consulting engineer. His address is care General Development Co., 61 Broadway, New York.

Professor J. H. Bragg, of University College, London, has been awarded the Nobel Prize for Physics for 1915 by the Swedish Royal Academy of Science for an examination by X-rays of the formation of crystals.

Pierre Bouery, for 15 years manager of La Grange hydraulic mine at Weaverville, Calif., has been appointed manager of the Valdez Creek Placer Mines in Alaska. Under Mr. Bouery's charge La Grange has been considered one of the most successful hydraulic operations in the world.

Word has been received from Eugene Schwaderer, one of the Michigan College of Mines students who left Houghton for South Africa in July, that the party has arrived at Messina in the Transvaal and found 20 Americans working there for the company, mostly men from Butte or Michigan.

Dr. John A. Mathews, who has been for a number of years general manager of the Halcomb Steel Co., Syracuse, N. Y., has been elected president of the company, succeeding H. S. Wilkinson, resigned. He also succeeds Mr. Wilkinson as president of the Syracuse Crucible Steel Co., a connected company.

Frank S. Badger, of J. G. White & Co., Ltd., sailed on Dec. 1 for Colombia where he will make a power reconnaissance for the Anglo-Colombian Development Co. which has under contemplation the construction of additional dredges in the Condoto gold-platinum region back from Buenaventura on the west coast.

Dr. L. D. Ricketts, of Bisbee, on account of his work in promoting the mining industry of Arizona was selected by Governor Hunt to visit the San Francisco exposition and receive an official greeting as the state's most distinguished citizen. On Nov. 17 he was the guest of the exposition directors at a luncheon in the California Building, where speeches were made by a number of mining engineers and a commemorative bronze medal was presented to Dr. Ricketts.

OBITUARY

Zachary Merton, head of Henry R. Merton & Co., London, died Nov. 30, according to a cable despatch just received.

Philip N. Shannon died suddenly in Pittsburgh, Penn., Nov. 22, aged 72 years. He was for many years a prominent oil operator being a pioneer in Pennsylvania and also holding large interests in Texas, Wyoming and Alabama.

W. J. Guthrie, formerly of Butte, Mont., died at his home near Los Angeles, Calif., Nov. 20. An autopsy is reported to have disclosed the presence of cyanide. It was stated that no physician was in attendance at the time of his death and there was some delay in notifying authorities of the death.

Orville A. Derby committed suicide in Rio de Janeiro, Brazil, Nov. 27, according to a cablegram from that city. The reason for his act is not known. Mr. Derby had served the Brazilian Government for many years as a geologist, and had been chief of the survey since 1907. He first went to South America in 1875 from Cornell University, where he had been an instructor in geology for two years following his graduation there. He was a frequent contributor on geological subjects to scientific journals. Mr. Derby was born at Kelloggsville, N. Y., in 1851. He was unmarried.

Byron Noel White died at Spokane, Wash., Sept. 11, aged 65 years. Born in St. Thomas, Ont., he worked as a young man in the Michigan copper country as a miner and prospector for a number of years, going thence to Spokane about 30 years ago. There he engaged in mining, with which he continued to be connected. He was one of the original owners of the Slocan Star mine, in British Columbia, and at the time of his death he was still largely interested in that property. He was also interested in the Pueblo mine, in Whitehorse copper camp, southern Yukon Territory, and, as well, in mining properties in Oregon. Besides, he operated in Mexico for a time. Mr. White's chief mining activities for a number of years were in connection with the development and productive operation of the Slocan Star mine, situated near Sandon, British Columbia. To acquire the Slocan Star group, which eventually comprised about a dozen mineral claims, in 1892 the Byron N. White Co. was incorporated with Byron N. White, president and general manager. Protracted and costly litigation between the Star Mining and Milling Co. as plaintiffs, and the Byron N. White Co. as defendants, during a period of about 10 years, was finally determined by a judgment of the Supreme Court of Canada, leave to appeal from which was refused by the Privy Council in England in the year 1909. The decision was against the White Co., but later, in 1911, a merger was arranged and the Slocan Star Mines, Ltd., organized to acquire and operate both properties concerned, with Byron White as one of the directors and Oscar White as mine superintendent, since which time the property has been extensively further developed. Mr. White was well known and highly esteemed throughout the Northwest and especially in British Columbia, in the future of which he was a firm believer. He leaves a widow and one son.

SOCIETIES

International Trade Conference—A conference on international trade will be held at the Hotel Astor, New York, Dec. 6-8, under the auspices of the National Association of Manufacturers.

American Institute of Mining Engineers—The next meeting of the New York Section will be held Dec. 8, at the Machinery Club, 50 Church Street. The meeting will be preceded by a dinner served at 6:30 p.m. Following the dinner the subject of "The Engineer in Modern Warfare with Particular Reference to the Present Conflict," will be discussed by several U. S. army engineers.

INDUSTRIAL NEWS

The Morse Bros. Machinery and Supply Co. has purchased the entire plant of the Kuenzel process smeltery situated at Buena Vista, Colo., and will dismantle it and ship it to Denver. This plant was never completed and only parts of it were placed in operation. There is a complete power plant of high-pressure boilers, engines, blowers, compressors, besides crushing plant, machine shop, fire and boiler feed pumps, shafting, elevators, etc.

Editorial Correspondence

SAN FRANCISCO—Nov. 24

Employment of Negroes as Mine Laborers is reported to have been undertaken in the Coso district, Inyo County. More than 25 negroes passed through Visalia Nov. 7 en route to the mines. They came from Virginia and are said to be employed by eastern men who have recently taken hold of mining property in that district. It is reported that their compensation is to be $10 per month and board. The labor in the mines in California has for a long time been done by foreigners; and foreign labor is at present not plentiful. What effect the employment of negroes will have upon the labor element is problematical. This is the first time that a full crew of negro labor has been employed at mining work in California, although the employment of negroes in various other industries is common enough.

The Filing of an Injunction in San Bernardino County to restrain the sale of 3,500 acres of potash lands at Searles Lake as part of the estate of Pliney H. Perkins, while adding another chapter to the litigation, at the same time attracts further attention to the operations of the American Trona Co. The sale of the property involved in the estate has been postponed and the matter will be heard in the Superior Court. But the American Trona Co. is going along with the development of the process for recovering the potash from the brine of the lake, regardless of added litigation. The development of the Searles Lake deposits began before the European war was thought of in America. So the location and development of China Lake basin, a few miles west of Searles Lake, was begun before the war attracted renewed attention to the potash deposit in California. Charles H. Churchill, a prospector and miner who had been on the desert half a lifetime, and who was the discoverer of tungsten in San Bernardino County, has been engaged for several years locating and developing a large acreage of ground that he believes will produce potash and borax on a large scale. Whether or not the European war continues for a long period, the development of these potash lands both at Searles Lake and China Lake will no doubt be continued in the same spirit and with the same energy.

Standard Oil Co., has taken over the Kern County property of Monte Cristo Co., also the Monte Cristo lease at Fullerton. The price is said to be $375,000, which is considered very low. There is a quarter-section of the Maricopa and 40 acres at Fullerton. Total number of wells 115. Monte Cristo has produced a large amount of low-gravity oil. The Fullerton wells are deeper and produce a lighter-gravity oil. The Standard has also taken over a full section in the Antelope Hills district, Kern County, from the Oil Exploration Co., Ltd. The price is said to be $40,000. Testing operation has been in progress in the district for some time past. The Associated is very active in the Lost Hills district, having more than 100 men employed in section 13, plowing and leveling off locations for wells to be drilled. Teams and large motor trucks are working night and day in order to get material and supplies upon the ground before the winter rains start. About 20 wells will be drilled. Oil sands in this section lie 500 to 700 ft. deep. Oil is light gravity. The independent producers, while of a necessity having reduced their output in the past year, are aware that the purchases of more territory by the Standard and increased operation by the Associated is evidence of a future that cannot be destroyed even by the litigation instituted by the government. While the big companies are taking on more land and preparing for increased production, the marketing concerns are keeping their plants going largely with oil purchased from small producers. The only oil men who seem to be really discouraged are those on land that may be involved in the government litigation.

BUTTE—Nov. 25

More Development Work in Butte Mines is being carried on at present than at any time in the history of the district. On Nov. 1 the Rainbow Development Co. began work on its contract at the Butte & London. On that date the unwatering of the shaft was completed and the sinking of the shaft from the 1,100-ft. level to the 1,600-ft. level was begun. The shaft is now down close to the 1,200 level. By Apr. 1 the station on the 1,600 should be in and the entire property will then be crosscut from north to south. Sinking at the Rainbow shaft is going steadily forward and the two properties will be developed jointly. At the East Butte properties, which are to the south of the Rainbow and Butte & London, the sinking of the shaft of the Pittsmont mine came to a stop after going down a distance of 250 ft. from the 1,600 level. At that point a heavy wet fault was encountered that caused delay. The plans call for a further sinking there to the 2,100-ft. level. At the Tropic, adjoining these properties on the east, the Anaconda company will carry on sinking during the coming year and carry the shaft down to the 2,000-ft. level. The Blackrock shaft of the Butte & Superior has been carried down from the 1,600-ft. level to a depth of 1,920 ft. and crosscutting will be carried on from the 1,700-, 1,800- and 1,900-ft. levels. Sinking is now being carried on at the Butte & Great Falls property in the northeast part of the district. All of these mines are in what is known as the East and North Butte districts and in territory that has not heretofore been explored at depth. The unwatering of the Lexington, Alice, Nettie and Emma mines which is going on steadily will be followed by sinking in nearly all those shafts. Sinking at the Elm Orlu is now going forward steadily and the purpose is to carry the shaft from the 1,700 level down to the 3,000-ft. level with stations at 1,900, 2,000 and every 200 ft. below that to the lowest level. It is estimated that sinking in all the mines of Butte being carried to lower levels, is now averaging 2,500 ft. per month or a total of nearly half a mile each month in added depth to the Butte mine shafts.

The New Experimental Zinc Plant of the Anaconda company at the Washoe smeltery is claimed to be a complete success from a commercial as well as from a metallurgical standpoint. The costs, it is said, have been reduced to a point where zinc can be made at a profit even if it were to fall in price to the point where it started previous to the war in Europe. The Anaconda company is expected to proceed immediately with either the enlargement of the experimental plant at Anaconda or with the construction of a new plant in Great Falls, Anaconda or Butte. In the 10-ton experimental plant at Anaconda which was put into operation in October, three large melting pots are used. These were of old construction and limited in capacity. The company has now nearing completion a new brick furnace that will increase the capacity of the plant to 25 tons of zinc per day. This will make a monthly capacity of 1,500,000 pounds of electrolytic zinc when the new plant is operating at the full limit. Cakes of the new electrolytic zinc have been on exhibition in Butte and have attracted great interest in mining circles. This zinc is said to be of such a high grade, 99.9% pure, that it has found a ready market at a good premium by manufacturers requiring it for brass specials and munition purposes. An improvement that has been made is the use of aluminum starting sheets in the electrolytic process. Under the plan of operation adopted at first, aluminum starting plates were used to make zinc starting sheets. On each aluminum plate two zinc starting sheets were made and these in turn were taken off and used for starting the regular zinc plates in the electrolytic tanks. By using the aluminum starting sheets direct, this double handling is avoided. Two plates of zinc are formed on each aluminum starting sheet and are taken direct to the furnace after being removed from the tanks. The Anaconda company expects to have several mines with large zinc orebodies ready for operation early next year. Included in this list are the Emma which it has under lease, the Alice and the Lexington, all of which are being unwatered at present. It is now taking zinc ores for its experimental plant from the Poulin and East Gray Rock mines.

MIAMI, ARIZ.—Nov. 22

Construction at the Inspiration Mill is going on at a rapid rate. The building for the housing of all the pumps and compressors is nearly completed. The seven additional thickening tanks for the tailings-dewatering plant have yet to be installed. In the mill proper, the Marcy ball mills of nine of the 18 sections of the mill are in operation, 18 mills in all, there being two in each section. The flotation machines for the 8th and 9th sections have not been installed, the machines in the first seven sections having to treat the ore ground in the nine crushing sections in operation. The flooring for the flotation machines for the 11 uncompleted sec-

tions is now being laid and several of the cleaning flotation machines, namely in sections 8, 9, 10 and 11 are being erected, the corresponding roughing cells cannot of course be put in until the laying of the floor is completed. The machinery for the concentrating department for all sections has been installed and is ready for operation except for placing the steel drags on the belts of some of the drag classifiers. In sections 8, 10 and 11 flotation machines of the Inspiration type are being installed which are similar to the machines of sections 5, 6 and 7 except whereas those in the last mentioned sections are built of timber, the newer machines in sections 8, 10 and 11 are constructed of light sheet steel. In section 9, another type of flotation machine is being installed, built partly of wood and partly of steel. This machine will operate with agitating paddles somewhat like those used in the Minerals Separation machine, but from the appearance of the machine at present, as it is being installed, the agitation and flotation will take place in the same cell, the tank or trough of the machine being a simple rectangular box in the middle of each cell of which an agitator will hang. This type machine will make in all three types of flotation machines in the Inspiration mill, namely the Callow, the Inspiration and the agitator machines. In the flotation plant the odor of coal tar has replaced that of the eye-burning creosol and creosote.

Construction Work at the Inspiration Mine is nearly completed and for the last few weeks a general cleaning up has been under way both on the surface and underground. This work had consisted of clearing away temporary structures, litter, etc., that had accumulated during the construction period, which at the mine is now about closed. The road from Miami to the mine has been closed, making it necessary to go up to the mine by team or auto over the road that passes by the smeltery and mill. The ground to the west of the Captain shaft of the Miami Copper Co. is caving and cracks that crossed the road have been widening at a rapid rate because of the Miami company's caving operations going on underneath. The miner's change house at Inspiration is nearing completion, and will be ready for occupancy just as soon as the interior fittings have been completed. The double-deck Otis elevator, that will carry a total of 40 men, in the main west shaft is about ready for regular use, and will be used for lowering men by the time the change house is completed. This elevator is electrically lighted and is equipped with a telephone. It is operated from the deck by the cager exactly as is an office-building elevator. There are two push buttons at each station in the mine for calling the elevator for going up or down. It is said that this elevator is the fastest moving one of its kind, having been designed for a maximum hoisting speed of 850 ft. per minute. The electric controlling device installed by the General Electric Co. on the Nordberg twin-skip hoists is now in constant use. With this controlling mechanism the hoisting of the two skips in balance in each shaft is entirely automatic from the time the current is turned on at the beginning until turned off at the end of the shift; the hoisting engineer's most onerous duty is the oiling of the machinery. The hoists may be operated by hand whenever desired, the hoisting speed then being considerably greater than when operating under the automatic control. The last of the four crushing units in the coarse-crushing plant at the main hoisting shaft is now in commission; the conveying machinery on which delivery had been delayed has been installed so that the plant is now ready for operations at full capacity.

CLIFTON, ARIZ.—Nov. 20

A Petition for the Recall of Governor Hunt of Arizona, who is said to have headed a public subscription list with $500, asking at the same time that all citizens donate to the strikers' cause; who threatened to put the mine managers in the bull-pen in order to accomplish his desires regarding treating with the strikers; who issued a Thanksgiving proclamation of which this is a sample: "Today, in Arizona, whither, with phenomenal encompassment of distance, that lofty civilization inaugurated by our Puritan forefathers has advanced with irresistible tread in obedience to Destiny's decree, an intelligent, liberty-loving populace, mindful of the perpetual, omniscent guardianship of Divine Providence, adhere to a time-honored custom by gratefully acknowledging the beneficence of an omnipotent Creator with appropriate manifestations of gratitude for blessings bountifully bestowed," is being circulated in which one of the indictments is: "That the said George W. P. Hunt has deliberately attempted to foment and encourage class hatreds and divisions. That he has been partisan and prejudiced in his dealings with the most vital interests of the state and that, by a program of unconcealed and deliberate catering to the most radical elements, he has created a condition approaching anarchy in certain sections of the state."

TORONTO—Nov. 27

The Consolidated Mining and Smelting Co., of Canada, has issued a circular announcing the issue of a new block of stock, and giving a statement of the affairs of the company, which shows a remarkable expansion. The zinc output for 1916 has been ordered by the Canadian Shell Committee at profitable prices. At the request of the Shell Committee, the company has undertaken the refining of copper which will be done on a limited scale at first, but later it is expected to develop and involve the treatment of much of the matte and blister copper taken from British Columbia mines. The Shell Committee will take the output of refined copper during 1916. The capacity of the lead furnace has been taxed to its full extent during the past year, and the output is sold for six months ahead.

OTTAWA—Nov. 27

Antimony Deposits in the Wheaton district in Southern Yukon are declared by Dr. D. D. Cairnes, of the Geological Survey, who has made a thorough examination of them this year, to be among the largest antimony deposits in the world. In the White Horse copper belt the Pueblo mine, from which 100,000 tons of copper ore averaging 4% copper was shipped prior to the opening of the war, is about to begin operations again. About 100,000 tons of silver ore have been shipped this year from the Atkins mine, at Galena Creek, on the Upper Stewart River. Other promising silver properties are now being developed in the vicinity of the Atkins mine.

VICTORIA, B. C.—Nov. 22

Pacific Coast Collieries, which deferred its bond interest last May, has taken similar action again this month. The property was compelled to close down for a long period, but is now operating and the outlook for the future is better.

Silver Ingots Valued at $65,000 formed part of the cargo of the Nippon Yusen Kaisha liner Yokohama Maru on her last voyage to Hongkong. The silver was shipped via Victoria from the Consolidated Mining and Smelting Co.'s plant at Trail, B. C., and was the largest and most valuable that has yet been sent across the Pacific from British Columbia mines.

COBALT—Nov. 27

The Increase in the Price of Silver has resulted in a renewal of productive activity in the Cobalt camp, and companies which for some time have been curtailing their output and holding back shipments are now arranging to take advantage of improved market conditions by increasing production. In many cases development operations carried on steadily during the depression have put the companies in better condition for mining, so that if the present price is maintained a largely increased output may be anticipated. Mining staffs are being largely reinforced.

There is More New Exploration Work started or planned for this camp at present than there has been for several years. Much of this is by new interests not directly connected with the old successful companies and is on properties which have been partly explored in the early boom days or which have been idle after brief production under the stimulus of the boom. Most of the operations are financed from the States and they are largely in the charge of men new to the district who have been able to get control of well located properties on very good terms and who have their own private "hunch" as to where the ore is to be found. In most cases the work planned does not require a heavy capital outlay and this is presumably a feature that had caused these opportunities to become of interest again at this time. In fact, the camp has and does offer special opportunities for companies with limited capital. The hazard is very great, but the financial requirements of the work are relatively small considering the great prizes in prospect if ore is struck. Among the new projects already formed may be mentioned the Genesee, controlling a lot north of the Chambers-Ferland in the conglomerate, backed by Buffalo and Rochester people; the Twentieth Century, north of Cross Lake, near the Green-Mehan, financed in Buffalo; the Mercy, a survival of the Gould operation in the Cart Lake area, controlled by some of the Seneca-Superior crowd; the Cyril Lake or old Airgoid near the Dominion, backed by St. Paul and Duluth operators; the Adanac, south of the Temiskaming and supposed to have a continuation of the Temiskaming veins, sustained by Burr Cartwright, of Buffalo; the Aguinico, on Lake Temiskaming, north of Cross Lake, being opened chiefly for its cobalt ores by C. E. Smith, of Toronto; the Green-Mehan, once well known on the stock markets, now being unwatered and examined; the Casey-Seneca, in the Casey-Cobalt area, north of the main productive area and isolated from it.

The Mining News

ALASKA

CLIFF MINE (Valdez)—Wharf being rebuilt by Manager Ellis preparatory to shipping in spring.

BARNES PROPERTY (Crowe Creek, Seward)—Richard Dawson, driving tunnel ledge, reports ore averaging $14 per ton.

TEIKHELL (Teikhell District)—Pres. Joseph McCoy reports good progress in development of mine. Tunnels are being driven to tap lead of ore.

ALASKA ENDICOTT M. AND M. CO. (Juneau)—Incorporated with capital of $1,200,000, to own, operate, deal in mines, etc. E. M. Aldrich is Alaska agent.

KOYUKUK CLEAN UP—Will be in the neighborhood of $250,000 this year according to F. D. Howard, former commissioner for that district, most of the gold coming from Hammond River.

NEVADA CREEK (Douglas Island)—M. S. Hudson in charge of mine has added 20 men to crew and will push main tunnel during winter; 800 ft. additional tunneling will be started at once.

BLACK DIAMOND GOLD (Valdez)—C. C. Reynolds, George Hobart, H. Whitney, J. Crawford, G. J. Love and L. Graham are developing this property and report striking a 21-in. lead of free-milling ore.

SPEEL RIVER PROJECT (Juneau)—P. B. Dawson, connected with construction plans of Project has recently been at Speel River looking over proposed work. Reported that work will start in spring.

ALASKA GASTINEAU (Juneau)—During September 500,000 tons of ore were broken in Perseverance stopes. Mill at Thane milled 160,000 tons. Total cost of mining and milling under 60c. per ton. Original estimate was 75c. per ton. At Annex Creek Water-Power Project, water should be turned through power house by end of year. Tunnel finished and concreting well under way. A. G. M. Co. settled with H. T. Tripp of Juneau for water rights on Annex Creek and Carlson Creek for consideration of $10,000.

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Has leased a large tract of mineral land about 16 mi. east of Fort Stockton, Texas. Ostensibly, acquisition was made for purpose of drilling for oil, but there is opinion prevalent that it is sulphur the company is after. New Cornelia, a C. & A. subsidiary, has developed at Ajo, Ariz., large body of low-grade oxidized copper ore and is building big leaching plant. It is to supply this plant with sulphuric acid that sulphur is wanted. Local well-driller will immediately start to put down two 500-ft. holes.

Gila County

IRON CAP COPPER (Copper Hill)—Produced in October 179,847 lb. of copper at a cost of 9.3c. per pound. Net earnings were $15,065. For six months ended Oct. 31, made net profits of $85,274. Shaft is down to 900-ft. level, where station is being cut.

Greenlee County

FEDERAL INVESTIGATION of causes leading up to the Clifton strike began at Clifton, Nov. 22, following arrival of two commissioners of the Department of Labor.

THE WOMEN OF GLOBE AND MIAMI will aid the strikers' families at Morenci, Clifton and Metcalf by raising money through an entertainment and county fair to be given at Central Hall in Globe.

Mohave County

UNITED EASTERN (Oatman)—Final steps taken at annual meeting of stockholders looking toward immediate start of construction of 200-ton cyanide plant, to be increased later to 400 tons per day. Frank A. Keith is president, and D. C. Jackling and Seeley W. Mudd are on the board of directors.

CALIFORNIA

Amador County

RHETTA (Plymouth)—Grading for installation of machinery has begun and mine will be reopened. It was former producer.

MAYON (Amador City)—Sinking is progressing with view of thoroughly prospecting ground by drifting. Thomas C. Mayon is owner.

FREMONT (Dry Creek)—Reported that unusually rich ore has been disclosed in lower levels. Mine is and has been for number of years producer and dividend payer. Wales Palmer is superintendent.

PLYMOUTH CONSOLIDATED (Plymouth)—Preliminary statement for October shows 11,000 tons of ore milled, total value, $54,499; working costs, $29,301; development expenditure, $3,328; surplus, $21,870.

Butte County

FORBESTOWN CHROME shipped by Western Pacific, having been wagon-hauled to Oroville. Shipment amounted to 45 tons; mined on property of California Hardwood Lumber Co.

Calaveras County

CALAVERAS COPPER (Copperopolis)—Installation of new mill progressing; expected to be ready for operation in December; 90 men employed in mine and mill.

Eldorado County

JUDSON (Diamond Springs)—Pumping plant installed for unwatering shaft. Property has yielded large amounts in pocket gold.

MONTEZUMA (Nashville)—Plymouth Exploration Co., of Amador County, is putting mine in shape for active operation, sinking double-compartment shaft at rate of 80 ft. a month; now down 700 ft., will be deepened to 1,200 ft. before drifting; 3 shifts and 20 men employed.

Modoc County

SUNSHINE (Highgrade)—Schauer brase is sacking high-grade ore and hauling to New Pinecreek. Expect to have carload by Christmas.

Nevada County

MEADOW LAKE (Colefax)—George Cooper and Tom Harris have bonded property to Theodore D. Robinson, of Lakeport, N. Y.

GOLDEN CENTER (Grass Valley)—Reported that payment of $18,000 has been made by company to Nicholas Berriman for Bromedary claim which was located in 1850 and worked in early days.

MEDICAL EXAMINATIONS of miners ordered by North Star and Empire and Pennsylvania mines. Under recent amendments to law, employers are now responsible for care of men affected by occupational diseases.

Plumas County

WALKER COPPER (Portola)—Flotation plant, 100 tons capacity, being installed at mines near Portola. Expected to be in operation early in January. Construction of 4,600-ft. aerial tramway in progress; surface buildings being erected.

SOUTHERN EUREKA (Greenville)—Reported that George D. Needy, of Spokane, and other Washington men have purchased this property, including Hibernia and McClellan mines; also the Wardlow group adjoining Southern Eureka. Property embraces about 450 acres in center of Greenville district and is surrounded by producing mines. Installation of modern mill contemplated.

Sierra County

WISCONSIN (Forest City)—Gold nugget weighing nearly 9 oz. found, also quartz boulders thickly studded with gold. Many rich nuggets found here in past. Property operated by Wisconsin-North Fork Mining Co. through same shaft as old North Fork gravel mine. G. F. Stone, manager.

Shasta County

MAMMOTH (Kennett)—New copper orebody reported in gossan croppings north of the Mammoth proper. Development at this point was undertaken for purpose of securing quartz ores.

Tuolumne County

HOPE (Sonora)—Air-driven pumps and air drills are to be installed; 12 men are employed in development work. Property is owned by Salt Lake City men. George W. Weston is general manager.

RAWHIDE (Jamestown)—Large amounts of machinery and supplies being received from Blair, Nev., by Silver Peak Mining Co., which recently purchased property. Said to be purpose of company to move entire plant from Blair to Jamestown.

COLORADO

Clear Creek County

MARY MINES AND LEASING (Idaho Springs)—This company, composed of local operators, has started development on Mary vein. Work will be carried on through Big Five tunnel.

IMPERIAL MINES (Georgetown)—Lessees operating on Centennial vein have opened 14-in. vein of $50 ore for distance of 70 ft. Operations are being carried on through Wilcox tunnel.

CAPITAL CENTRAL (Georgetown)—Development which has been in progress during past few months has disclosed body of milling ore which will probably be shipped to Linn mill for concentration.

SPECIE PAYMENT GOLD (Idaho Springs)—Systematic development is to be resumed in this company's property on Bellevue Mt. and preliminary operations are under way. New work is under direction of E. J. F. Coleman who is president and manager of the company.

Teller County

C. O. D. (Cripple Creek)—Lessees Parsons and Vetters, operating on 10th level, have made rich strike. Discovery was made in raise extended from 10th level at point about 750 ft. north of the shaft. Pay streak is 30 in. wide and is composed of quartz and fluorite. Assays indicate value of about $150 a ton. Discovery is on what is considered split from main C.O.D. vein and is about 800 ft. below surface.

IDAHO

Shoshone County

IMPERIAL (Wallace)—Operations have been resumed in lower workings, 720 ft. below upper workings and 1,200 ft. below surface. John H. Nordquist is manager.

GUELPH (Wallace)—New shaft down 25 ft. Sinking is by hand, but company plans to install compressor and drills, taking current from lines of Washington Water Power Co.

LITTLE PITTSBURGH (Kellogg)—Compressor delivered at property, which is under bond to Colonial Mining Co. Electric power line has been extended to run compressor. Property opened by crosscut 650 ft. and drift on vein 40 ft. shows 20 ft. of zinc ore, 2 ft. of which assays 47% and balance 26%. Company will ship high-grade ore, delivering it to wagon road by tramway and hauling to railroad about 8 mi.

EMPIRE (Little North Fork)—Compressor has been delivered to this property, formerly known as Horst-Powell, and power lines are being extended to mine by W. W. Power Co. Company has considerable ore blocked out and plans mill in spring. Several shipments made during summer.

BOSS ZINC (Osburn)—Has about 2 ft. zinc-lead ore in short crosscut from bottom of shaft. Much development work in that section for many years has failed to disclose commercial ore, although surface indications and formation are highly favorable. Strike on Boss is therefore of more than usual interest.

SNOWSTORM (Mullan)—Rumor that Snowstorm company had taken over Banner & Bangle property at Troy, Mont., denied by Leo Greenough, manager, who states that Snowstorm has two other properties under consideration. Greenough interests have been developing Banner & Bangle for several years and plan construction of 300-ton mill next spring. Ore is lead-zinc.

SUNSET (Wallace)—This property, acquired many years ago by ex-Senator W. A. Clark, of Montana, which has been under active development by him during recent years, is to have new electrically driven compressor and hoist. Present power is gasoline, with which shaft has been sunk 400 ft., with drifts east and west at 200 and 400. Shaft will be sent deeper with new plant. Has large body of low-grade lead and zinc ore.

GALENA GROUP (Wallace)—Situated on Ninemile west of Success, will be developed by Cœur d'Alene M. and S. Co. Winze sunk to depth of 60 ft. from short upper tunnel, disclosed promising body of galena and carbonate ore; work in winze was stopped because of difficulty of handling water. Second tunnel was driven at 500 ft. lower elevation, cutting vein 900 ft. from portal. Company will drive on vein 400 ft. to get under winze.

RED MONARCH (Wallace)—Red Monarch Consolidated Mining Co. has been organized, combining Red Monarch, Rawhide and Emerald groups of claims in Beaver district. Spokane men are controlling factor in organization and are now preparing for extensive development. Two well-defined veins will be explored, one of them running in an easterly and westerly direction and the other north and south. Contract has also been made with diamond-drill company to do 8,000 ft. of exploration.

MICHIGAN

(Iron)

YOUNG (Iron River)—New lease has been granted. Mine will be unwatered and worked this winter. This is one of last mines in Iron River field to be reopened.

METEOR (Ironwood)—Shaft-sinking will be resumed here. Depth of about 200 ft. was reached when work was stopped two years ago. Considerable work must be done before ore is reached.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—Last boat was loaded Nov. 23. Cargo was from Republic mine. Snow hindered loading operations at mines. Company shipped more than 2,225,000 tons. Most of other Marquette range companies are also through for year.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—A shaft is to be sunk on Junction Forty and ore removed. This land adjoins Section 16 mine of Oliver Iron Mining Co. Latter company worked to Junction line. Intention was to have Oliver remove ore. This could not be done, as Section 16 shaft is handling all ore it can. Diamond drills are at work on surface and underground in Sixteen to locate best place for new shaft. Deposit is large and of good grade.

FORTUNE LAKE MINING CO. (Crystal Falls)—This company will not go ahead with its development work at present. Contractors have stopped their work of changing course of Briar Hill Creek. No houses will be erected. Two big shafts will not go down. Lands were drilled first with churn drills. Later, few diamond-drill holes were put down. It is reported that the ore showed from 1 to 3% sulphur. This would make it of little value at this time. All of lands have not been explored. More drill work will be carried on shortly.

MINNESOTA

Duluth

ZENITH FURNACE CO. (Duluth)—Now manufacturing benzol and toluol as byproducts of coke manufacture.

RALSTON STEEL CAR CO.—Company negotiating for site for $2,000,000 plant near the Minnesota Steel Co. plant at Duluth. Present plant and office are at Columbus, Ohio.

Cuyuna Range

CUYUNA-MILLE LACS (Ironton)—Season's shipments will total 10,000 tons. Product, high-manganese iron ore, with 10 to 35% manganese content

BREITUNG (Crosby)—After loading all equipment on cars and abandoning operations, orders were received to resume work at this development shaft.

Mesabi Range

BELGRADE (Elba)—New shaft being sunk and new station will be cut.

BANGOR (Aurora)—Shaft now down 300 ft. will be sunk to greater depth during winter.

SECTION 27 (Chisholm)—Engine and dynamo being erected preparatory to installing electric-haulage system.

CLARK (Chisholm)—Steam-heated pockets being installed at shafthouse to prevent ore from freezing before loading. Shipments to be made throughout the winter to the Minnesota Steel Co. at Duluth.

MISSOURI—KANSAS—OKLAHOMA

TEMPLE CHATMAN (Miami, Okla.)—Has let contract for drilling of several hundred acres southwest of Miami.

GREENFIELD & LOCKWOOD (Lawton, Kan.)—Has new 150-ton mill about ready to start. Expects to have ground drained by time mill is ready to run. Had to increase pumping capacity.

LOCKPORT MILL (Galena, Kan.)—Important improvements being made at mill, situated on James Murphy land. Three of latest model sludge tables being installed. Mill runs exclusivcly on custom work. Will be ready for operation in about four weeks. William Crockett is superintendent.

LUCKY GEORGE (Joplin, Mo.)—R. C. Watson, superintendent. Building new 200-ton mill. The company has 15-acre lease on Lindeman tract of land at Bell Center, northwest of Joplin. Two shafts already in ore; expect to have both of them opened up ready for operation by time mill is completed. Trial runs at custom mill showed that dirt would run 10% zinc ore.

AYLOR (Joplin, Mo.)—A 300-ton mill is going up on Aylor land. E. A. C. Elliott is superintendent. Two pumps have been running for some time to drain ground. Present work will be conducted at 180-ft. level, where good run of ore has been encountered, but good pay dirt is claimed to extend to 220-ft. level. Company has drilled eight holes, all of which are said to show same ore that is now being opened up in mill shaft at 180-ft. level.

MONTANA

Lincoln County

MINING ACTIVITY NEAR TROY—Leo Greenough, well known mining man, is preparing for considerable activity on Grouse Mountain, few miles south of Troy, where he is operating B. & B. mine. Projected electric railroad from Troy to mine will be constructed immediately and mill of sufficient size to handle big output will be put up. Mr. Greenough has secured options on other mining claims on Grouse Mountain.

Silver Bow County

BUTTE-ALEX SCOTT (Butte)—Earnings for October were slightly over $30,000 or an average of over $1,500 per day for 20 days which mine was operated. November will show still better results according to advices from mine.

BUTTE-BALLAKLAVA (Butte)—October earnings were over $1,000 a day, best showing made since company took over management at time lessees were working property. Ore hoisted averaged more than 4½% copper and was mined from levels between the 1,300 and 1,600. Crosscutting is being done on 2,200 level.

LILLIE MINE (Butte)—On Nov. 24 Judge McClernan entered decree for partition of Lillie claim between North Butte and Butte-Main Range companies. Latter owns five-sixths, former one-sixth of Lillie claim. By agreement Butte-Main Range gets what is known as north portion of claim, containing 7.817 acres. North Butte gets southern portion, containing 8.811 acres. Being worth more than north portion, North Butte is to pay $30,000 to Butte-Main Range company.

BUTTE & SUPERIOR (Butte)—According to quarterly report for three months ended Sept. 30, net earnings were $2,761,839. Ore mined and milled, 130,210 dry tons, averaging 17.147% zinc and resulting in production of 37,396 tons of concentrates averaging 55.123% zinc, corresponding to recovery of 92.32%. Mining costs were $3.46 per ton, milling costs $1.77 per ton. According to report filed in federal court 43,000 tons of ore were treated in Minerals Separation plant during October at cost of $2.75 a ton, to recover 10,473 tons of concentrates valued at $79.77 a ton.

ANACONDA (Butte)—Butte mines of Anaconda were compelled to close down two days during last week on account of surplus of ore that it was impossible to handle at Washoe and Great Falls reduction plants of company. Average daily production of 19 operating shafts of company is 13,600 tons of ore. Two-day shut down enabled smelters to catch up and it is not anticipated that any further curtailment of mining output will be necessary as improvements at both Anaconda and Great Falls will be completed soon after Jan. 1 and capacity of smelting plants increased by 20%. While most of ores from Butte are going to Anaconda, Great Falls plant is helping out to considerable extent. Three sections of old mine of which was shut down year ago with expectation that it would never be started again, are caring for 1,500 tons of ore daily and making about 500 tons of concentrates. Six of the eight sections in old concentrator plant at Anaconda have been reconstructed and work on two remaining sections is being rushed. By Jan. 1 it is estimated that Great Falls and Washoe plants will be able to handle daily output from Butte mines of Anaconda company of 15,000 tons and copper production will be raised to above 25,000,000 lb. per month. Officers of company expect that copper production for next year will reach 300,000,000 lb. Neverswent mine, last of large operating shafts of company that is shut down, is now in readiness to start up at any time that conditions require it. New hoist is in position and shaft has been retimbered its entire length, making it one of best-equipped mines of district.

NEVADA

Esmeralda County

JUMBO EXTENSION (Goldfield)—October production was 3,476 tons; gross value, $112,000. Total mining costs were $16,000. Smelting, freight and treatment amounted to $32,000 and smelting losses $14,000. Net realization for month, $50,-000. Velvet shaft is now down 700 ft. and connections will be made with present workings on 780, 860 and 1,017 levels.

Humboldt County

NEVADA PACKARD (Rochester)—New mill being tuned up; crushing ore. Mine has produced 2,300 tons of ore, average value $48.21 per ton, and there are 36,000 tons, average value of $15, blocked out. There are 7,000 tons already broken ready for the mill.

ROCHESTER MINES CO. (Rochester)—Friedman tunnel has cut vein at depth of about 1,300 ft. exposing 44 ft. of vein

matter, several feet of which is of good milling grade. Level of tunnel is about 700 ft. below bottom of workings from which present production is being made. It is estimated that November production will be $55,000.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 20 amounted to 10,093 tons valued at $207,634 compared with 9,189 tons week previous. Producers were: Tonopah Belmont, 2,998 tons; Tonopah Mining, 3,150; Tonopah Extension, 1,850; West End, 612; Jim Butler, 1,050; North Star, 53; and miscellaneous leasers 380 tons.

TONOPAH BELMONT (Tonopah)—During October 12,342 dry tons of total net value of $142,206 were milled, resulting in profit of $65,069.

TONOPAH MINING (Tonopah)—During October mill treated 12,435 tons; average value of $12.80 per ton, resulting in profit of $60,700.

JIM BUTLER (Tonopah)—October production was 4,604 tons resulting in profit of $27,067, compared with $22,232 profit for September.

TONOPAH EXTENSION (Tonopah)—Profits for October amounted to $66,000, compared with $52,000 for September. Increased profit due largely to excellent conditions at No. 2 shaft where stoping continues from 750 to 1,350 levels. Crosscut from 1,540 level of Victor shaft should cut Murry vein within next 140 ft.

Storey County

CROWN POINT-BELCHER (Gold Hill)—Saved 235 cars milling ore from 1,600 level. Jacket mill treated usual tonnage and shipped bullion.

MEXICAN (Virginia)—East crosscut 2,700 level in porphyry and quartz of low assay at 33-ft. point. Winze in east crosscut No. 2 sunk to 11-ft. point; 2- to 4-ft. vein matter, from low assay to $30 per ton. Reopening west crosscut on 2,500 level. Mill crushed 162 tons custom ore, average assay $29.74 per ton.

UNION (Virginia)—Top of raise in No. 1 stope 2,500 level in ore assaying $21 per ton. Saved 55 tons, average assay $26.70 per ton. Northwest drift from sill floor in low-grade ore. From south end No. 3 stope 2,500 level saved 88 tons, average assay $43.71 per ton. Wedge rock saved from north end of stope in cutting out for timbers.

OPHIR (Virginia)—Low-grade quartz in south drift 2,500 level. At 145-ft. point south of winze 4 ft. of low-grade quartz. Central tunnel 250 level north drift shows 8 ft. of ore in face. Saved 365 cars of ore from stopes above north and south drifts. Milled 328 tons. Advanced Con. Virginia and Ophir west crosscut on 2,700 level to 70-ft. point.

NEW MEXICO

Dona Ana County

VICTORIA MINING AND SMELTING CO'S silver-lead holdings were bought by C. T. Boyd, of Los Angeles, at sale ordered by U. S. District Court to satisfy bankruptcy proceedings. Properties comprise about 1,000 acres of mineral lands in two groups about 20 mi. apart. Southern group is between Organ and San Andras mountains and the northern group is situated in the Plomo district in San Andras about 35 mi. northeast of Las Cruces. New company will start extensive developments immediately.

UTAH

Beaver County

CEDAR TALISMAN (Milford)—Since beginning shipments of zinc ore from 600 level, company has produced 10 cars ore carrying about 30% zinc.

NORTH AMERICA (Milford)—Work is to be resumed at this property adjoining Croff mine on south. Ore carrying lead and silver is exposed on 180-ft. level.

GALENA (Frisco)—Work has been resumed at this property near Horn silver. Tunnel is being driven to cut fissure productive of lead-silver ore in past years. Tunnel is in 185 ft., with about 200 ft. to go.

Juab County

MAY DAY (Eureka)—Small cyanide plant operated by Griggs, Carter & Castleton on ore from May Day dump has been closed down for winter.

TINTIC STANDARD (Eureka)—Preparations for sinking new working shaft being made. This is to do away with lack of air in the lower workings, property having only one opening to surface.

YANKEE (Eureka)—Second car of ore has been shipped from recent strike near surface. This is reported to have carried 180 oz. silver and $6 to $8 in gold, making value for 50-ton car about $4,500.

LOWER MAMMOTH (Mammoth)—Zinc ore is being mined on 1,500, 1,700 and 1,800 levels. During September 3 cars were shipped and 2 in October. Company has good surplus in treasury. Copper and lead-silver ore being mined on 1,000 level.

IRON BLOSSOM (Silver City)—New deposit of copper ore opened in winze from 600 has been drifted on 70 ft. Several shipments have been made from here, but no stoping has yet been started. New stope has been opened in north end of mine on 500 level.

EAGLE & BLUE BELL (Eureka)—Practically all of stock of Victoria company has been turned in in exchange for Eagle & Blue Bell stock. It is probable that as soon as new equipment at latter property has been installed, work through Victoria shaft will cease, and development in that ground will be carried on through Eagle & Blue Bell workings.

COLORADO (Silver City)—$60,000 in stocks, securities and personal checks has been turned over to the clerk of the United States district court to satisfy judgment in the suit of J. L. Wilson against company for alleged deferred dividends. Sum is to satisfy all claims and liens against company, various attorneys' liens having been filed for division of judgment. Division will be made without participation of defendant company. Decision in favor of company by local Federal court was reversed by circuit court of appeals.

Salt Lake County

UTAH CONSOLIDATED (Bingham)—This company is shipping 250 tons of lead ore daily, in addition to shipments of copper ore.

CARBOFF (Salt Lake)—Work is being done with machine drills, since electrical equipment and new 8-drill compressor have been installed. Tunnel is being straightened and laid with 25-lb. rail. Electric haulage is to be used. Shipments are being maintained at rate of 125 tons daily, and it is thought that roads can be kept open during winter.

Summit County

PARK CITY SHIPMENTS for the week ended Nov. 20 amounted to 1,300 tons, valued at $52,000, as compared with 1,078 tons week previous.

NEW YORK BONANZA (Park City)—Work will soon be resumed here.

SNAKE CREEK TUNNEL (Park City)—Progress during October amounted to 312 ft., making total length 13,025 ft.

SILVER KING CONSOLIDATED (Park City)—From 30 to 40 tons of high-grade ore are being shipped daily. A two-mile tunnel is being considered to develop western end of ground.

THREE KINGS (Park City)—Company has sunk double compartment shaft 600 ft., and has drifted 400 ft. to south. The work is at present in limestone, and drift is being driven to reach contact with underlying Ontario quartzite. Electric hoist, electrically driven compressor, etc., is being used. The company owns 160 acres, adjoining Silver King Coalition and Silver King Consolidated. Operating shaft is in Nigger Hollow. E. S. Fisher is general manager.

Utah County

AT AMERICAN FORK, throughout the winter season, it is expected that a larger number of properties than usual will continue work. Lessees at the Pacific have recently shipped car of lead-silver ore of good grade, and fissure carrying lead-silver ore also is reported to have been cut at Bellerophon.

Washington County

AT THE NEW GOLD CAMP OF GOLDSTRIKE in the former Bull Valley district near Modena work continues. At Hamburg, whose strike of rich gold ore near surface was cause of recent activity in district, middle tunnel is being driven to cut ore in winze from upper workings. New ore is reported in Goldstrike Virginia, Primers Fraction and Goldstrike Bonanza.

CANADA

British Columbia

SALMON-BEAR RIVER GROUP (Portland Canal)—Main adit tunnel is now in 350 ft. and is expected to reach orebody in another 150 ft. Group is under bond to H. R. Plate, of New York.

CANADA COPPER CORPORATION (Greenwood)—Has taken up subject of new financing for construction of new plant to cost $2,000,000. Engineers report that there have been developed to date at Copper Mountain 8,900,000 tons of "proven" ore averaging 1.75% copper and 2,000,000 tons of "partially" proven ore averaging 1.75% or a total of 10,900,000 tons, and an estimated 20c. recoverable per ton in gold and silver. Erection of 2,000-ton plant is recommended. Canadian Pacific engineers are assured of advisability of running a spur to mines from Princeton, 12 mi. Greenwood ores are smelted direct, whereas Copper Mountain ores are of disseminated porphyry type and will require concentration by flotation process.

Ontario

LAKE SHORE (Kirkland Lake)—Is again in operation. Sinking to 200 is being carried on.

TEMISKAMING (Cobalt)—Mill has 40 stamps but only 20 have been running; remaining 20 are to be put in commission.

SCHUMACHER (Porcupine)—Has sunk main shaft to 600 level. Two hundred thousand shares, par value $1, are to be put on market at 50c. a share.

SENECA-SUPERIOR (Cobalt)—Operating costs are only about 5c. per oz. Statement as of Nov. 20 showed cash in bank of $180,000 in addition to $59,500 received for sale of ore.

McINTYRE EXTENSION (Porcupine)—Has reached the 850 level. Some ore has been developed and will be treated in the McIntyre mill when the additions are completed, which will be about the first of year. Mill capacity will be increased 50%.

HOLLINGER (Porcupine)—Contract for headframe over central shaft has been let to Dominion Bridge Co. Winding engine to be installed here will be of 5,000 tons' capacity raising 5-ton skips and capable of raising ore from depth of 3,000 ft.

HURONIA (Larder Lake)—Option on this property held by Canadian Mines and Finance Co. has been allowed to lapse. Considerable work was done on property and fair quantity of ore developed. Oreshoots were short, however, and amount of money involved was large in comparison with value of ore.

PLENAURUM (Porcupine)—Has been unwatered and is now being sampled by engineers from La Rose mine. If examination is satisfactory, La Rose will purchase 59,500 shares of treasury stock at $1 share; money to go into development. After expenditure of this money sufficient vendors' stock can be purchased to give control.

MEXICO

Sonora

GREENE-CANANEA (Cananea)—One section of concentrator was equipped with apparatus of the Minerals Separation, Ltd., process several months ago, but the mill-run from July to mid-September, between enforced shutdowns, was not long enough to demonstrate what the process would do on ores from the Cananea-Duluth mine, which will constitute the principal tonnage on which flotation will be tried out.

The Market Report

Metal Markets

NEW YORK—Dec. 1, 1915

In all of the principal markets there was diminished activity and a tendency toward softening of prices, with the exception of lead.

Copper, Tin, Lead and Zinc

Copper—The demand for copper began to wane early in the week and in the latter portion the market became rather dull, although some round lots were sold on Tuesday. The aggregate volume of business transacted during the week was materially less than in the previous week. However, the total of November business was very large, perhaps as large as that which was done in June, which was a remarkable month. Early in the week some copper was sold at 20c., r. t., but the market never became fully established at that figure, sales being made at the same time at 19¾c., r. t. Within the range of 19¾@20c., r. t., producers were disposed to accept any bids that were made to them, and also any reasonable opportunities to dispose of copper abroad regardless of just what foreign sales might net. Business in England was taken at about £98 throughout the week. There was a tendency to accept bids for copper to be delivered later than February at slightly lower terms than for delivery during the immediate quarter. In the latter portion of the week copper was to be had so freely at 19¾c., r. t., that the terms of 20¼ and 20c. which were asked by some producers no longer cut any figure in the market.

Copper Exports for the week ended Nov. 13 are reported by the Department of Commerce at 18,874,973 lb. The larger items were 9,650,928 lb. to France, 4,831,591 lb. to Italy, 1,805,897 lb. to England and 1,459,788 lb. to Sweden. Imports were 2,739,439 lb. metal and 2,883,574 lb. in ore and matte; 5,623,013 lb. in all. The chief imports were from Chile, Cuba, England and Japan.

Copper Sheets, base price is 25c. per lb. for hot-rolled and 26c. for cold-rolled, with usual extras. Copper wire is 21@21½c. per lb., carload lots at mill.

Tin—Business was light and the market was very narrow. Orders to buy or sell even in moderate quantities would influence it sharply one way or the other. The deliveries in November were relatively small, being only 2,975 tons—2,575 on the Atlantic Coast and 400 on the Pacific Coast.

Tin output of the Federated Malay States is reported at 40,487 long tons in 1914, and 38,636 in 1915; decrease 1,851 tons.

Imports of tin ore and concentrates in Great Britain in October were 3,210 long tons; of which 2,491 tons were from Bolivia and 494 tons from Nigeria.

Tin arrivals at Pacific ports of the United States 11 months ended Nov. 30, were 1,412 long tons, being 117 tons less than last year.

Lead—The firmness of the market in St. Louis and the narrowness of difference between the prices at St. Louis and at New York would normally foreshadow an advance in New York. The A. S. & R. Co. maintained its price of 5.25c., but independents made sales at 5 to 10 points higher. The freight congestion on the railways entering New York is playing a part in the New York lead market, shipments of lead from St. Louis to New York being considerably longer on the way than normally.

The prices of the American Smelting and Refining Co. for desilverized lead delivered in several markets are as follows: St Louis, 7½ points under the New York price; Chicago, 5 points under; Detroit and Cleveland, 2½ points over; Pittsburgh and Philadelphia, 5 points over.

Spelter—Producers reported relatively small business in the early part of the week, after which there was utter absence of demand, and the market passed largely in the hands of dealers. There was a weakening tendency right through the week and on Dec 1 a distinct softening. The large difference between the prices for prompt and later deliveries continues, producers being willing to accept relatively low prices for deliveries a little way forward.

The Russo-Asiatic Corporation expects to have one unit of the zinc-smelting plant that is to treat the ore of the Riddersk mine ready for operation next March.

Zinc Sheets are in good demand, but have not advanced this week, and the base price today is $22 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Dec. 1

Aluminum—The market shows no change, metal for early delivery being scarce and in good demand. The current price is 58@62c. per lb. for No. 1 ingots, New York. Futures are not quoted.

Antimony—The market remains strong, and there have been some fair-sized dealings. Ordinary brands, chiefly

DAILY PRICES OF METALS IN NEW YORK

Nov Dec	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Spot, Cts per Lb	Lead New York, Cts. per Lb.	Lead St. Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
25							
			19 50		5 20	15.50	
26	4 6913	56	@19 75	39	5 25	@5 22½	@18.50
			19 50		5 25	5 20	15.50
27	4 6963	56½	@19 75	39	@5 30	@5.22½	@18.50
			19 50		5 25	5 20	15.50
29	4 6963	56½	@19 60	39¾	@5.30	@5.22½	@18.00
			19 50		5 25	5 20	15.50
30	4 6950	56½	@19 60	39½	@5.35	@5.22½	@18.00
			19.50		5 25	5.20	14.50
1	4 7113	56½	@19.60	39	@5.35	@5 22½	@17.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St Louis is given as the basing point St Louis and New York are normally quoted 0.17c apart

The quotations for electrolytic copper are for cakes, ingots and wirebars Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash The difference between the price delivered and the New York cash equivalent is at present about 0.20c on domestic business The price of electrolytic cathodes is 0.05 to 0.10c below that of electrolytic Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St Louis being the basing market We quote the New York price at 17c per 100 lb. above the St Louis price.

Silver quotations are in cents per troy ounce of fine silver

Some current freight rates on metals per 100 lb. are: St Louis-New York 17c., St Louis-Chicago, 6.3c., St Louis-Pittsburgh, 13.1c.

LONDON

Nov.-Dec	Copper Standard Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts per Lb.
25	6½	80	80¼	98½	20 66	166½	166	28½	6 01	102	21.39
26	27	81	81½	98½	20 66	168½	167¼	28¼	6 03	105	22.10
27	27¼										
29	27⅛	80½	80½	99	20 76	168½	167½	28½	6.03	105	22.12
30	27⅛	79½	80	99½	20 86	168	167½	29	6 09	104	21.81
1	26⅞	80	80½	99½	20 95	166¼	165½	28½	6.09	99	20.86

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 5 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80 £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Chinese, are selling around 40c. per lb. for large lots, while up to 42½c. has been named on some smaller business. Cookson's is nominally held at 52c., with very little to be had.

Antimony ore is available only in small lots and $2.40@2.50 per unit is named.

Quicksilver—Stocks are not large and prices are at a high level still and are advancing. New York price is $110 per flask of 75 lb. for large lots and $110@115 for smaller orders. San Francisco reports by telegraph $105 per flask, with very small stocks. London price continues £16 10s. per flask, with no discount from second hands.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium metal,** 75c. per lb., New York.—**Cobalt metal,** 97% pure, is sold at $2 per lb.—**Magnesium,** pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.

Gold, Silver and Platinum

NEW YORK—Dec. 1

Gold and silver movement in the United States 10 months ended Oct. 31 is reported by the Department of Commerce as follows:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$207,958,750	$15,874,980	$42,453,190	$40,795,086
Imports	45,886,949	345,560,373	20,515,394	28,504,357
Excess	E. $162,071,801	I. $329,685,393	E. $21,937,796	E. $12,290,729

Exports of merchandise for the 10 months are valued at $2,867,123,745; imports, $1,450,624,406; excess of exports, $1,416,499,339. Adding the gold and silver gives $1,052,585,421 as the total export balance.

For the 10 months ended Oct. 31 imports of gold at San Francisco increased from $4,091,964 in 1914 to $54,033,016 in 1915: the gain being due chiefly to receipts from Japan. Exports were $461,995 for the 10 months.

Platinum—The market is still uncertain and prices high. Dealers are unwilling to make regular quotations, and there are negotiations over almost every transaction. Sales have been made as high as $70 and even $74 per oz. for refined platinum and up to $77@78 per oz. for hard metal.

Our Russian correspondent writes under date of Nov. 5 that a persistent demand both from abroad and for the internal market continues. The prices have again increased. The offer of metal is less than the demand and therefore higher prices are expected. From Ekaterinburg it is reported that, owing to the high prices, abandoned mines with low content are being put at work, and it is hoped that this will increase the offer of platinum; but the large dealers are persuaded that prices will not be reduced, as the demand is too high.

Palladium—Some sales of palladium are reported at $45@50 per oz., according to size and terms of order

Silver has advanced by sudden bounds about 1d. per oz., English standard, owing to the discovery that the stock in London was much less than expected. It is reported at about 7,000,000 oz. The higher price has brought out sellers and some reaction is probable should there be free selling at the advance.

Zinc and Lead Ore Markets

JOPLIN, MO.—Nov. 13

Blende, high price $118; base per ton 60% zinc, premium ore, $115; medium, $111@105; lower grades down to $100; Calamine base per ton 40% zinc, $80@70; average selling price, all grades of zinc, $101.24 per ton. Lead, high settling price $71.50, base per ton 80% metal content, $70@71; average selling price, all grades of lead, $67.84 per ton.

SHIPMENTS WEEK ENDED NOV. 27

	Blende	Calamine	Lead	Values
Totals this week	15,262,560	3,048,140	1,760,310	$986,600
Total 11 months	535,072,200	41,709,700	82,910,180	24,497,080

Blende value, the week, $820,110; 11 months, $21,227,610.

Calamine value, the week, $106,790; 11 months, $1,061,870.

Lead value, the week, $59,700; 11 months, $2,207,600.

The total shipment of 9,155 tons of zinc eclipses all previous records of sales, and is the strongest point marking the demand for zinc ore. The 4,000 tons stock at Granby is more than half gone and much of that remaining is sold for future delivery. Also a large portion of the Miami reserve has been sold and is being shipped. Elsewhere no large stocks have accumulated. Tonight the miners are threatening a strike if producers do not raise wages, but this is premature with many of the stronger companies which have a wage agreement based on the average base price of ore the preceding month.

PLATTEVILLE, WIS.—Nov. 27

The base price paid this week for zinc ore was $108 per ton for 60% grades. No sales of lead ore were reported.

SHIPMENTS, WEEK ENDED, NOV. 27

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	6,076,000	.....	840,320
Year	189,643,750	6,338,640	26,524,310

Shipped during week to separating plants, 5,518,000 lb. zinc ore.

Iron Trade Review

NEW YORK—Dec. 1

The iron and steel markets continue to be extremely active, with heavy demand for both home consumption and export, while higher prices seem hardly to check the demand.

One exception to this is the withdrawal by the Pennsylvania R.R. of its order for 11,000 cars, on account of the high prices asked. In other cases, however, advances seem to make little difference, the rush being to secure material for delivery when needed. The export business is still a very large factor in the market.

Pig iron is quite as active as steel and prices are being firmly held at the advances made. Steel-making irons are in special demand with low-phosphorus also.

The statement comes from Philadelphia that the Reploglе-Drexel syndicate has secured enough Cambria Steel stock in the market, in addition to that bought from the Pennsylvania R.R., to give them control of the company, and that plans for its reorganization will soon be brought forward. It is certain that there has been heavy buying of the outside stock.

PITTSBURGH—Nov. 30

Effective Dec. 1 the American Steel and Wire Co. is advancing wire products $2 a ton, making plain wire 1.85c. and wire nails $2 per keg, base. The general advancing tendency in steel prices is somewhat less pronounced. There is less pressure to place strictly new business, perhaps simply because early deliveries could not be secured, while there is heavier specifying on contracts.

A further quieting down in new buying is to be expected for December, while specifying on contract will doubtless be less active in the first quarter, on account of the higher range of contract prices, but the mills will enter the new year with nearly six months of solid work on their books, and there is no expectation in any quarter of any weakening whatever in the steel market for many months.

Lake Superior iron-ore prices for next year have not been closed and while an early announcement is expected in some quarters there is a contingent in favor of waiting until after Jan. 1 for the naming of prices.

Pig Iron—Pig-iron prices have been advancing very sharply, and all grades are quotable at $1 higher than a week ago. Apparently there is scarcely any unsold capacity for the next four or five months. We quote: Bessemer, $18@18.50; basic, $17; malleable and foundry, $17@17.50; forge, $16.50@17, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market has stiffened. Imported is firm at $100, seaboard, on contract, and domestic producers are firm at $110, shipping point, as minimum. Prompt lots go at $100@105 per ton.

Steel—The market is quiet as regular consumers have made private arrangements with their regular sources of supply and chance comers have no standing at all with producers who are indisposed to sell except when there is a direct obligation to take care of a regular customer. The market, such as there is, can be quoted at about $1 higher than a week ago: Bessemer billets, $28; bessemer sheet bars, $28@28.50; openhearth billets, $29@30, openhearth sheet bars, $29.50@30, f.o.b. maker's mill, Pittsburgh or Youngstown.

Chemicals

NEW YORK—Dec. 1

The general market is fairly steady, with few changes reported, and business inclined to be more active.

Arsenic—A moderate business is forward and little or no change is noted. Quotations are $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is quiet and on about the usual scale. Quotations are unchanged, at $8 per 100 lb. for carload lots and $8.25 per 100 lb. for smaller parcels

Nitrate of Soda—Prices keep up well, though arrivals have been large. Quotations continue $2.90 per 100 lb. for December and $2.85 for later deliveries.

Pyrites—Imports at Baltimore for the week included 9,876 tons pyrites from Huelva, Spain.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest		Amt.
Acacia, g	Colo	1,438,989	$ 1	$ 122,004	Jan.	'11	$0 01
Adams, s.l.c.	Colo	80,000	10	778,000	Dec.	'09	0 04
Ahmeek, c.	Mich.	50,000	25	3,175,000	Nov.	'15	2.50
Alaska Mexican, g.	Alas.	180,000	5	3,507,381	Nov.	'15	0.10
Alaska Treadwell, g.	Alas.	200,000	25	15,535,000	Nov.	'15	0.50
Alaska United, g.	Alas.	180,200	5	1,991,210	Nov.	'15	0 30
Am Zinc, Lead & Sm.	U. S.	171,200	25	983,320	Jan.	'14	0 50
Anaconda, c.	Mont.	2,496,250	50	100,073,125	Nov.	'15	1 00
Argonaut, g.	Calif.	200,000	5	1,680,000	Sept	'15	0 06
Arizona Copper, pf.	Ariz.	1,426,120	1 20	2,127,043	Oct.	'15	
Arizona Copper, com.	Ariz.	1,519,896	1 20	18,461,338	July	'15	0.24
Bagdad-Chase, g., pf.	Calif.	184,819	5	202,394	Jan.	'09	0 10
Baltic, c.	Mich.	100,000	25	7,950,000	Dec.	'13	2 00
Bingham N. H., c.	Utah	228,690	5	454,302	Oct.	'15	0 20
Bonanza Dev., g.	Colo	300,000	1	1,425,000	Oct.	'11	0 20
Brunswick, g	Calif	395,287	1	203,314	Sept.	'15	0.06
Bunker Hill Con., g	Calif.	200,000	1	865,000	Nov.	'15	0.02½
Bunker Hill & Sul , l.s.	Ida.	327,000	10	16,609,500	Nov.	'15	0 25
Butte-Alex Scott, c.	Mont.	74,000	10	159,100	Oct.	'15	0 15
Butte-Ballaklava, c	Mont	250,000	10	125,000	Aug.	'10	0 50
Butte & Superior, z.	Mont.	272,019	10	3,264,985	Sept.	'15	5.75
Caledonia, l s e	Ida	2,605,000	1	650,300	Aug.	'15	0.03
Calumet & Arizona, c.	Ariz	617,385	10	22,176,828	Sept	'15	1 00
Calumet & Hecla, c.	Mich.	100,000	25	127,750,000	Sept.	'15	15 00
Camp Bird, g.s.	Colo	1,100,051	5	10,695,986	Nov.	'15	0 24
Centen'l-Eur , l s.g.c	Utah.	100,000	5	4,050,000	Apr.	'14	1 50
Center Creek, l z.	Mo	100,000	10	550,000	Oct.	'15	0 15
Champion, c.	Mich	100,000	25	10,900,000	Nov.	'15	2 00
Chief Consolidated, s.g.l.	Utah	871,384	1	306,821	Aug.	'15	0 05
Chino, c	New Mex.	869,940	5	5,828,015	Sept.	'15	0 75
Cliff, g	Utah.	300,000	1	90,000	Jan.	'13	0 10
Cliff, g	Alas.	100,000	1	210,000	Oct.	'13	0 01
Colo Gold Dredging.	Colo	100,000	10	650,000	Sept.	'14	1 00
Colorado, l s.g.	Utah.	1,000,000	0.20	2,570,000	Dec.	'12	0 03
Columbus Con., g.s.	Utah.	285,540	5	226,832	Oct.	'07	0 20
Commercial Gold.	Ore	1,750,000	1	43,750	Dec.	'10	0.00½
Con. Mercur, g.	Utah.	1,000,000	1	3,445,313	July	'13	0 03
Continental, z l.	Mo	22,000	25	341,000	July	'15	0 50
Copper Range Con., c.	Mich	393,739	100	13,986,746	Oct.	'13	0 75
Daly Judge, s l.	Utah.	300,000	1	1,095,000	Oct.	'15	0.25
Daly West, s l.	Utah.	180,000	20	6,606,000	Jan.	'13	0 15
Doctor Jackpot, g.	Colo	3,000,000	0 10	45,000	Mar.	'11	0 00½
Doe Run, l	Mo	65,783	100	3,550,969	Dec.	'13	0 76
Eagle & Blue Bell, g s.l.	Utah.	893,146	1	401,916	Aug.	'15	0.10
Elkton Con , g	Colo	2,500,000	1	3,579,460	May	'15	0 02
El Paso, g	Colo	490,000	5	1,707,545	Feb	'14	0 10
Ernestine, g.s.	N. M.	300,000	5	150,000	July	'15	0.10
Fed. M. & S , com.	Idaho.	60,000	100	2,708,750	Jan	'09	1 50
Fed. M. & S , pf	Idaho.	120,000	100	9,976,361	Sept.	'15	1 00
Florence, g	Nev.	1,050,000	1	840,000	Apr.	'11	0 10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan.	'08	0 05
Free Coinage, g.	Colo	10,000	100	180,000	Dec.	'09	1 00
Fremont Con., g.	Calif.	200,000	2 50	258,000	Oct.	'14	0 02
Frontier, z.	Wis	1,250	100	146,202	Nov.	'13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,305,000	Dec.	'14	10.00
Gold Chain, g	Utah.	1,000,000	1	130,000	May	'13	0.03
Gold Coin of Victor.	Colo	1,000,000	1	1,350,000	Feb.	'09	0.02
Gold Dollar Con.	Colo	2,500,000	0 10	100,000	Dec.	'12	0.00½
Gold King Con., g.	Colo	5,750,370	1	1,407,319	Dec.	'11	0.03
Golden Cycle, g	Colo	1,500,000	1	4,200,000	Dec.	'15	0 02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar.	'10	0.05
Goldfield Con , g.	Nev.	3,559,148	10	28,643,916	Oct.	'15	0.10
Grand Central, g	Utah.	500,000	1	1,620,750	Sept.	'14	0.05
Granite, g.	Colo	1,650,000	1	270,000	Nov.	'12	0.01
Hazel, g	Cal	900,000	1	971,000	Dec.	'13	0 01
Hecla, l s.	Idaho.	1,000,000	0 25	3,655,000	Nov.	'15	0.07
Hercules, l.s.	Idaho.	1,000,000	1	5,725,000	June	'15	
Homestake, g	S. D.	251,160	100	38,457,194	Nov.	'15	0 65
Horn Silver, l s z.	Utah.	400,000	25	5,642,000	Sept.	'07	0.05
Iowa, g s.l.	Colo	1,666,667	1	233,499	Aug.	'14	0.00½
Iowa-Tiger, g s.	Colo.	3,000	1	9,250	Dec.	'14	1 00
Iron Blossom, s l g.	Utah.	1,000,000	0 10	2,470,000	Oct.	'15	0.05
Iron Silver, s l g.	Colo	500,000	20	4,950,000	Dec.	'14	0 10
Jamison, g.	Cal	390,000	10	378,300	Jan.	'11	0.02
Jerry Johnson, g.	Colo	2,500,000	0.10	187,500	Nov.	'14	0.01
Kendall, g.	Mont.	500,000	5	1,505,000	July	'14	0 06
Kennedy, g.	Cal	100,000	100	1,831,001	Apr.	'10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug	'09	0.12
Klar Piquette, z.l.	Wis.	20,000	1	259,000	Apr.	'13	0.50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct.	'13	0.00½
Liberty Bell, g.	Colo	133,552	5	1,559,179	Sept.	'13	
Little Bell, l.s.	Utah.	300,000	1	75,000	Mar.	'11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan.	'08	0.03
Mammoth, g s.c.	Utah.	400,000	2.50	2,300,000	July	'13	0.05
Mary McKinney, g.	Colo	1,309,252	1	1,169,308	July	'14	0 02
May Day, g.s l.	Utah.	800,000	0 25	244,000	Nov.	'15	0.03
Mexican, g.s.	Nev.	201,600	2.50	161,910	June	'14	0 75
Miami, c.	Ariz.	747,112	5	6,392,457	Nov.	'15	1.00
Modoc, g s.	Colo.	500,000	1	275,000	Dec.	'11	0.01
Mohawk, c	Mich.	100,000	25	3,575,000	Feb.	'15	2 00
Monarch-Mad'a, g.s.l .	Colo.	1,000,000	1	40,000	May	'11	0 01
Montana-Tonop., s.g.	Nev.	921,865	1	488,588	Dec.	'12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May	'08	0.44
National, g.	Nev.	750,000	1	570,000	May	'11	0.10
Nevada Con., c.	Nev.	1,999,457	5	18,976,141	Sept.	'15	0.37½
New Century, z.l.	Mo.	330,000	1	237,600	Oct.	'09	0 01
New Idria, q.	Cal.	100,000	5	1,730,000	Oct.	'15	0.50
North Butte, c.	Mont.	430,000	15	12,277,000	July	'15	0.40
North Star, g.	Cal	250,000	10	4,687,040	Sept.	'15	0 20
Old Domin'n, M. & Sm.	Ariz.	162,000	25	7,553,000	Sept.	'15	1 50
Ophir, s.g.	Nev.	201,600	3	2,068,360	Jan.	'12	0 10
Opohongo, g.s l	Utah.	898,978	0.25	89,907	Jan.	'13	0 02
Oroville Dredging.	Cal	700,000	5	1,771,838	Sept.	'15	0 12
Osceola, c.	Mich.	96,150	25	12,900,800	Nov.	'15	2.50
Parrot, c.	Mont.	229,850	10	7,871,839	July	'15	1.63
Pearl Con , g.	Wash.	1,909,711	0.05	181,122	Dec.	'10	0.02
Pharmacist, g.	Colo.	1,500,000	1	7,500	Feb.	'10	0.00½
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct.	'11	0.03
Pittsburgh-Idaho, l.	Ida.	803,000	1	216,810	Oct.	'12	0.04
Pittsburgh Silver Peak, g	Nev.	2,790,000	1	771,200	July	'14	0.02
Portland, g.	Colo.	3,000,000	1	10,083,080	Oct.	'15	0.02
Quilp.	Wash.	1,500,000	1	67,500	Feb	'12	0 01

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest		Amt.
Quincy, c.	Mich.	110,000	$ 25	$21,447,500	Sept.	'15	$2.00
Ray, c	Ariz	1,485,333	10	4,362,796	Sept.	'15	0.37½
Republic, g	Wash.	1,000,000	1	170,000	Nov.	'12	0.01½
Rochester, l z.	Mo	4,900	100	190,846	July	'12	0.50
Round Mountain, g.	Nev.	1,188,019	1	369,365	Aug.	'13	0.04
Seven Troughs Coal., g.	Nev.	1,500,000	1	144,306	Sept.	'15	0.02½
St. Joseph, l.	Mo.	1,472,252	10	9,925,530	Sept.	'15	0.25
Shannon, c	Ariz.	300,000	10	750,000	Jan.	'13	0.50
Shattuck Arizona, c.	Ariz.	350,000	10	2,625,000	Aug.	'15	0.50
Silver King Coal., l s	Utah.	1,250,000	5	3,097,385	Oct.	'15	0.15
Silver King Con., l.s.	Utah.	627 582	1	748,096	Oct.	'15	0.10
Sioux Con., s.l.g	Utah.	745,389	1	872,097	July	'11	0.04
Skidoo, g	Cal	1,000,000	5	365,000	Oct.	'14	0.01
Snowstorm, c.g.	Ida	1,500,000	1	1,192,103	Oct.	'13	0.02
South Eureka, g.	Calif.	299,981	1	411,680	July	'15	0.03
Standard Con , g.s.	Cal	178,394	10	5,274,407	Nov.	'13	0.25
Stewart, s.l.	Ida.	1,238,362	1	1,950,396	Sept.	'15	0.10
Stratton's Ind., g	Colo.	1,000,000	0.60	456,625	Dec.	'14	0.03
Success, z.	Ida	1,500,000	1	1,020,000	Nov.	'15	0.06
Superior & Pitts., c.	Ariz.	1,499,792	10	9,748,658	Sept.	'15	0.38
Tamarack, c	Mich.	60,000	25	9,420,000	July	'07	4.00
Tennessee, c.	Tenn.	200,000	25	4,906,250	Oct.	'15	0.75
Tomboy, g s.	Colo.	310,000	4 85	3,709,395	June	'15	0.24
Tom Reed, g.	Ariz.	909,555	1	2,443,757	Apr.	'15	0.06
Tonopah Belm't, s.g.	Nev.	1,500,000	1	7,643,010	Oct.	'15	0.12½
Tonopah Ext., g s.	Nev.	943,433	1	967,016	Oct.	'15	0.07½
Tonopah of Nev., s.g.	Nev.	1,000,000	1	13,000,000	Oct.	'15	0.15
Tri-Mountain, c.	Mich.	100,000	25	1,450,000	Dec.	'13	2.00
Tuolumne, c	Mont.	800,000	1	520,000	May	'13	0.10
Uncle Sam, g s l	Utah.	500,000	1	495,000	Sept.	'11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov.	'12	0.01
United (Crip. Ck) g.	Colo.	4,000,100	1	440,435	Jan.	'10	0.04
United Globe, c.	Ariz.	23,000	100	2,472,500	June	'15	6.00
United Verde, c.	Ariz.	300,000	100	36,397,000	Nov.	'15	0.75
Utah, s l.	Utah.	100,000	10	281,860	Dec.	'10	0 02
Utah, c.	Utah.	1,624,490	10	30,275,161	Sept.	'15	1.00
Utah Con , c.	Utah.	300,000	5	9,000,000	Sept.	'15	0.50
Valley View, g.	Colo.	1,000,000	1	210,000	Dec.	'10	0.04
Victoria, g s l.	Utah.	250,000	1	207,500	Mar.	'10	0 04
Vindicator Con., g.	Colo	1,500,000	1	3,217,500	Oct.	'15	0.03
Wasp No. 2, g	S. D.	500,000	1	544,466	Nov.	'15	0 01
Wellington Mines, g.	Colo	10,000,000	1	650,000	Nov.	'15	0.02
Wolverine, c	Mich	60,000	25	8,520,000	Oct.	'15	4 00
Yak, s.l.	Colo	1,000,000	1	1,937,685	Sept.	'15	0.03
Yankee Con , g.s.	Utah.	1,000,000	1	167,500	Jan.	'13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,163,789	May	'15	0.02
Yellow Pine, l.z.s.	Nev.	1,000,000	1	813,008	Nov.	'15	0.07
Yukon Gold, g	Alas.	3,500,000	5	7,350,000	Sept.	'15	0.07½

Iron, Industrial and Holding Companies

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest		Amt.
Amalgamated, c.	Mont.	1,538,879	100	103,495,183	Aug.	'15	$3.77
Am. Sm. & Ref., com	U. S.	500,000	100	28,833,333	Sept.	'15	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	53,083,333	Sept.	'15	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	10,529,800	Oct.	'15	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	15,500,000	Oct.	'15	1.25
Greene Cananea.	U. S.	450,642	100	4,371,646	June	'14	1.00
Guggenheim Expl.	U. S.	833,732	25	23,323,327	Oct.	'15	1.00
Inter'l Nickel, com.	U. S.	380,315	100	23,408,834	Nov.	'15	5.00
Inter'l Nickel, pfd	U. S.	89,126	100	8,739,358	Nov.	'15	1.50
National Lead, com.	N. Y.	206,554	100	8,890,632	Sept.	'15	0.75
National Lead, pf.	N. Y.	243,676	100	30,545,959	Sept.	'15	1.75
Old Dominion, c.	Ariz.	293,245	25	6,747,098	Sept.	'15	1.50
Phelps, Dodge & Co.	U. S.	450,000	100	44,184,304	Sept.	'15	5.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	222,360,438	Dec.	'14	0.50
U. S. Steel Corp., pf.	U. S.	3,602,811	100	389,503,012	Nov.	'15	1.75
U. S. S , R. & M , com.	U.S.-Mex	351,114	50	6,362,188	July	'14	0.75
U. S. S , R & M , pf.	U.S.-Mex	486,348	50	16,369,693	Oct.	'15	0.87½

Canadian, Mexican and Central American Companies

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest		Amt.
Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 212,500	Oct.	'12	$0.25
Amparo, g s.	Mex.	2,000,000	1	1,640,884	Nov.	'15	0.03
B. C. Copper	B. C.	591,709	5	615,198	Jan.	'13	0.15
Beaver Con., s.	Ont.	1,996,490	1	589,857	Oct.	'15	0.03
Buffalo, s.	Ont.	1,000,000	1	2,757,000	July	'14	0.03
Canadian Goldfields, g	B. C.	600,000	0 10	290,000	July	'14	0.001½
Chontalpan, g s l z	Mex	7,000	25	59,500	May	'14	0.75
Cobalt Townsite, s.	Ont.	45,000	1	1,042,259	May	'14	0.10
Coniagas, s.	Ont.	800,000	5	7,720,000	Aug.	'15	0.30
Con. M. & S. Co. of Can	B. C.	58,052	100	2,175,005	Oct.	'15	2.00
Crown Reserve, s.	Ont.	1,768,814	1	6,067,030	July	'15	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar.	'11	0.25
Dos Estrellas, g.s.	Mex.	300,000	0 50	10,335,000	Dec.	'13	1.50
El Oro, g.s.	Mex.	1,147,500	4 85	8,668,418	July	'13	0.24
Esperanza, s.g.	Mex.	455,000	4 85	13,327,999	July	'15	0.24
Granby, s.l.c.	B C.	9,985	100	5,996,931	Nov.	'15	1.50
Greene Con , c	Mex.	1,000,000	10	9,544,400	May	'14	0.50
Guanajuato D , pf., s.	Mex.	10,000	1000	274,356	Jan	'11	3.00
Hedley Gold.	B. C.	120,000	10	1,704,000	Sept	'15	0 50
Hollinger, g.	Ont.	600,000	5	3,933,000	Nov.	'15	0.20
Kerr Lake, s.	Ont.	600,000	5	5,970,000	Sept.	'15	0.25
La Rose Con., s	Ont.	1,498,627	5	6,014,588	Oct.	'15	0.05
Le Roi No. 2, g	B. C.	120,000	24.30	1,501,740	May	'15	0.24
Lucky Tiger Com., g.	Mex.	715,337	10	3,253,391	Nov.	'15	0.09
McK.-Dar. Sav. s.	Ont.	2,247,692	1	4,607,761	Oct.	'15	0.03
Mines Co. of Am. (new)	Mex.	1,700,000	10	1,215,000	July	'13	0 12½
N. Y. & Hond. Ros., g.	C. A.	200,000	10	3,790,000	Oct.	'15	0 30
Nipissing, s.	Ont.	1,200,000	5	13,590,000	Oct.	'15	0.25
Peñoles, s.l.g.	Mex.	80,000	25	6,361,688	June	'13	1.25
Pinguico, pf., s.	Mex.	20,000	100	840,000	Oct.	'13	3 00
Right of Way Mns, s.	Ont.	1,685,500	1	219,115	Nov.	'14	0 02
Rio Plata, s.	Mex.	371,518	5	345,745	Feb.	'13	0 05
San Rafael, g.s.	Mex.	2,400	25	1,442,380	Jan.	'14	0 50
San Toy, g.s.	Mex.	5,750,000	1	530,000	July	'13	0 01
Sorpresa, g s.	Mex.	19,200	20	3,979,240	Jan.	'11	34 00
Stand'd Silver-Lead.	B. C.	2,000,000	1	1,650,000	Nov.	'15	0.02½
Temiskaming, s	Ont.	2,500,000	1	1,384,155	Apr.	'13	0.06
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,940,250	Nov.	'14	3 00
Trethewey, s.	Ont.	1,000,000	1	1,061,998	July	'14	0.05
Wettlaufer-Lorrain, s.	Ont	1,416,590	1	637,465	Oct.	'13	0 05

Assessments

Company	Delinq.	Sale	Amt.
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0.01
Clear Grit, Ida	Dec. 14	Jan. 5	0.0015
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah	Dec. 11	Jan. 3	0.02
Confidence, Nev	Dec. 24	Jan. 14	0.10
Cons. Imperial, Nev.	Nov. 30	Dec. 21	0.01
Copper Mt. M. & D., Ida	Oct. 28	Dec. 1	0.002
Darby M. & M., Ida	Nov. 16	Dec. 16	0.00125
Dry Canon Cons., Utah	Dec. 18	Jan. 17	0.001
Emerald Oil, Utah	Nov. 27	Dec. 16	0.06
Eureka M. & M., Ida	Nov. 26	Dec. 27	0.001
Great Western, Nev	Nov. 15	Dec. 7	0.001
Hancock Cons., Mich	Jan. 3		1.00
Hector, Ida	Nov. 18	Dec. 10	0.005
Idaho & Los Angeles, Ida	Nov. 26	Dec. 27	0.005
Idaho-Nevada Exp., Ida	Nov. 1	Dec. 1	0.002
Idora, Ida., (post.)		Dec. 2	0.005
Ivanhoe, Ida	Nov. 8	Dec. 9	0.0025
Jack Waite, Ida	Nov. 20	Dec. 20	0.01
Laclede, Ida.	Dec. 6	Dec. 27	0.003
Leonora M. & M., Utah	Nov. 27	Dec. 17	0.005
Lucky Swede, Ida	Nov. 11	Dec. 11	0.002
Missoula Copper, Ida.	Nov. 15	Dec. 15	0.002
Montana Standard	Nov. 15	Dec. 15	0.005
National Copper, Ida	Nov. 20	Dec. 18	0.01
National Lead, Ida	Nov. 15	Dec. 15	0.001
Nevada-Douglas, Nev.	Nov. 30	Dec. 31	0.10
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0.50
Northern Light, Ida	Nov. 2	Dec. 2	0.004
O. K. Ex. M. & R., Utah	Nov. 20	Dec. 15	0.005
Oom Paul Con., Ida	Nov. 16	Dec. 6	0.01
Oreano, Ida	Dec. 18	Jan. 18	0.001
Oriental, Nev	Nov. 6	Dec. 7	0.003
Original, Nev	Nov. 6	Dec. 7	0.003
Phedora, Ida., (post.)		Dec. 11	0.0005
Phoenix, Mich	Jan. 1		1.00
Rescue Eula, Nev	Dec. 6	Jan. 10	0.01
Seg. Belcher & Midas, Nev.	Dec. 12	Jan. 6	0.02
Silver Cliff, Ida	Nov. 8	Dec. 6	0.0025
Sonora M. & M., Ida	Nov. 4	Dec. 17	0.003
Sunset Dev., Ida	Dec. 8	Jan. 3	0.002
Sunshine, Ida. (post.)		Dec. 15	0.0006
Ton. Gipsy Queen, Nev	Oct. 29	Dec. 6	0.01
Tonopah Midway, Nev	Dec. 11	Jan. 11	0.01
Umatilla Ton., Nev	Nov. 8	Dec. 13	0.005
West Toledo, Utah	Dec. 16	Jan. 3	0.01
Wolf Mountain, Utah	Nov. 12	Dec. 14	0.0025

Stock Quotations

Among sales at auction in Philadelphia on Nov. 24, we note 1 Shannon-Arizona R.R. 6% bond at $950. The stock of the Chile Copper Co. has been listed on the New York Stock Exchange.

COLO. SPRINGS Nov. 30		SALT LAKE Nov. 30	
Name of Comp.	Bid	Name of Comp.	Bid.
Acacia	.02½	Beck Tunnel	.06½
Cripple Cr'k Con.	.008	Black Jack	.07
C. K. & N	‡.02	Colorado Mining	.08
Doctor Jack Pot	.09¾	Crown Point	.01¼
Elkton Con	.29	Daly-Judge	7.50
El Paso	.80	Emma Cop	.23
Findlay	.03½	Gold Chain	.55
Gold Dollar	.02	Grand Central	.50
Gold Sovereign	.06¼	Iron Blossom	.95
Golden Cycle	1.84½	Lower Mammoth	.07½
Isabella	.18¾	May Day	.17½
Jack Pot	.06½	Opohongo	.00½
Jerry Johnson	.05	Prince Con	.81
Lexington	‡.005	Seven Troughs	.01¼
Mary McKinney	.40	Silver King Coal'n	3.45
Pharmacist	‡.008	Silver King Con	2.25
Portland	1.72	Sioux Con	.01¾
Raven B. H	.03	Uncle Sam	.07
Vindicator	1.74½	Yankee	.31½

TORONTO Nov. 30			
Bailey	.04½	Dome Exten.	.28
Chambers Ferland	.22	Foley O'Brien	.50
Coniagas	5.15	Hollinger	27.50
Peterson Lake	.38	Imperial	.04
Right of Way	.05½	Jupiter	.17½
Seneca Superior	.90	McIntyre	.56
Silver Queen	‡.01	Pearl Lake	‡.00¾
T. & Hudson Bay	21.00	Porcu. Crown	.87
Timiskaming	.66½	Preston E. D	.05
Trethewey	.18	Vipond	.78
Wettlaufer-Lor.	.11½	West Dome	.15½

SAN FRANCISCO Nov. 30			
Alta	.08	Belmont	4.85
Andes	.09	Jim Butler	1.00
Best & Belcher	.05	Lone Star	.03
Caledonia	.40	MacNamara	.03
Challenge Con	.06	Midway	.14
Chollar	‡.02	Mont.-Tonopah	.35
Confidence	.15	North Star	.17
Con. Virginia	.22	Rescue Eula	.08
Gould & Curry	.03	West End Con	.80
Hale & Norcross	.04	Atlanta	.24
Jacket-Cr. Pt	.15	Blue Bell	.03
Julia	‡.02	Booth	.42
Mexican	.33	C.O.D. Con	.03
Occidental	.75	Comb. Frac	.07
Ophir	.27	D'field Daisy	.03
Overman	.08	Jumbo Extension	1.22½
Potosi	‡.02	Pitts.-Silver Peak	.06
Savage	.05	Round Mountain	.41
Sierra Nevada	.46	Sandstorm Kendall	.09½
Union Con	.57	Silver Pick	.05
Utah Con	.03	Central Eureka	.06

N. Y. EXCH. Nov. 30	
Name of Comp.	Clg.
Alaska Juneau	10¼
Am.Sm.&Ref.,com	99
Am. Sm. & Ref., pf.	110½
Am. Sm. Sec., pf. A	90
Am. Sm. Sec., pf. B	85½
Anaconda	88½
Batopilas Min	2¼
Bethlehem Steel	460
Bethlehem Steel, pf.	160½
Chile Cop	25¼
Chino	54½
Colo. Fuel & Iron	51¾
Crucible Steel	74½
Dome Mines	28½
Federal M. & S., pf.	50½
Great Nor., ore., ctf.	50
Greene Cananea	45½
Guggen. Exp	78½
Homestake	121
Inspiration Con	45¾
International Nickel	185
Miami Copper	34¼
Nat'l Lead, com.	65
National Lead, pf.	112
Nev. Consol	16¾
Ontario Min	7¼
Quicksilver	4
Ray Con	25¾
Republic I&S, com.	51
Republic I&S, pf.	110
Tennessee Copper	58
Utah Copper	79¾
U. S. Steel, com	86¾
U. S. Steel, pf	115½

N. Y. CURB Nov. 30	
Alta Con	.14
Beaver Con	.44
Big Four	.05
Braden Copper	16¼
Buffalo Mines	1
Can. Cop. Corpn	1 15/16
Cashboy	.06½
Cerro de Pasco	37½
Con. Ariz. Sm.	1½
Con. Coppermines	1 15/16
Con. Nev.-Utah	5/16
Dia. Black B	.05
Florence	.37
Goldfield Con	1½
Goldfield Merger	.18
Howe Sound	4
Kennecott Cop	53½
Kerr Lake	4¾
La Rose	11/16
Magma	15½
McKinley-Dar-Sa	.51
Mines of Am	3¾
Mother Lode	.31
Nevada Hills	.20
New Utah Bingham	2½
Nipissing Mines	8¼
Oro	.06½
St. Joseph Lead	14½
South Utah	.25
Stand'd Oil of N.J.	506
Standard S. L	2
Stewart	⅝
Success	.60
Tonopah	7
Tonopah Ex	4
Tonopah Merger	.60
Tribullion	⅝
Yukon Gold	2¾

LONDON Nov. 18	
Alaska Tre'dwell	£6 17s 6d
Burma Corp.	1 11 3
Cam & Motor	0 13 9
Camp Bird	0 7 9
El Oro	0 10 0
Esperanza	0 10 9
Mexico Mines	4 6 3
Nechi, pfd.	0 12 6
Oroville	0 14 3
Santa Gert'dis	0 10 6
Tomboy	1 4 0
Tough Oakes	0 9 0

BOSTON EXCH Nov. 30	
Name of Comp.	Clg.
Adventure	2½
Ahmeek	395
Alaska Gold M	25
Algomah	1¾
Allouez	56
Am. Zinc	69½
Ariz. Com., ctfs.	7¼
Bonanza	.35
Butte-Balaklava	3¼
Butte & Superior	73
Calumet & Ariz	68½
Calumet & Hecla	568
Centennial	16¼
Copper Range	58½
Daly West	3¼
East Butte	15¾
Franklin	9½
Granby	82
Hancock	16¾
Hedley	29¾
Helvetia	40
Indiana	5¼
Island Cr'k, com.	44½
Island Cr'k, pfd.	89
Isle Royale	27
Keweenaw	2¾
Lake	15½
La Salle	5½
Mason Valley	1½
Mass	12¾
Mayflower	4
Michigan	2
Mohawk	87
New Arcadian	9½
North Butte	31½
North Lake	2¼
Ojibway	1¾
Old Colony	3
Old Dominion	58¾
Osceola	84½
Quincy	85
Santa Fe	3¾
Shannon	8
Shattuck-Ariz	34¾
Superior	27
Superior & Bost	2½
Tamarack	52½
Trinity	10¼
Tuolumne	.36
U. S. Smelting	47½
U. S. Smelt'g, pf	48¼
Utah Apex	3 7/16
Utah Con	12½
Victoria	2½
Winona	3½
Wolverine	58½
Wyandot	1¾

BOSTON CURB Nov. 30	
Bingham Mines	8¼
Boston Ely	.39
Butte & Lon'n Dev.	.37
Calaveras	2
Calumet-Corbin	.05
Chief Con	1¾
Cortez	.45
Crown Reserve	.63
Davis-Daly	1¾
Eagle & Blue Bell	1¾
First Nat. Cop	5 11/16
Houghton Copper	2½
Iron Cap Cop., pf	7
Majestic	1¼
Mexican Metals	.37
Nevada-Douglas	.82
New Baltic	3½
New Cornelia	9½
Ohio Copper	.24
Oneco	1
Raven Copper	.10
Rex Cons	.25
Smokey Dev	.15
So. Lake	6½
Tonopah Victor	.35
United Verde Ext	4
Utah Metal	10

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	49.385	28.083	23.199	23.925
November	58.995	49.082	51.714	27.263	22.703	25.094
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

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

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	17.686	‡	72.601	‡	88.000
November	11.739	18.627	53.227	77.744		93.273
December	12.801		56.841		*	
Year	...		....		....	

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33.080	‡	151.554
November	33.304	39.224	139.391	167.670
December	33.601	...	147.102	
Av. year	34.301	...	...	...

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3.384	4.499	‡	23.994
November	3.683	5.155	3.585	5.078	18.500	26.278
December	3.800	.	3.662		19.097	
Year	3.862	.....	3.737	.....	....	....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	12.800	4.750	12.596	‡	66.536
November	5.112	15.962	4.962	15.792	25.016	88.409
December	5.592		5.430		27.369	.
Year	5.213	.	5.061	.	....	.

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.4	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59	18.26	13.43	17.30	13.83	17.20
December	14.70	.	13.15	..	13.83	
Year	$14.88	. .	$13.78		$14.01	

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 23 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

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2337—ARIZONA—Copper Queen Reduction Works, Arizona. C. A. Tupper. (Min. and Eng. Wld., Nov. 6, 1915; 3¼ pp., illus.) 20c.

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2349—REFINING—Electrolytic Refined Copper. A. C. Clark. (Advance copy, Internat. Eng. Congress, Sept., 1915; 9 pp., illus.)

2350—SMELTING at Panulcillo, Chile. (Eng. and Min. Journ., Nov. 13, 1915; 2¾ pp., illus.) Account of operations of Central Chili Copper Co. 20c.

2351—TAILINGS—Potash in Certain Copper and Gold Ores. R. S. Butler, with a note on Muscovite, by G. Steiger. (Bull. 620-J, U. S. Geol. Surv., Nov. 15, 1915. 12 pp.) On the possibility of recovering potash from tailings obtained in the concentration of gold and copper ores.

2352—UTAH—The Disseminated Copper Ores of Bingham Canyon, Utah. J. J. Beeson. (Bull., A. I. M. E., Nov., 1915; 45 pp., illus.)

GOLD AND SILVER—GEOLOGY

2353—ALASKA—The Willow Creek District, Alaska. Stephen R. Capps. (Bull. 607, U. S. Geol. Surv., 1915; 86 pp., illus.)

2354—ARIZONA—Gold Deposits Near Quartzite, Arizona. Edward L. Jones Jr. (Bull. 620-C, U. S. Geol. Surv., Sept. 23, 1915; 13 pp., illus.)

2355—BRAZIL—The Geology of Central Minas Geraes, Brazil. E. C. Harder and R. T. Chamberlin. (Journ. of Geology, July-Aug., 1915; 40 pp., illus.) 60c.

2356—PHILIPPINES—Notes on the Mineral Resources of Surigao Province. Wallace E. Pratt. (Mineral Resources of the Philippine Islands for 1914; 7½ pp.)

2357—TASMANIA—The Geology of the Waihi Grand Junction Mine. Arthur Jarman. (Bull. 133, I. M. M., Oct. 14, 1915; 45 pp., illus.)

GOLD DREDGING AND PLACER MINING

2358—ALASKA—The Willow Creek District, Alaska. Stephen R. Capps. (Bull. 607, U. S. Geol. Surv., 1915; 86 pp., illus.)

2359—ALASKA—Winter Mining at Fairbanks. Hubert I. Ellis. (Eng. and Min. Journ., Oct. 30, 1915; 4¼ pp., illus.) 20c.

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2363—SAVING FINE GOLD. T. W. Gruetter. (Min. and Sci. Press, Nov. 6, 1915; 5¼ p.) 20c.

2364—VICTORIA—Dredge Mining and Hydraulic Sluicing in Victoria. (Annual Report of the Chief Mining Inspector for 1914. 16 pp.)

2365—YUKON—Mining in the Yukon. (Can. Min. Journ., Nov. 1, 1915; 7¼ pp., illus.) From "The Yukon Territory," by J. B. Tyrrell, in "Canada and Its Provinces," Vol. 22. 20c.

GOLD AND SILVER—CYANIDING

2366—CYANIDE CONSUMPTION on the Witwatersrand. H. A. White. (Journ. Chem., Met. and Min. Soc. of So. Afr., Sept., 1915; 11¾ pp.) 60c.

2367—MERCURY DETERMINATION—The Determination of Mercury in Cyanide Solution and Precipitate. W. J. Sharwood. (Min. and Sci. Press, Oct. 30, 1915; 2 pp.) 20c.

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GOLD AND SILVER—GENERAL

2371—ARIZONA—The Oatman, Ariz., Mining District. (Min. and Eng. Wld., Nov. 13, 1915; 3 pp., illus.) 20c.

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2375—PHILIPPINES—Gold Production of the Philippine Islands in 1914. Wallace E. Pratt. (Mineral Resources of the Philippine Islands for 1914; 1½ pp.)

2376—SOUTH DAKOTA—Trojan Ore and Milling Practice. Jesse Simmons. (Min and Sci. Press, Nov. 6, 1915; 3⅜ pp., illus.) 20c.

2377—SUMATRA—Erz und Kohle auf Sumatra. P. Muller-Herrings. (Glückauf, Sept. 25 and Oct. 2, 1915; 12 pp., illus.) 40c.

2378—TAILINGS—Potash in Certain Copper and Gold Ores. R. S. Butler, with a note on Muscovite by G. Steiger. (Bull. 620-J, U. S. Geol. Surv., Nov. 15, 1915; 12 pp.) On the possibility of recovering potash from tailings obtained in the concentration of gold and copper ores.

2379—TAILINGS Reclaimed by Cableway at Goldfield, Nev. John Sinclair. (Min. and Eng. Wld., Oct. 23, 1915; 2 pp., illus.) 20c.

2380—UTAH—The Daly-Judge Mine and the Snake Creek Tunnel. Will C. Higgins. (Salt Lake Min. Rev., Oct. 30, 1915; 5½ pp., illus.) 20c.

IRON ORE DEPOSITS, MINING, ETC.

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The Engineering and Mining Journal

VOLUME 100 DECEMBER 11, 1915 NUMBER 24

Flotation of Silver-Lead Mineral at a New South Wales Mine

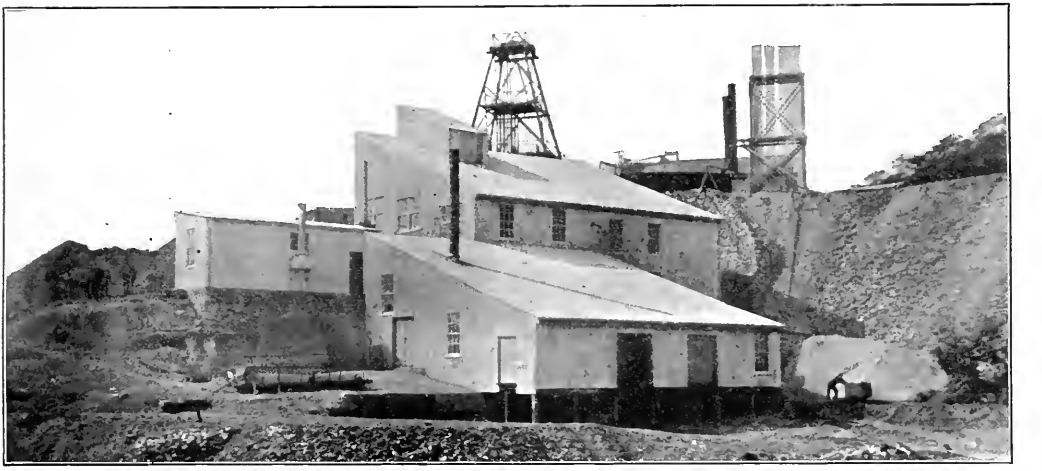
By H. Hardy Smith*

SYNOPSIS—A plant designed to treat a complex silver-lead ore where table concentration would not work. Many difficulties were met and surmounted, among which were a contaminated water-supply and much scale formed in the flotation machine. An original method of froth removal was devised. Details of practice fully discussed.

The small mill described in this article was erected at the Silver Peak mine for the purpose of treating the second-grade ores of the Yerranderie silver-lead mining field, New South Wales, Australia. Owing to the distance of the field from smelting works and the high cost of transport, over bad roads by horse teams, only the richest ores could be shipped at a profit. The question of smelting locally was studied, but owing to the highly siliceous nature of the "seconds" (about 70% SiO_2) and the difficulty of procuring suitable fluxes, the idea was abandoned.

The question of concentration was then considered, the problem proving to be a difficult one. The metallic minerals in the ore were, in order of importance: Galena, pyrite, marcasite, arsenical pyrite, blende, chalcopyrite and small quantities of secondary minerals from all the foregoing.

All these minerals carried silver to a greater or lesser extent, but the chief silver-bearing constitutents were the galena, and the iron sulphides, especially the marcasite. The galena occurred in two crystalline forms, one coarse and the other fine, the latter having a fracture similar to hard cast iron. This was rich in silver. Being extremely soft and friable, it slimed badly on crushing. Some of the ore contained it in such a fine state of dissemination that it appeared as a dark streak through the quartz, necessitating very fine grinding to free the values.



GENERAL VIEW OF THE SILVER PEAK FLOTATION MILL, VICTORIA, AUSTRALIA

The gangue was chiefly a hard glassy quartz with small quantities of felsitic country rock. From this description of the ore it will be readily understood that concentrating it was not simple.

Experiments were first made with gravity concentration, but the recoveries, especially of the silver, were low. The coarsely crystalline galena presented no difficulties, being amenable to jigging and table concentration; but this type was relatively low in silver, and the fine-grained variety, carrying the greater part of the silver, slimed so badly that no system of gravity concentration could give satisfactory recoveries. Flotation concentration was therefore tried, and as good results were reported from

*Suan mine, Holkol, Chosen.

small-scale tests made by Minerals Separation, a plant incorporating that process was decided upon.

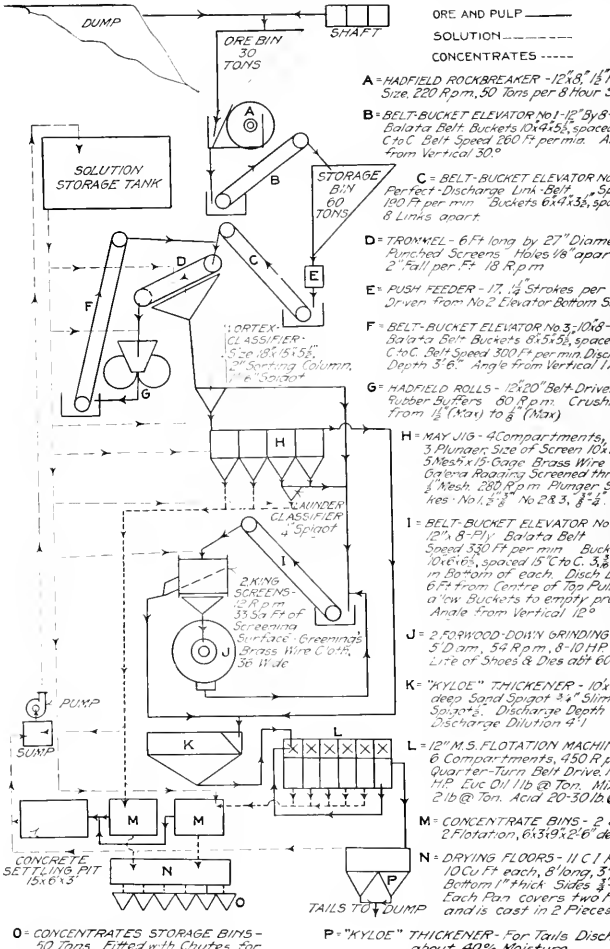
The average assay of the ore to be treated was about 30 oz. silver, 10% lead and 1 to 2 dwt. gold per ton. Because of the excessive transportation charges, the aim was to recover as much as possible of these metals in the form of high-grade concentrates. As the orebodies on the field were narrow and limited in extent, the company desired a mill of small capacity (about 50 tons per day) and small capital cost, which proviso precluded anything of an elaborate nature in the design. Several thousand tons of "seconds" had been mined during the opening up of the high-grade shoots of ore and lay awaiting treatment. The plan was to get the mill started and "tuned up" on this ore, supplementing it with ore from current development and, on results proving satisfactory, to mine the second-grade ore on an extensive scale. The flowsheet of the mill as erected is shown in the accompanying drawing.

The thickener before the flotation machine was of the inclined-baffleboard type already described.[1] They are cheap to build and simple and efficient in operation. The clear overflow from the thickener ran to the pump sump. The thickened underflow ran to a 6-compartment, 12-in. standard Minerals Separation machine. The tailings from the Minerals Separation machine ran to another thickener, the clear overflow from which ran to the pump sump, and the thick overflow into trucks and thence to the dump.

The flotation concentrates ran to a pair of bins, one being filled while the other was settling and being emptied. The turbid overflow from these bins ran to a concrete-lined pit where it was allowed to settle completely, the clear overflow from the pit running to the pump sump. This pit was cleaned out at intervals. After siphoning off the excess water from a concentrates bin, the sloppy concentrates were shoveled onto cast-iron drying floors and when dried sufficiently, into bins which fed chutes leading to the bagging floor.

The jig concentrates were handled similarly. On starting up the plant the first serious difficulty encountered was in the regrinding section, which could not handle the tonnage, when grinding to the degree of fineness required for good work at the flotation section. With the idea of lightening the load on the pans, the rolls were set hard up with considerable pressure between them so as to act by choke crushing. The increase in the quantity of slimes produced was immaterial owing to the ability of the flotation plant to handle this product efficiently. This readjustment made some improvement, but not sufficient to make up the leeway, and finally coarse screens had to be put on the King screening machines, increasing the aperture from 0.015 in. to 0.024 in. This resulted in a product altogether too coarse for good work at the flotation section, a point which must be kept in mind when considering the results.

The pulp as it left the regrinding section had a dilution of about 15 to 1 and before being treated at the flotation plant this was reduced to 4 to 1 in a Kyloe pulp thickener, the surplus water being returned by pump to the mill-water supply tank.



COMPLETE FLOW SHEET OF THE SILVER PEAK MILL

Oils Used in the Flotation Plant

The treatment at the Minerals Separation flotation plant involved the use of heat, acid and two oils. *Eucalyptus amygdalina* was used as an emulsifying agent and a dark lubricating-oil mixture to maintain the froth. The

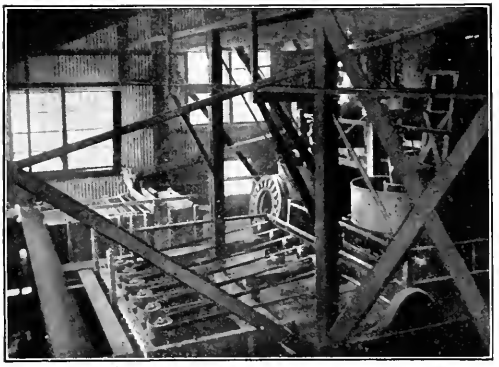
[1] "Flotation Process at Ryloe, N. S. W.," "Eng. and Min. Journ.," Dec. 7, 1912.

pulp was heated to 120° F. by live steam introduced into No. 1 agitating box. The consumption of steam was heavy, being equivalent to about 10 hp. (noncondensing) even when the initial temperature of the pulp was kept at about 90° F. by passing some of the mill water through the engine condenser.

The consumption of the different kinds of reagents varied considerably with the different kinds of ore, but the average was about as follows: Acid, 20 to 30 lb. per ton; *eucalyptus amygdalina*, ¾ to 1½ lb. per ton; mineral-oil mixture, 2 to 2½ lb. per ton. The sequence and method of using the reagents had to be altered from time to time to overcome difficulties that cropped up in the treatment.

Necessity for a Clean Water-Supply

One of the early difficulties encountered was of a peculiar kind and is well worth recounting. The water-supply for the mill was drawn from a dam, fed partly by surface drainage and partly by water from the mine. For four years previous to the commencement of milling operations this water supply had not been drawn on and had simply evaporated and soaked away. A few days



INTERIOR OF THE FLOTATION MILL

after starting the plant the water became discolored, first to a greenish yellow, then through yellow to a brick red. As soon as this reddish water arrived at the flotation plant the process went out of commission. The trouble seemed to be a total absence of aëration, which no amount of eucalyptus oil or other reagent could remedy. As much as 50 c.c. of eucalyptus oil was added to No. 1 agitating box at one time without producing any real froth or any signs at the back of the flotation spitz of the violent ebullition that is characteristic when the machine is in good working order. Occasional "blobs" of air came to the surface, but nothing in the shape of a froth.

The red discoloration was due to a fine precipitate which on analysis seemed to be a basic sulphate of iron. The precipitate was soluble in excess of acid, but the consumption made this remedy impracticable. The trouble was finally overcome, partly by keeping the mill solution in closed circuit and partly by manipulation of the reagents. Even with the closed circuit the loss by evaporation and leakage amounted to about 5,000 gal. per shift and this had to be made up with mine water.

This method of working led to another difficulty in the shape of scale and incrustations which formed chiefly in the Minerals Separation machine, but also in the screens and settler. In the flotation spitz the deposit took the form of sponge-like masses of crystals, while in the agitating boxes, in spite of the strong scouring action of the impellers, it was like a bad boiler scale. Both types dropped off at intervals and blocked the valves and pipes in the machine. At one period the trouble became so acute that it looked as if the plant would be a complete failure. The deposits were first noticeable when the solution contained only 150 grains of salts per gal. of solution, and up to a certain point they increased with the density of the solution. The incrustation appeared to be fine sand and slime bound together with sulphate of lime and magnesia.

At the King screens the meshes of the wire cloth became badly blinded. After a week or ten days the screening area became so reduced that the screens could not handle the tonnage, so the wire cloth had to be removed and cleaned by pickling in weak acid solution and then scrubbing with stiff wire brushes. The changing of the cloth on this type of screen is quite a tedious operation, and much time was lost thereby.

Samples of scale were assayed and showed in the deposit from the flotation spitz 61 oz. Ag and 14.5% Pb and in the deposit from the agitating boxes 16 oz. Ag and 3.5% Pb. The residue after evaporating filtered solution assayed 4 oz. Ag and 1.2% Pb, showing that small quantities of both silver and lead were being dissolved.

Device for Removing Floating Froth

The removal of the float from the surface of the flotation spitz presented another difficulty. When the machine was doing its best work the float was dense and heavy, being more of the nature of a thick scum than the usual frothy float composed of a fairly light mixture of bubbles and coagulated sulphides. The usual method in a case like this is to use paddles, but here they were ineffective as the float would not feed forward under the paddles. If the paddles were run fast and dipped deep, so as to cause a forward suction, the slime was stirred up and overflowed the lips with the concentrate, making it low-grade.

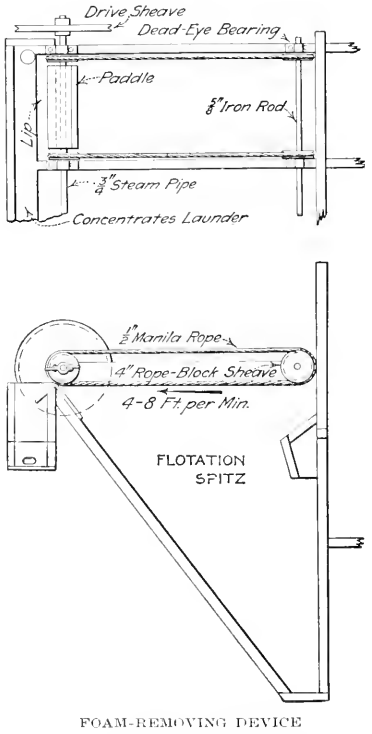
To overcome the difficulty the device shown in the sketch was put in. It consists simply of a pair of ropes traveling forward along both sides of the spitz. A ¾-in. pipe was run along the front of the spitz boxes, mounted on three simple bearings. To this pipe, 4-in. rope sheaves were keyed, two to each spitz. Along the back of the boxes a ¾-in. iron rod was run and another set of 4-in. sheaves threaded on and held in place by pins through the rod so that they could revolve freely without moving sideways. One-half-inch manila rope was spliced on over the sheaves. The ¾-in. pipe was driven at a very slow speed by a long rope from a slow-moving countershaft in the mill. Different-sized driving sheaves were kept handy so that the speed of the rope rabbles could be altered when necessary. It varied from 4 to 8 ft. per min. for the different classes of ore.

A coil of rope was kept handy, and a template was marked on a bench so that as the ropes wore they could be replaced rapidly by new ones. The ropes were put on with a rough long splice, and the men soon became expert enough to replace a rope in a few minutes. While one rope was out of business, the other did the work fairly well. Once the amount of shrinkage had been determined and allowed for, this characteristic of manila rope caused no trouble, its hairy nature made it effective, and this

combined with its low cost, made it preferable to rubber or composition bands. After about 12 months, the back sheaves had to be renewed.

If the surface of the water was kept within ¼ in. of the lips these rope rabbles would feed the float into the launder, but as this close regulation of the water level was difficult, very small paddles were mounted between the sheaves on the front pipe so as to dip just behind the lips and touch the froth over.

The assays of the floats from the various spitz boxes are shown in Table 2. The overflow from No. 6 spitz was always, and that from 4 and 5 sometimes, returned to No. 1 agitating box for retreatment. A retreatment scheme for the whole of the concentrates in a separate machine, though highly desirable under the conditions, was not feasible—first, on account of the extra cost of



FOAM-REMOVING DEVICE

plant and treatment, and second, because the amount of concentrates produced (from 3 to 5 tons per 24 hr.) was not sufficient to keep a machine adequately supplied.

Washing Concentrates to Improve Grade

In spite of all precautions the bulk concentrate from the machine ran about 15% insoluble. To improve this a scheme for washing the concentrates in the settling bins was introduced. The bin was fitted with a number of inclined removable baffles, and behind the first one a heavy spray of cold water was played on the float. This had the effect of disintegrating it so that the sulphides, still in the form of coagules, settled to the bottom at the same time a portion of the floated gangue was carried over a lip by the slow-moving current of water. The solids in the overflow assayed 50 oz. Ag, 10% Pb and 70% insoluble.

The average value of the mill concentrates is shown in the table:

	Au., Dwt.	Ag., Oz.	Pb, %
In jig concentrates	6.0	69.4	21.5
In flotation concentrates	7.4	115.7	19.6

The mill tailings ran from 8 to 12 oz. Ag per ton, under 10 grains Au, and 2 to 2.5% Pb. The proportion of jig

TABLE 1. GRADING ANALYSIS OF REGRINDING SECTION

Grades	Energy Unit	Feed Weight %	Feed Total E.U.	Discharge Weight %	Discharge Total E.U.
— ⅛ + 12	10.7	25.8	276.06	....	....
— 12 + 20	15.0	24.2	363.0	....	....
— 20 + 36	17.0	11.7	198.9	0.4	6.8
— 36 + 40	18.0	6.6	118.8	4.0	72.0
— 40 + 60	19.5	7.7	150.2	24.3	473.8
— 60 + 80	21.0	4.0	84.0	15.5	325.5
— 80 + 100	23.0	2.6	59.8	9.1	209.3
— 100 + 150	24.0	1.4	33.6	4.9	117.6
— 150	27.5	16.0	440.0	41.8	1,149.5
		100.0	1,724.4	100.0	2,354.5
					1,727.4
				Difference	630.1

Tons per 24 hr., 33.6.
Horsepower, 16.0.

$$\text{Efficiency} = \frac{630.1 \times 33.6}{16} = 13.2$$

TABLE 2. ASSAY OF OVERFLOWS FROM FLOTATION BOXES

Box No.	Silver, Oz. per Ton	Lead, %	Insoluble, %
1	158.0	25.6	9.3
2	132.7	23.2	10.8
3	134.0	23.0	10.7
4	130.0	22.0	15.7
5	123.0	21.5	18.5
6	49.0	9.0	50.6

concentrates to flotation concentrate was about 2 to 1. The recoveries for the whole mill averaged only about 70% of the silver and 75% of the lead. In considering these low recoveries it must be remembered that during the period under review the plant was operating under two great disabilities—first, the inadequate regrinding facilities, and second, the fact that during the whole time, except for a few days toward the end, the plant was operated only one shift of 8 hr. per day. To give an idea of the importance of the former, a complete grading analysis of the feed and products from the flotation plant is given in Table 3. In columns 25 and 26 the recoveries made on each grade are given. Note the low recoveries on the coarser grades. It is not until the —100 to +150 grade is reached that anything like respectable recoveries are effected. The heads which remain on 80 screen contain 687.4 oz. Ag (by addition in column 5). The corresponding tailings contain 599.8 oz. (by addition in column 21), which represents a recovery of only 12.7%. The heads which pass an 80-mesh screen contain 1,285.6 oz. Ag, while the corresponding tailings contain only 312 oz., which represents a recovery of 75.7%.

Had the whole of the heads been ground to pass an 80-mesh screen, the —80-mesh product would have been enriched by 687.4 oz., bringing the total up to 1,937 oz.; while, assuming that the extra tonnage of —80-mesh product would not affect the recovery made on that grade (if anything it should improve it), the —80-mesh tailings would be increased by 34.3% of 687.4 oz., or 235.8 oz., bringing the total loss in the tails up to 547.8 oz., which would give a total recovery of 72.2% of the silver.

The recovery under the existing conditions was only 53.8%, so that by grinding the whole of the feed to pass an 80-mesh screen the recovery would have been increased at least 18%, making the total recovery for the mill about 90% of the silver. Unfreed values were not altogether

responsible for the losses due to the coarse crushing. Much of the free mineral itself was in pieces too large to be successfully floated. This was especially the case with the iron minerals and the finely crystalline galena. The large particles of coarsely crystalline galena appeared to float more readily. A good tailing of fairly coarse free mineral could be obtained by panning a sample of tailings which had been allowed to weather for some time so as to overcome the tendency of the sulphides to float off. So that better recoveries could have been expected if the sands had been passed over concentrating tables before being treated at the flotation plant. It would probably prove more economical to crush fairly fine, say not more than 15% on 80-mesh, and to table the sands, than to crush the whole product through 80-mesh and rely exclusively on flotation for the recovery of the sulphides. But here again, at this mill, the limited capital available was the governing factor.

TABLE 3. GRADING ANALYSIS AT FLOTATION PLANT

	HEADS 100 Tons (Assumed)						
Grades by I.M.M. Screens	Weight of Heads, %	Assay Ag, oz. @ T.	Values Pb, %	Total Values per 100 Tons of Feed Ag, oz.	Total Values per 100 Tons of Feed Pb, Tons	Per Cent. of Total Values in Feed Ag	Per Cent. of Total Values in Feed Pb
— 25 + 30	0 4	12 0	1.5	4 8	0 006	0 24	0.2
— 30 + 40	5.1	13.0	1 6	66 3	0 082	3 4	2.7
— 40 + 60	28.4	11.5	1.6	326 6	0.448	16 5	14.7
— 60 + 80	20.4	14 2	1 7	289 7	0 347	14 7	11.4
— 80 + 100	9.4	17.3	1.8	162.6	0.169	8.2	5.6
— 100 + 150	5 5	20.5	2 6	112 8	0 143	5 7	4.7
— 150	30.8	32.8	6.0	1010 2	1.848	51.2	60.7
Totals.....	100.0			1973.0	3.043	99.9	100.0
Average totals..		19.73	3.04				

	CONCENTRATES 5.8 Tons (from Average Assays)							
Grades by I.M.M. Screens	Weight of Concentrates, %	Weight per 100 Tons of Feed, Tons	Assay Ag, Oz., @ T.	Values Pb, %	Total Values per 100 Tons of Feed Ag, Oz.	Total Values per 100 Tons of Feed Pb, Tons	Per Cent. of Total Value in Feed Ag	Per Cent. of Total Value in Feed Pb
— 25 + 30	0.5	.003	120.0	27 0	0.36	0.001	0.018	0.032
— 30 + 40	0.7	0 042	121 0	26.0	5 1	0 011	0.25	0.36
— 40 + 60	4 0	0 238	115 0	31 7	27 4	0 116	1 39	3.81
— 60 + 80	6.3	0.365	150 0	26 8	54.7	0 098	2.77	3.22
— 80 + 100	8.0	0 470	204.5	10 0	96.3	0 047	4 88	1.54
— 100 + 150	8 8	0.521	162 5	18.4	84.6	0.096	4 28	3 15
— 150	71.8	4.172	190.0	31.6	792.7	1.322	40 17	43.48
Totals.....	100.0	5.811			1061.4	1.691	53.76	55.59
Average totals..			182.6	28.4				

	TAILINGS 94.2 Tons (by Difference)								Recoveries Made on Each Grade	
Grades by I.M.M. Screens	Weight of Tails, %	Weight per 100 Tons of Feed, Tons	Assay Ag, Oz., @ T.	Values Pb, %	Total Values per 100 Tons of Feed Ag, Oz.	Total Values per 100 Tons of Feed Pb, Tons	Per Cent. of Total Values in Feed Ag	Per Cent. of Total Values in Feed Pb	Ag, %	Pb, %
— 25 + 30	0 4	0 37	12 0	1 4	4 44	0 005	0 22	0 17	7 5	13 3
— 30 + 40	5.0	4 71	13.0	1.5	61 23	0 071	3 10	2 31	7 6	13.6
— 40 + 60	29.4	27 69	10 8	1 2	299 16	0 332	15 16	10 93	8.1	25.9
— 60 + 80	24.0	22 61	10 4	1 1	235.04	0 249	11 91	8 17	18.8	28.2
— 80 + 100	10 8	10 18	6 5	1 2	66 30	0 122	3 36	4 02	59 2	27 8
— 100 + 150	5.0	4 71	6 0	1 0	28 20	0 047	1 42	1.53	75.0	67.0
— 150	25.4	23.93	9.1	2.2	217 49	0.526	11 02	17 29	78 4	71.5
Totals.....	100.0	94.2			911 86	1.352	46.19	44.42		
Average totals..			9.68	1.44					53.8	55.6

Germans in the Metal Market

In the Court of Appeal, Nov. 18, 1915, Lords Justices Swinfen Eady, Phillimore and Pickford heard an appeal by Aron Hirsch & Sohn, metal merchants and smelters, of Halberstadt, in Prussia, from a decision of Justice Bray in an action brought against them by the Zinc Corporation, Ltd., of Copthall Avenue, E. C., says the London *Financial Times*. The action was for a declaration that a contract for the supply of zinc concentrates from certain mines in Australia to Hirsch & Sohn was void by reason of the war.

J. A. Compston, K. C., for Hirsch & Sohn, said that his clients had for a long time been taking the total production of zinc concentrates from certain mines in Australia. On the outbreak of war this action was brought. In it two questions were raised: (1) Was the contract one of a class which would be dissolved by the war? (2) If it were, was there not a clause in it which would suspend the operation of the contract during the war, and therefore prevent it being dissolved? Justice Bray held that this was a contract that would be determined by war. The second point gave him considerable trouble. He did not decide it and could say no more than that he inclined to the opinion that war was one of the things that would bring the suspensory clause into operation; but he said all that was suspended were future deliveries. That left in the contract clauses that would operate, and as they would necessitate communication with the enemy, the contract was void. On these grounds a declaration was granted, but without prejudice to all contracts and deliveries made before the war.

The hearing was adjourned.

Method Used in Driving the Rogers Pass Tunnel*

The 5-mi. tunnel of the Canadian Pacific Ry. at the Rogers Pass summit of the Rocky Mountains (having its east portal 80.5 mi. west of Field, B. C.) will be the longest tunnel on this continent, and will be large enough for a double track.

The tunnel will be 26,400 ft. long between portals, on tangent, and will have a grade of 0.95% throughout. In section it will be 29 ft. wide at rail level, with vertical sides and semicircular roof. The height will be 21½ ft. from base of rail to crown, or 23 ft. above subgrade. Construction was commenced in September, 1913, and the contract calls for completion within 3½ yr. (by Dec. 3, 1916). This necessitates rapid and steady progress, and for this purpose a novel method of driving the tunnel was devised by the contractors and approved by the railway company's engineers.

Two Pioneer Side Tunnels Employed

To drive this long tunnel from the two ends only would have involved a protracted period of construction, and in order to expedite the work it was highly desirable to attack it at various points by means of intermediate headings. Shafts as used for tunnels at moderate depths were out of the question for this great Rocky Mountain tunnel. Nor were there opportunities for the use of adits such as have been employed in exceptional cases of side-hill tunnels.

The method devised was to drive from each end a pioneer tunnel or drift, parallel with the main tunnel, but about 50 ft. distant from it. From these two drifts lateral drifts or crosscuts are driven to the center line of the tunnel at intervals of 1,400 to 3,000 ft. From each of these points the main tunnel heading is driven, working usually in the upgrade direction. This method gives numerous points of attack on the main tunnel. The drifts serve for the removal of material by cars, the ventilation of the headings and the placing of pipes and cables clear of the tunnel construction work. The two pioneer drifts, however, are on opposite sides of the line of the tunnel, the drift at the east end being on the north side and that at the west end on the south side of the tunnel. Thus they cannot be extended to form a continuous pass-

*Excerpt from "Engineering News," Nov. 11, 1915.

age, and each drift will be somewhat shorter than the half length of the tunnel.

These drifts and crosscuts were intended simply to facilitate the work on the tunnel, and their construction is entirely at the contractors' expense. It was not intended to use them permanently.

The nearest approach to a previous use of this system in driving long tunnels was in the construction of the first Simplon Tunnel in Switzerland.

The pioneer drifts and crosscuts are of rectangular section, 8 ft. wide and 6 ft. 6 in. high. The main or central heading, also rectangular, is 11 ft. wide and 9 ft. high. Working from each portal, this main drift is being enlarged to the full tunnel section.

Driving the Drifts and Headings

To save time and excavation the pioneer drifts were started considerably above the grade of the tunnel heading. The drift at the east end starts about 50 ft. above grade and is practically level, so that the first two crosscuts slope down to reach the main heading.

In driving the pioneer drifts at the east end four Leyner drills are mounted on a bar. These put in about 24 holes 6 ft. deep, 1¼-in. top and 1⅛-in. bottom diameter. Each hole is loaded with from 4 to 8 lb. of 50% dynamite. Similar drills are used in the center bench, drilling rounds of 26 holes 6 ft. apart, or 225 lin.ft. per round. These sections or "rings" are shot off for muck as required.

For ventilating the faces of the pioneer drift and advance heading two exhaust fans of the Connersville type (with 12-in. wood-stave pipe) are used, placed usually near a crosscut. From this point the exhaust pipe is carried to within 25 ft. of each face. A gate is provided so that the fan can exhaust from either face as required. Only one of these fans is worked at a time, so that one can be moved while the other is in service. The fan is started at each blast, and the men can return to work in from 15 to 25 min. By opening the 1½-in. air line for the drills the smoke and fumes can be cleared away from the face so that they will be removed by the exhaust.

At the portal of each pioneer drift there has been installed a multivane fan 5 ft. in diameter, which forces air into the drift. This air is diverted into the main tunnel whenever required. For instance, after shooting in the enlargement to full tunnel section the air is turned in at a cross-drift beyond the point of shooting. In this way the smoke and gases are cleared out of the tunnel very rapidly.

Working Force and Staff

The force per 8-hr. shift in the pioneer drift is as follows: Four drillers (4 drills at each end), 2 helpers, 8 to 10 muckers, 1 nipper, 1 driver, 1 shift boss, 1 to 4 mules and about 40 cars.

The force per 8-hr. shift in the advance heading of the main tunnel is as follows: Three drillers (3 drills at each end), 2 helpers, 8 to 10 muckers, 1 nipper, 1 driver, 1 shift boss, 1 mule, and 60 to 80 cars (according to the length of haul). In addition, there is the following force on each 10-hr. shift to cover the two small drifts in each end: One assistant superintendent, 1 walking boss, 2 blacksmiths, 2 blacksmith helpers, 12 laborers, 10 dump men, 6 teamsters, 14 mules, 1 hoistman and 2 pipe-fitters, carpenters, mechanics, etc.

The center bench of the main tunnel is worked in 8-hr. shifts with 2 to 10 drills, 2 to 10 helpers, 5 to 10 muckers, 1 shifter, 1 driver and 1 mule.

The completion of the main tunnel to full section is worked in 10-hr. shifts, with the following force per shift: One driller, 1 helper, 1 to 2 powdermen, 1 engineman and 1 craneman on the mucking shovel, 10 to 12 pit men at the shovel, 1 general foreman, 1 foreman and 12 to 15 laborers for the dump and track work, 2 compressed-air dinkey locomotives with 2 enginemen and 2 brakemen, 1 steam locomotive and 1 engineman, 1 fireman, 1 conductor and 2 car-repair men.

The contractors for the tunnel are Foley Bros., Welch & Stuart, of Winnipeg, and A. C. Dennis is the superintendent. The work is under the direction of John G. Sullivan, chief engineer, Canadian Pacific Ry., and W. A. James, engineer of construction.

The Explosion at Granite Mountain Shaft*

The explosion of 650 lb. of dynamite, which was loaded on a car and was about to be lowered down the Granite Mountain shaft of the North Butte Mining Co., caused the greatest loss of life that has resulted from any accident that has occurred in the history of Butte mining operations. This was due, mainly, to the fact that the explosion occurred shortly after 1 o'clock in the afternoon, when the shift bosses and nippers were waiting near the shaft to be lowered for the afternoon's work. Sixteen men were killed and four were injured.

Owing to the fact that all those who were near enough to the powder to have had any knowledge of the cause of the explosion were killed, any attempt to fix this cause is limited to pure conjecture. Among the many theories that have been advanced is the one that the powder may have been exploded by a rock falling from the headframe and striking it. However, the facts that the car was standing 25 ft. away from the collar of the shaft and that no skips containing ore or waste were at the top do not seem to support this theory. Experiments made after the accident also failed to indicate any such possibility. A stone approximately 8x4-in. in size, dropped from a height of 75 ft. onto a powder box filled with sawdust, caused only a slight indentation of the wood.

The explanation that now seems most plausible is that the car was struck by a stray rifle bullet fired by a person at considerable distance from the scene of the accident. The collar of the shaft is situated on an elevation at some height above the rest of the ground in the immediate vicinity, and it would therefore have been possible for a bullet coming from nearly any direction to strike the car. Boys are notoriously careless in handling guns, and unfortunately they and their guns are too common in the district.—The *Anode*, November, 1915.

The Largest Plate Mill in the World has been ordered for the Lukens Iron and Steel Co. at Coatesville, Penn. The exact length has not yet been determined, but it will be either 200 or 204 in. This compares with a 178-in. mill at Witkowitz, in Austria-Hungary, a 178-in. mill just ordered for the Imperial Steel Works of Japan, and a 168-in., two-high, reversing mill at the Dalzell works near Glasgow, Scotland. The Lukens mill will be four-high and provided with chilled working rolls 34 in. in diameter, supported both at the top and bottom by steel rolls 50 in. in diameter.

*See "Eng. and Min. Journ.," Oct. 30, 1915.

Natural Gas—Its Occurrence and Properties

By Dorsey Hager*

SYNOPSIS—*A résumé of the geologic and commercial factors in the development of natural-gas deposits. Further development of the American fields is urged.*

Natural gas is of course any gas formed in nature, such as marsh gas, sulphur dioxide, carbon dioxide (the "choke-damp" of the mines), sulphureted hydrogen and petroleum gas. However, as generally understood, natural gas is that obtained from oil or gas fields, and burned in our homes and factories instead of gases manufactured from coal or from petroleum.

The geology of natural-gas formations is now well understood. The chances for the occurrence of commercial natural gas in many untouched areas are so favorable, the efficiency and cheapness of natural gas are so much greater than other fuels, that I have wondered at the relative lack of interest of manufacturers in the possibilities of employing such a cheap fuel; and also at the lack of comprehension by gas men of the value of geology as applied to prospecting for natural gas.

Geographic Distribution in the United States

At present the chief productive natural-gas areas of the United States are in Kansas, Oklahoma, Louisiana, Pennsylvania, West Virginia and California. The Oklahoma and Kansas natural-gas deposits have been touched,

ANALYSES OF NATURAL GAS

Sample—Where Taken	Methane, CH_4	Ethane, C_2H_6	Carbon Dioxide, CO_2	Nitrogen, N_2	Hydrogen, H	Other Hydrocarbons	Helium, He	B.t.u. per Cu.Ft.
1 Pittsburgh, Pa	92 00	3 00	.	2 0	3	.	. . .	978
2 Midway, Calif. (Dry) . . .	92 00	.	3 2	0.3	..	3 2	. . .	998
3 Hogshooter, Okla. (Dry)	92 20		1 0	4 8	..	. .	. . . .	1,003
4 Glen Pool, Okla. (Wet)	38 75	61 10	0 2		..	.		1,551
5 Dexter, Kan. . .	14 85	0 41		82 7		.	1.84	Noncombustible

Gases 2 and 3 are dry gases. Gas No. 4 is "wet" or casing-head gas. [Gas No. 5 is peculiar in that it contains 82.7% of nitrogen and 1.84% helium.

but have not been developed as fully as the oil resources. Illinois, Indiana, Ohio, Kentucky, New York, Tennessee, Alabama, Texas, Wyoming, Montana, Utah and New Mexico also have small gas fields. Alabama, southern Tennessee, eastern Mississippi, Iowa, Missouri, and Arkansas have gas possibilities that should be developed.

Natural gas is composed principally of the hydrocarbons methane (CH_4, commonly called marsh gas) and ethane (C_2H_6). Two elements, carbon and hydrogen, are the chief constituents of all natural gas. The analyses of one exceptional and of four typical gases are presented in the accompanying table.

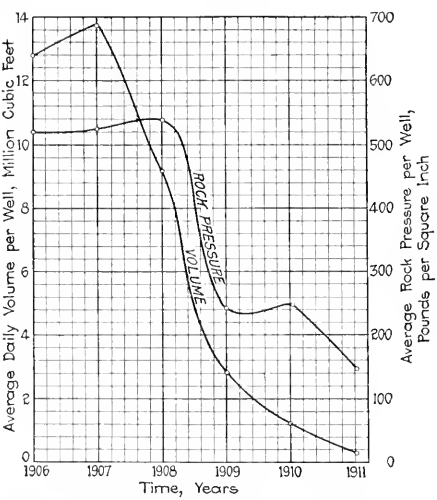
Origin of Natural Gas Uncertain

The origin of natural gas is shrouded in mystery. It may be of organic or inorganic origin—that is, formed by the decomposition of animal or vegetable matter—or it may be the result of the interaction of certain chemicals lying at great depths underground. Marsh gas is certainly due to decaying vegetable and animal matter, and it is not improbable that the natural gas from petroleum is also of the same origin.

Methane is the most stable of the hydrocarbons. It is highly probable that the heat breaks up the more complex hydrocarbons to form methane, so that gas is being continually formed in the earth wherever petroleum is found. It is not at all improbable that tremendous quantities of gas are formed in the change of lignite to bituminous coal and of bituminous coal to anthracite.

However, speculations along such lines lead to endless controversy, and for all practical purposes it is sufficient to note the occurrences of natural gas, and its economic importance, leaving speculations as to its origin to the ultra-scientists.

It is interesting to note that gas generally occurs in regions where lignitiferous, bituminous or petroliferous shales are found. The gas is generally found above the



DECLINE IN VOLUME AND ROCK PRESSURE OF WELLS IN THE CANEY FIELD—AFTER BLATCHLEY

Ascent of the curves is caused by new wells being added to the field during intermediate years

shales or in porous sand lenses interbedded in the shales. The relation of commercial accumulations of natural gas to shales is important, as one would not care to locate a well in regions where shales carrying organic matter are absent.

Some commercial gas has occurred in glacial drifts in Iowa, Illinois and Kansas. The gas was in all likelihood marsh gas resulting from the decay of vegetation buried at shallow depths. It may also be possible to utilize the marsh gas formed in the Gulf Coast regions, where, if collected above ground, it would in some places have a distinct commercial value as fuel for houses. Tremen-

*Petroleum geologist and engineer, Hotel Tulsa Building, Tulsa, Okla.

dous quantities of decaying vegetation occur in the coastal plains, and the utilization of the marsh gas given off by that vegetation is only a question of time.

Natural gas occurs in formations of the most recent to those of the early Paleozoic, Ordovician and Silurian ages. In fact, gas seems to be found wherever decaying vegetation or animal matter has occurred. The presence of natural gas in the older beds presupposes earlier vegetable or animal life, unless the gas has migrated from younger beds. Commercial accumulations are, however, dependent upon the trapping of the gas.

Factors Affecting Commercial Deposits

Commercial deposits of natural gas are dependent upon two essentials—a source of supply for the gas, and proper reservoirs. The source of supply has been treated under origin, and the reservoirs will now be considered.

It has been ascertained by careful observation and study that most productive natural-gas fields occur in beds that have been folded into arch-like structures called domes, anticlines (see Fig. 1), or some modification of those structures, as terraces, noses or monoclines. Lensed conditions also tend to accumulations. (See Fig. 2.)

An arch-like structure, such as that in Fig. 1, is called an anticline. Under ideal conditions the gas accumulates at the top of the fold; oil, if present in the same sand, lies below the gas, and water below the oil, in the order of the specific gravities.

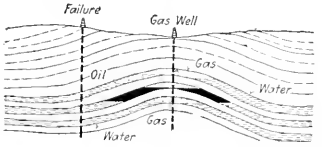


Fig. 1.

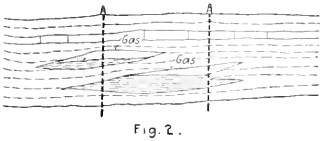


Fig. 2.

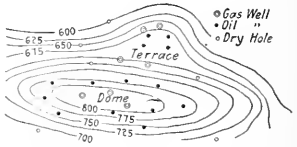


Fig. 3.

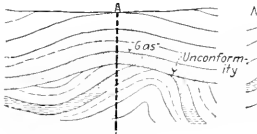


Fig. 4.

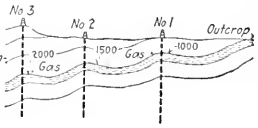


Fig. 5.

FIGS. 1 TO 5. DIFFERENT CONDITIONS OF NATURAL-GAS OCCURRENCE

The foregoing is the ideal case. In many instances gas is found above or below the oil sands. Where it is found in an oil sand, the oil and gas are quite often so closely associated that the gas may be said to be held in compression in the oil. Fig. 3 shows an anticlinal or domed condition, with a terrace upon its flank. Gas occurs at the top of the fold and also, as will be noticed, where the dip changes so markedly, both above and below the terrace.

Any sudden break or change in the dip tends to cause an accumulation of gas. Porous rocks, sands, sandstones, limestones or fractured shales form good reservoirs for gas if they are overlain and underlain by relatively impervious beds of sandstone, limestone or shale. The covering and underlying beds must be such that gas cannot escape through them and be dissipated into the air. Where the beds carrying the gas are "tight," or closely cemented, accumulations at the tops of folds will not be very productive. The more porous the reservoir, the greater the volume of gas it can hold, and cementation closes the pore space. Where the structures were faulted or broken so that vents to the surface were opened, gas escaped from the beds.

In some cases the gas has, in all probability, migrated from lower beds to higher, owing to unconformities (see Fig. 4) or to faulting. Gas naturally travels wherever an opening is afforded and only comes to rest where there is a relatively impervious covering to prevent its escape. The covering may be a compact limestone, dense shale or closely cemented sandstone.

Gas generally occurs with oil, but there are many productive gas sands that do not carry oil. These are called "dry" gas sands, to distinguish them from the gases carrying petroleum vapors. Gas sands occur above or below oil sands (see Fig. 1); also in districts where no commercial oil sands are obtained.

Variations in Pressure

The pressures of gas vary in different fields and for different depths of gas sands. There is, however, a remarkably close relation between the gas pressures and the depths of the gas sands. Especially is this true in the Mid-Continental oil and gas fields and in West Virginia. A well (see Fig. 5) 1,000 ft. deep will have a gas pressure of 400 lb.; one 1,500 ft., 600 lb.; one 2,000 ft., 800 lb.; or approximately 40 lb. per 100 ft. A study of a large number of wells shows that the pressure is approximately equivalent to the pressure exerted by a water column the height of the well.

Allowance should be made for the differences in specific gravities of the water and for the differences in elevations between the surface water table and the elevations at the collars of the wells. A column of fresh water 1 ft. high and 1 in. square exerts a pressure of 0.434 lb. per sq.in. Underground waters in the oil and gas fields have specific gravities of 1 to 1.3, which would make the water much heavier. In calculating, however, one can disregard specific gravities and simply use 0.4 lb.; this lower figure allows sufficiently for the loss in theoretical head resulting from friction, differences in elevation of the water table, etc. A difference of elevation of 100 ft. between wells means 40 lb. difference in pressure.

Allowing for such irregularities the pressures are remarkably consistent; so much so that in regions like Oklahoma and Kansas the gas companies base their estimates of pressures and also figure the weight of fittings necessary to control the well upon this important relation.

For example, fittings for a well 1,000 deep need to withstand only 400-lb. pressure. A factor of safety of 2 gives 800 lb. Such fittings will, however, be unsafe with wells 3,000 ft. deep, where there is a pressure of $300 \times .40 = 1{,}200$ lb. per sq.in.

The point is raised that if water is holding in the gas, the water should replace the gas when the gas pressure is weakened. Such, in fact, is generally the case. The gas is withdrawn very rapidly. The water moves more

slowly through the pore spaces of the sand, owing to friction and adhesion, with the result that the gas pressures are reduced for a short time. By shutting in a well, however, the gas pressure rises again, showing that hydraulic pressure is back of it.

There is considerable question as to the cause of the pressure, but there is no doubt that the hydraulic theory holds with but few exceptions. There is such a close relation between the head of water and the gas pressure that I do not feel inclined to disregard the artesian theory, especially for sands which are exposed to meteoric waters. I fully realize that artesian conditions do not apply in all places. At Fort Smith, Ark., little or no water is found in the gas sand. Pressures of but 145 to 280 lb. per sq.in. instead of 400 to 800 lb., are obtained at depths of 1,000 to 2,000 ft. The sands, however, are nearly free of water.[1] The synclines carry gas in that field.

Maximum gas pressures of 1,260 lb. are reported[2] at Midway, Calif.; 1,500 to 1,700 lb. are reported[3] in Green County, Penn.

Calculating Gas Volumes

A few calculations will give some estimate of the capacity of rocks to hold gas; also the large acreage that must necessarily be drained by gas wells. We will assume as a unit, a sand 1 ft. thick, containing 10% of voids or pore space per cubic foot, and covering one acre. An acre-foot, or 43,560 ft. of sand, under the conditions cited contains $43{,}560 \times 0.10 = 4{,}356$ cu.ft. of pore space. If this space be filled with gas at atmospheric pressure it will contain 4,356 cu.ft. The specific gravity of gas compared to air varies from 0.5529 for methane, to nearly 1, the specific gravity of air. The higher the quantity of ethane and the more complex hydrocarbons, the higher the specific gravity. An average specific gravity of 0.6 is generally assumed.

Gas volumes are measured at an average mean atmospheric pressure of 14.4 lb. per sq.in. and at a pressure of 4 oz. (0.25 lb.) above the mean atmospheric pressure. The pressure approximately corresponds to 14.7 lb. at 60 deg. F., the pressure at mean sea level. Theoretically, the temperature at depth should be taken into account, but in an approximate calculation such refinements are of little value. The number of expansions for 100-lb. "rock" pressure would be $\frac{100 + 14.7}{14.7} = 7.8$. The total volume per acre-foot will be volume of gas times expansions, or $4{,}356 \times 7.8 = 33{,}976$ cu.ft. per rock pressure of 100 lb. At 500-lb. rock pressure the expansions are 35 and the volume per acre-foot equals $4{,}356 \times 35 = 152{,}460$ cu.ft. At 1,000-lb. pressure the expansions are $\frac{1{,}000 + 14.7}{14.7} = 69+$, instead of 78.0 as one would at first imagine, the added 14.7 lb. becoming of less consequence the higher the rock pressure becomes. The volume will be $4{,}356 \times 69 = 300{,}582$ cu.ft. per acre-foot.

Gas has such mobility that one gas well situated at the top of a dome should in time drain all the gas from the sand. Good practice, however, allows 100 acres of land per gas well. One well per 40 acres is the minimum of good practice. Allowing one well to drain 100 acres, a well, under the conditions given, would take care of 152,460,000 cu.ft., for a pressure of 500 lb. and a sand 10 ft. thick.

A single well often produces many times the theoretical amount. It is more than likely that petroleum acts as a solvent for the gas and holds tremendous volumes in solution, as the hydraulic pressures set up are not sufficient to liquefy the gas. As several wild gas wells have produced from 30,000,000 to 70,000,000 cu.ft. per day and kept it up for months, it is a matter of wonder as to where the gas came from.

The graphic chart[4] (Fig. 6) gives some idea of gas volumes in producing fields. This was taken at the famous Caney, Kan., gas field and shows the life of that remarkable field. The high average volume of 10,694,000 cu.ft. per well, with the rock pressure of 490 lb. per sq.in. shows that such wells must have drained a large area. The total volume of gas over a period of five years would be $10{,}694{,}000 \times 1.825 = 19{,}516{,}550{,}000$ cu.ft. If the value of such gas at the well is $0.05 per 1,000 ft., the total value is $19{,}516{,}550 \times 0.05 = \$975{,}827.50$ per well. As such a well should not cost over $5,000 to drill, one should obtain extraordinary returns on the money invested. Pipe lines are expensive, however, the leakage is large, royalties and overhead expenses are to be considered, and depreciation is rapid. While there are large profits in the natural-gas industry, the profits are none too large for the risks taken.

Heating Value of Natural Gas and Other Fuels

The value of natural gas in heating is approximately 1,000 B.t.u. per cu.ft. The higher the percentage of hydrocarbon gases, such as ethane, the higher the number of heat units. This is clearly shown in the analyses already given. Comparison with coal, petroleum, wood and producer gas is presented in another table.

COMPARISON OF NATURAL GAS AND OTHER FUELS

Fuel	B.t.u.	Equivalent in B.t.u. of 1,000,000 Cu.Ft. of Natural Gas	Value
Natural gas, per cu.ft.	1,000	1,000,000 cu.ft.	At 10c. per 1,000 cu.ft. $100.
Oil gas, per cu.ft.	850	1,176,470 cu.ft.	At 25c. per 1,000 cu.ft., $294.
Producer gas, per cu.ft.	200	5,000,000 cu.ft.	At 5c. per 1,000 cu.ft., $250.
Petroleum, 14° Bé	18,500	160 bbls.	At $1 per bbl., $160.
Coal (bituminous), per lb	12,500	40 tons	At $2.50 per ton, $100.
Wood, per lb	5,000	66.6 cords (1 cd. 3,000 lb.)	At $3.50 per cord, $198

However, B.t.u. do not measure the true efficiency of gas. The efficiency of combustion of gas is greater than that of other fuels, so the actual efficiency will be 10 to 20% greater.

The development of the casing-head gasoline industry has sprung into prominence within the last five years. It has been found that gas coming directly off petroleum carries hydrocarbon vapors that can be condensed by pressure. These vapors consist of the lighter hydrocarbons that go to make up naphthas, benzine, gasoline, etc., having specific gravities of 70 to 100°. A rich gas may carry 5 gal. of gasoline per 1,000 cu.ft., but 1 gal. per 1,000 cu.ft. can be made to pay if a sufficiently large quantity of gas is obtained. The gasoline is first extracted, and the "dry" gas is introduced in the gas line for fuel.

[1] Carl D. Smith, Bull. 541, U. S. Geol. Surv.
[2] R. P. McLaughlin, "Pressures," Bull. 69, California State Mining Bureau, 1915.
[3] I. C. White, Vol. Ia, W. Va. Geol. Sur.
[4] "Waste of Oil and Gas in Oklahoma," Blatchley, U. S. Bureau of Mines.

High Wages and Steady Work a Cure for Butte Socialism

SPECIAL CORRESPONDENCE

The great improvement in conditions in the Butte mining district in the past year called forth from the mayor of the city, Charles H. Lane, a special Thanksgiving proclamation in which he calls attention to the facts that at present Butte has the largest number of men working in its mines ever known and that the payrolls are the largest, the community the most contented and happy and the reasons for thankfulness greater than ever before.

The improvement in labor conditions in the past year has been marked. It is just a year since the Anaconda and other large mining companies announced their intention of employing men without regard to their labor-union affiliations. The companies took the position that the men might belong to any union they chose or no union at all, but the question would not be raised or recognized. At the same time the companies made the pledge that labor conditions would not be allowed to become worse under the open-shop system than under the old one and pledged themselves to adhere to the union scale in effect.

They have carried out this promise with the result that the high price of copper makes the Butte wage scale today $4 per day of 8 hr. for every man in the mines, as against $3.50 that was being paid under the old régime. The men are well satisfied, and the efforts of foreign agitators to gain a foothold here have met with no success.

Socialism, which was so powerful that it held the reins of city government for four years and came near to getting control of the county government, is dying out, and while the socialists still maintain their organization, they have few members compared with former times. High wages and steady work for all have proved a good remedy for socialism.

Butte miners and mining companies are watching with interest for the completion of the improvements at the Washoe and Great Falls smelteries, as they anticipate that there will be a large increase then in the amount of ore handled from the mines of Butte. This will mean quite an addition to the force of men employed here, and the prediction is freely made that Butte's mine payrolls will comprise 20,000 names before the end of the winter.

Mount Lyell Mining and Ry. Co.

Announcement was made some time ago of the new rich ore encountered in the properties of the Mount Lyell Mining and Railway Co., Ltd. The recent report for the half-year ended Sept. 30, 1915, states that prospecting work has disclosed considerable additions to the South orebody and large accessions to reserves in No. 40 and No. 41 stopes in the North Mount Lyell mine, which continued to yield high-grade ore. The crosscut at the 1,200-ft. level of the North Mount Lyell mine was driven 54 ft. through rich ore, which is still in the face.

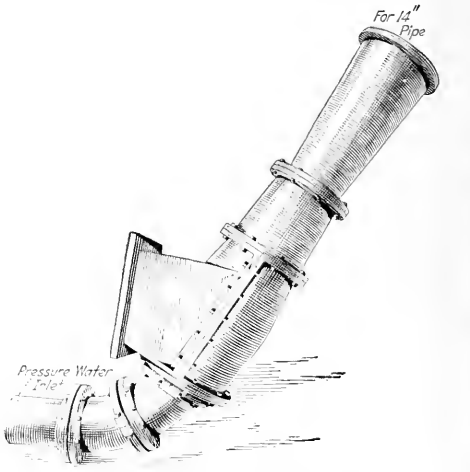
The ore reserves of the Mount Lyell mine were given as 1,791,479 tons; North Mount Lyell mine, 973,210 tons, not including important additions disclosed by development work. The cost of producing blister copper for the half-year was 18s. 7d. ($4.52) per ton of ore. During this period 1,053 tons of blister copper was produced. The net profits were £139,071, after writing off £20,123 for depreciation, £14,656 for prospecting and development work, and £18,500 for Federal and state income taxes. The saving from the full use of the Lake Margaret power installation was partly offset by the greater consumption of coke and the increased cost of supplies.

The flotation plant is being erected and is expected to start work during the current half-year. Options have been acquired on some West Coast mines owned by the Hercules Gold and Silver Mining Co., the Primrose Mining Co. and the Tasmanian Copper Co. Flotation tests of these ores on a commercial scale have been arranged for at Broken Hill.

Hydraulic Mining at Circle

BY HUBERT I. ELLIS*

In the *Journal* of Dec. 19, 1914, there appeared a short article, "Hydraulic Mining at Circle," describing the operations of Theron E. Fell on Mastodon Creek, Circle district, Alaska. Through the courtesy of Mr. Fell I have recently obtained additional data, which are given here.



SKETCH OF HYDRAULIC ELEVATOR

The Mastodon Creek ground is tight, contains much clay and many comparatively large rocks, and is difficult to work by pick-and-shovel methods. The cost of hydraulicking with water under a head of 100 ft. averages about 25c. per cu.yd. When using a 175-ft. head the plant washes 500 cu.yd. of material per day at a cost of 17c. per cu.yd. All giants except the one used in the tailings are of the No. 1 size, having a nozzle orifice of 2 in. The tailings giant is a No. 2, with a 3-in. orifice.

The general layout of the plant is illustrated in Fig. 1. The giants and boxes are first set as shown by the full lines. A sort of wing-dam is built, baffle boards are put on the boxes, and the gravel is driven into the boxes from one side. When this side of the cut is clear the large rocks are wheeled forward to provide drainage for the cut. The

*Kellogg, Idaho.

boards are then changed, and the other side is cleaned. This leaves only a ridge of gravel under the boxes when the cut has been finished, and this is blown upstream to the ground in the next cut. Bedrock is washed clean upstream with the tailings giant after the boxes have been removed. When all the material possible has been blown into the boxes from the first setting and bedrock has been

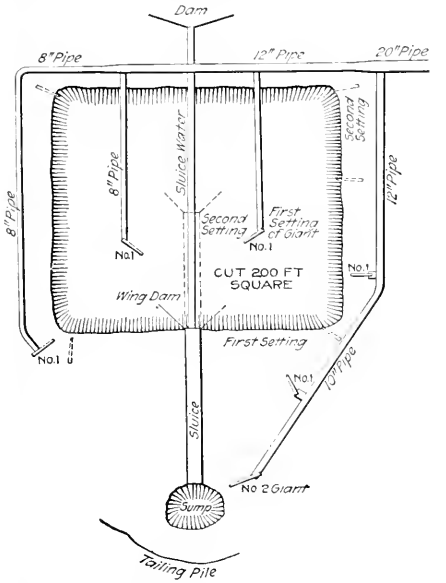


FIG. 1. PLAN OF FALL, HYDRAULIC MINE

cleaned, new boxes are added to the upper end of the string and the giants are reset in the positions shown by the dotted lines.

Some difficulty has been experienced in disposing of the tailings. At first an inclined chute and a No. 2 giant were used at the dump, but where the gravel contains but little sand the tailings are now simply blown up into a pile with the giant.

The chute method, *A* and *B*, Fig. 2, is illustrated. The chute is 4 ft. wide and has 3-ft. sides. The bottom is

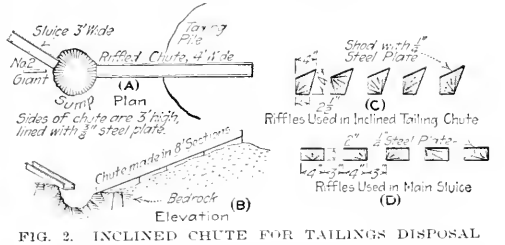


FIG. 2. INCLINED CHUTE FOR TAILINGS DISPOSAL

fitted with beveled steel-shod riffles, shown at *C*, set at an angle that will keep the gravel from rolling back into the sump. This method is better than the other when the gravel contains a considerable proportion of fine sand and pebbles that the water will carry away. It also serves to keep the water from washing back small rocks that have been blown up out of the sump.

The proportions of a tailing pile are shown in Fig. 3. This is made by simply blowing the gravel up with the giant working under a 100-ft. head, no chute of any kind being employed. Experience has shown that the tailings can be stacked in this manner to a height equal to

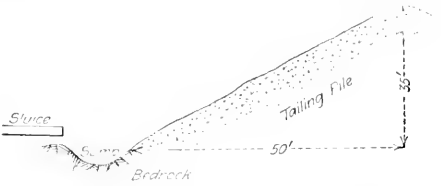


FIG. 3. SECTION OF "BLOWN-UP" TAILINGS PILE

one-third of the head on the giant at a distance from the sump equal to one-half the head. There is no difficulty in handling rocks half the size of a kerosene can by this method, and it is much more economical of water than the hydraulic elevator and more efficient for some classes of material than the inclined chute.

Butte & Superior Report

The Butte & Superior Copper Co., Ltd., reports results for the third quarter of 1915 as follows: Dry tons of ore milled, 130,210; average zinc contents, 17.147%; average silver contents, 1.6027 oz. per ton; zinc concentrates produced, 37,396 tons; average zinc in concentrates, 55.1219%; total zinc in concentrates, 41,230,885 lb.; average silver in zinc concentrates, 21.9646 oz. per ton; mill recovery (zinc recovered in concentrates), 92.3322%; mining costs per ton, $3.4584; milling costs per ton, $1.7652; total cost per ton, mining and milling, $5.2236.

The tonnage of ore treated was the largest of any quarter in the company's operations. In addition there was an increase of 2.8% in the recovery and an improvement of 2.1% in the grade of concentrates produced. The Black Rock shaft was continued to a depth of 1,559 ft., a station cut on the 1,500-ft. level and a skip pocket installed on the 1,600-ft. level. Preparations are being made to sink a new working shaft of greater capacity than the present one, designed to fulfill mining requirements to much greater depths than could be economically served with the present shaft. The new shaft will be entirely out of the orebody and, when completed, will release large bodies of ore adjacent to the present shaft, which cannot safely be mined during its use as a main ereway. Underground developments for the quarter were satisfactory in every way. Extensions of the orebody were disclosed in an easterly direction on all of the principal lower levels where work is now being conducted. No recalculation of ore reserves was made as applying to the third quarter, but it may be said that the new ore reserves developed were practically equivalent in quantity to the ore mined.

Financial results for the third quarter were as follows: Net value of zinc concentrates (at mill), $2,997,128; net value of lead concentrates (at mill) and of residues, $228,111; miscellaneous income, $14,716; total gross operating returns, $3,239,955; operating costs, $679,635; profits, $2,560,330, together with a further profit of $201,510 due to the excess received from the sale of con-

centrates and smeltery residues over the values at which these products were estimated in the monthly statements. At the end of the quarter and after payment of the dividend at that time, the company states that it had on hand approximately $5,000,000 in quick assets, consisting of cash and products conservatively valued in process of treatment and in transit.

Radium Extraction from Carnotite

Bulletin 104, "Extraction and Recovery of Radium, Uranium and Vanadium from Carnotite," by Charles Parsons, R. B. Moore, S. C. Lind and C. C. Schaefer, has just been issued by the Bureau of Mines. This Bulletin gives the results of the coöperative work with the National Radium Institute and describes the methods of extracting radium from carnotite ore as carried out in the plant at Denver.

The methods devised have proved highly successful. They depend essentially upon the fact that strong hot nitric acid has a high solubility coefficient for radium and barium sulphates. This enables the carnotite ores to be treated directly with hot nitric acid, removing the radium therefrom at a single operation. The method follows in brief:

The carnotite ore pulverized to 20-mesh is treated in an earthenware leaching pot with 38% nitric acid, 500 lb. of ore being used to 121 lb. of 100% HNO_3. The acid is brought near to boiling by means of steam passed through a glass tube and the ore gradually stirred in. Heating is continued for 15 min., when the acid is filtered from the ore in a stoneware filter. This is followed by a second treatment in the same leaching pot with somewhat weaker hot nitric acid, after which the whole is washed with hot water. Nearly all of the uranium, about 50% of the vanadium and over 90% of the radium are carried into solution by this method and separated from the bulky residues, which are then discarded. The acid solution is nearly neutralized with sodium hydroxide and barium chloride and sulphuric acid added in proper quantities and held in settling tanks with conical bottoms for three days to settle out the radium-barium sulphate. The supernatant liquid is then siphoned into an excess of boiling sodium-carbonate solution to separate the uranium and vanadium from iron, aluminum and calcium. The radium-barium sulphate left in the tank is run onto a stoneware filter, filtered, washed and dried, the washings being also added to the sodium-carbonate solution already mentioned.

The soluble sodium-uranyl carbonate and the sodium vanadate are filtered from the iron-calcium precipitate in filter presses and run into uranium-precipitation tanks. The sodium carbonate is then nearly neutralized with nitric acid and sodium hydroxide added to complete precipitation of the uranium as sodium uranate. The filtrate containing the vanadium is carefully neutralized with nitric acid and iron sulphate added to precipitate vanadium as iron vanadate. Both the sodium uranate and the iron vanadate are separated from their solutions by means of filter presses. The filtrate from the iron vanadate consists almost wholly of a solution of sodium nitrate containing, of course, a small amount of impurity. This filtrate is evaporated, sodium nitrate recovered and used again for the manufacture of nitric acid. The radium-barium sulphate, without further treatment, is reduced in large graphite crucibles by charcoal, a very efficient conversion (90 to 95%) into barium-radium sulphide being obtained. The sulphides are dissolved in hydrochloric acid and the residue of unchanged sulphates re-treated.

The chloride solutions are crystallized in the plant in silica-lined kettles, care being taken to keep the solutions acid with hydrochloric acid, as the separation of radium from barium is much more rapid under these conditions. The concentrated chlorides carrying from 4 to 10 mg. of radium per kg. are taken to the laboratory, filtered from any insoluble impurities and crystallized again in strong acid solution until the bulk has been reduced to a small volume, when they are converted into bromides. This is done after first neutralizing with ammonia and precipitating with hydrogen sulphide to remove lead, which always accumulates and which is not precipitated by hydrochloric acid from strong barium-chloride solutions. After removal of the lead, the barium and radium are converted into carbonates by the addition of ammonium carbonate, washed, and dissolved in hydrobromic acid. From this point on crystallization takes place in pure quartz dishes in solution strongly acid with hydrobromic acid.

The fractional crystallization of radium from the original chlorides to the finished product is neither tedious nor difficult, but takes place rapidly when acid solutions are used and proper apparatus is available which will withstand their action. The efficiency of the process is high.

In connection with the radium plant a nitric-acid plant has been erected which produces over 5,000 lb. of nitric acid per day. Owing to the recovery of sodium nitrate, the cost of the nitric acid used has been very low, averaging under the present cost for nitrate slightly less than 2½c. per lb. To Sept. 1, 4,774 mg. of radium was produced in the form of sulphates and 1,947.5 mg. of element had been delivered in the form of bromide. Deliveries are continuing at the rate of 300 to 400 mg. per month.

Flotation at Cripple Creek

Flotation will replace the cyanide process in the Independence plant, at Victor, Colo., according to a report published by the *Daily Mining and Financial Record*, Denver, Nov. 27, 1915. The plant is now being remodeled, and next week the company will commence the construction of a sampler of large capacity. This sampler will be for the low-grade ores exclusively and will not compete with the samplers now in operation in the district. The sampler will be run in conjunction with the mill, and all the rock will be passed through the sampler crushers direct to the chilean mills, where the final grinding for flotation treatment is accomplished. The chilean mills will be supplemented by ball mills which will reduce the ores to a degree of fineness not hitherto attained.

By the flotation process the company feels assured that it can successfully treat ores of a lower grade than has heretofore been possible. There are millions of tons of dump ore that can be successfully handled and in addition, the boon to the leasers and prospectors of the camp will be inestimable in that these men will be enabled

to sell their low-grade ores at a sufficient profit to pay at least a part of their expenses and thus be able to continue development work which may result in the opening up of better ores.

Arrangements have been made with the railroads for the hauling of the ores from all parts of the district, and surveys for tracks to the sampler have already been made. The Portland company has under consideration the provision of an adequate supply of 50-ton steel dump cars that will be unloaded automatically. Under this plan, from the time the rock is dumped from the cars until the tailings are run on the dump the progress of the ores through the mill will be automatic.

The mill will have an initial capacity of 1,000 tons a day, with the probability that a much larger tonnage will be reached eventually, provided the Portland company secures the coöperation that it has every reason to expect.

The problem of successfully handling the low-grade ores of the gold camp has always been recognized as one of prime importance, and it is now believed that the solution of the problem will be achieved by the flotation process, which represents the latest word in scientific treatment.

Gold Dredging in Philippines

The rapid increase in the gold production of the Philippines during the last few years has been noteworthy. In 1910 the gold output was valued at 308,860 pesos; in 1914 it was 2,349,267 pesos. Gold dredging has played a prominent part in this advance and is likely to be still more important, as additions are being made to the dredging fleet. According to the statistics just announced by Wallace E. Pratt, chief of the Division of Mines, the dredges were responsible last year for nearly 44% of the total gold output. Eight dredges were in operation, seven of which were in the Paracale-Mambulao district of Ambos Camarines and one was on the Umari River in Tayabas Province on the east coast of Luzon.

The Gumaos Placer Co. operated continuously throughout the year. Its dredge, built by the New York Engineering Co. and described in previous numbers of the Bureau of Science bulletin,[1] has achieved an enviable record during the period over which its operation extends. On an original investment of 500,000 pesos ($250,000), the company has paid in dividends during 27 months of operation the sum of 535,000 pesos, or 107%. The generally nonuniform character of the dredging ground in this district is exemplified in the record of the Gumaos dredge; the average value per cubic meter for different monthly runs varies from 6 centavos to 1.66 pesos. The average value for the whole period of operation has been 64 centavos per cubic meter. The cost of operation, according to the company's figures, is about 21 centavos per cubic meter dredged. The average fineness of the bullion smelted is 873. The depth of bedrock varies up to 17 m., but has averaged about 11 m. The gold recovered is fine and is very sharp and angular. It is confined to a layer of wash usually less than 2 m. thick immediately overlaying bedrock; the overburden is largely clay. . . . [The total gold recovered, to the end of 1914, by this dredge is valued at 912,205 pesos.]

[1] "The Mineral Resources of the Philippine Islands for the Year 1914," Division of Mines, Bureau of Science, Manila, P. I.

The Paracale Bucket Dredging Proprietary, Ltd., and the Philippine Dredges, Ltd., closely associated Australian corporations, had four dredges at work during 1914. One of these started in November, and another lost a great deal of time as a result of litigation over title to the ground upon which it was situated. In spite of obstacles, however, the year's record was good, and much credit is due William Telford, the general superintendent for the two companies.

The Malaguit Dredging Co. placed a new dredge on Malaguit River early in 1914. Some time was lost in getting into proper running order, but the dredge recovered a gratifying amount of gold and will undoubtedly do better as the operation becomes established.

The Philippine Dredging Syndicate and the Maximelo Dredging Co. each operated one dredge in 1914. About the middle of the year the former company finally dismantled its old Risdon dredge, which was built in Masbate in 1905, moved over to the Paracale district in 1908 and has been digging on Malaguit River since that time.

The Mambulao Placer Co. is reported to have obtained exceptionally high results from the tests of its dredging property at the head of Mambulao Bay, and a New York Engineering Co. dredge will be erected at Mambulao during the coming year.

Several dividends were declared by the dredging companies during the last year, and the industry appears to be in a healthy condition. The year 1915 should show a materially increased gold production. New dredges are under construction for some of the operating companies at Paracale, and the Mambulao Placer Co. will enter the dredging field, although it may not begin to produce until early in 1916.

Results at La Grange Improving

The operations of La Grange hydraulic mine in Trinity County, California, which has been in *borrasca* for several years, showed an improvement this year over the 1914 results despite the fact that the season was unfavorable climatically. In July the southern, or richest, part of the mountain became accessible, and by confining operations to this section, the company's engineers expect that henceforth profitable results will be obtained.

This year the water supply, which at the beginning of the season promised to be as large as that of any previous year, turned out to be less than for any season in the history of the company. This was due to breaks in the aqueduct, resulting from exceptionally heavy falls of snow and unusually cold weather in August. However, the mine paid its expenses though up to July 1 the richest part of the deposit had been inaccessible.

Chippewa Falls Power Development

BRAINERD CORRESPONDENCE

The Wisconsin-Minnesota Light and Power Co. has applied to the Railroad Commission of Wisconsin for permission to construct a dam across the Chippewa River above Chippewa Falls. The dam will develop a head of 60 ft. and provide 43,000 hp., and it will be the largest power-development plant in Wisconsin. The proposed construction involves an expenditure of upward of $2,000,000. The company is capitalized at $10,000,000.

Details of Practical Mining

Leyner versus Piston Drill

By L. P. Gordon

The accompanying table shows a comparison between Leyner and piston drills. These data were taken from accurate records of the opening of new sublevels in a mine of one of the large operators in the Iron River district. The drills operated under the same conditions, namely:

1. Ore extremely coarse, "fitchery" and hard, requiring one set of steels, and more at times, per hole.

2. Mounting—Upright double-jack post with arm and clamp.

3. Drifts, 6x7 ft.

4. Uniform air pressure and hoses according to size of air inlets in drills.

5. Broken ore handled by trammers on opposite shifts.

Type of Drill	Men Shifts	Labor Cost*	Drift Feet	Drill Shifts	Drift Feet per Drill Shift	Holes Drilled	Average Depth of Holes, Ft.	Feet Drilled	Feet Drilled per Drill Shift	Average Labor Cost per Drift Foot*	Average Earnings per Man per Shift
Leyner	448	$1299.20	906	224	4.05	3226	5	16,160	70	1.43	2.89
Piston	298	809.39	261	149	1.75	1139	5	5,695	38	3.10	2.71

*Includes rigging and blasting.

The Leyners were used to great advantage in stoping, particularly in drilling slice and upper holes, and they handled 12-ft. steel with ease in down or stope holes. A tripod with an adapter plate fitted in the saddle was used as a mounting in drilling on the benches.

Deterioration of Hoisting Ropes*

There may be said to be five ways in which deterioration of a rope proceeds: First, there is frictional wear; second, there is breakage of wires due to inequalities in even the best material; third, there is the breakage caused by the stress of bending over sheave and drum; fourth, there is corrosion inside and out; fifth, there is fatigue of the steel caused by its passing its elastic limit and accelerated by bending and by rapid hoisting. All of these effects finally take the form of broken wires. For this reason the appearance of broken wires is considered the best single sign to follow in deciding when to discard a rope.

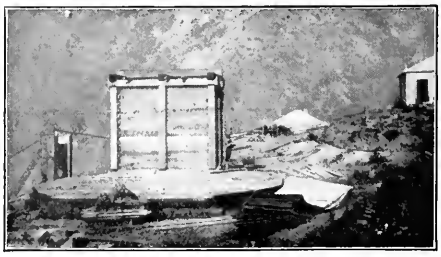
The manner in which breaks occur is of significance. Thus when a new rope is installed there is likely to be a short period, while the rope is taking its set and equalizing tension, during which breaks are relatively frequent. These breaks are of no importance and do not indicate that the rope is wearing out. After the period of their occurrence, the rope will run for some time without more wires breaking. Toward the end of the life of the rope, however, it may happen that the number of breaks begins to increase rapidly. Thus inspection on one day may show one wire broken at a certain point. The next day two may appear there and the third day, three or four. This condition arising is a sign that the rope is going to pieces and should be taken off forthwith. It may also happen that breaks occur before any great wear is visible—this, of course, after the period of initial breaking. Breakage without wear indicates faulty installation of some kind; either the rope is made of brittle wires or it is being bent over too small a drum or sheave.

*Abstract from Bulletin 75, U. S. Bureau of Mines.

A Wooden Ore Bin with Concrete Bottom

By C. M. Eye*

In order to avoid difficulties, encountered in the tropics, from rapid decay of wooden bottoms in ore bins, as well as to secure the maximum storage capacity, the bin shown in the cut was designed for the new 10-stamp mill of the Benguet Consolidated, at Antimok, Benguet, P. I. The base consists of a frame of 12x12



WOODEN ORE BIN WITH CONCRETE BOTTOM

timbers, rodded together, on which the 12x12 posts rest in daps, secured by steel pins 7/8x12-in. (Mortise-and-tenon joints were avoided on account of certainty of decay, due to water collecting in the mortises). All joints were well painted with asphalt paint, and base timbers were well tarred with hot coal tar.

Cross-timbers at the top are all 12x12, with two 12x16 timbers for the crusher. The bin is lined with 3x12 plank, all placed horizontally and cribbed at the corners. The bottom consists of 9 in. of rock, laid dry, with dry sand poured in and tamped, on which is laid 3 in. of concrete, bringing the floor level with the top of the base frame. The front of the bin rests on the retaining wall back of the stamps, with a 45° slope to the chutes to the feeders. The conformation of the site allowed placing the bin at a relatively greater height above, and distance from, the batteries, thus avoiding overhang and thrust. There are no connecting timbers between the bin and battery posts, the latter being braced by 12x16 timbers set in the retaining wall.

*Bagnio, P. I.

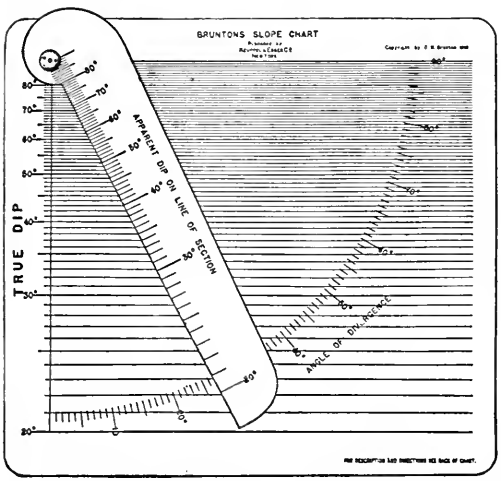
The inside dimensions of the bin as finished are: Width, 11 ft.; length, 14 ft.; height, 13 ft.; content, 2,000 cu.ft.; capacity, 100 tons, with broken ore at 20 cu.ft. per ton. The cut shows the structure as completed and the completed foundation platform for 25-ft. solution storage tank.

This bin is an exceedingly easy one to construct and secures the maximum of capacity with minimum of material.

*

The Brunton Slope Chart

The Brunton slope chart is a device for the determination of the apparent angle of sections when cut at planes of varying degrees of divergence from the dip. The chart enables the user instantly to obtain the apparent dip from the true dip, or *vice versa;* mechanically solving the equation, *tan C = cos A tan B*, in which *C* is the apparent dip, *A* the angle of diversion, and *B* the true dip.



BRUNTON SLOPE CHART FOR SOLVING EQUATION TAN C = COS A TAN B

In addition to its utility in the preparation of maps and geological sections, the chart is also useful for giving the valley angles in hoppers, ore bins, etc. It is published by the Kenffel & Esser Co., Hoboken, N. J.

*

Underground Toilet Systems

Passed Assistant Surgeon A. J. Lanza of the Bureau of Mines in Technical Paper 105, on "Pulmonary Diseases Among Miners in the Joplin District, Missouri," gives the following regarding underground toilet systems (or lack of them) at small mines. It offers good suggestions on a troublesome subject.

There is no established toilet system underground in the Joplin district. Many of the mines are small, employing 25 or 30 men and less, and the necessity for the toilet systems seen in large mines does not exist. As in other mining districts, there is a strict rule against ground pollution in the mines, a rule that, as elsewhere, is not infrequently broken. In some of the mines visited there was much evidence of this abuse, and in spite of the efforts of operators and ground boss[es] are always, from time to time, infringements of th[is] It does not seem at present that there is any pres[sing] need of establishing toilet systems underground, thou[gh] they might prove useful in some of the large mines [in] the district. In the latter, one sanitary privy underground would be a convenience and tend to check ground pollution. Such a privy could be cheaply constructed having removable containers (empty powder boxes with a layer of sawdust within) that could be hauled to the surface daily and burned. This is a cleanly, cheap and efficient toilet system where only a small number of men are employed.

In this connection, comment on mine privies is not out of place. At most of the mines there are privies on the surface, within easy access of the shaft or the change house. Some of these are clean and well kept; others are not clean, are not well kept, are in disrepair and are a nuisance in every respect. Wretchedly insanitary privies are only too common everywhere in this district, and those seen at the mines were often no exception to this rule.

*

Some Safety-Fuse Pointers*

The most important part of safety fuse is the powder train, and unless it is in good condition, results are likely to be bad. The worst fault that fuse can have is to be without powder. High-grade automatic machinery is used for detecting lack of powder or serious reduction in quantity, and it is a rare occurrence to find fuse lacking the standard charge.

There are two kinds of powder core. One is called "free" and the other "solid." "Free core" is where the grains are free in the yarns that inclose them and should appear clean and distinct. The "solid core" is where the powder core is made into a semisolid mass, clinging to the center thread and adjacent yarns, so that when the fuse is opened the powder will not drop out freely as it does in "free-core" fuse.

In examining fuse to see whether the powder core is injured, it is necessary to give consideration to the next most important feature of a good fuse, namely, the waterproof covering. These coverings are made of compounds of asphaltum, tar, etc., as well as gutta-percha. If improper materials are used, the compounds may penetrate through the yarns to the powder, and this will give it a dingy and somewhat sticky appearance, and may be so bad as to ruin it. Powder that is wet will be soft and dingy black in color, but usually it will harden into grayish lump particles after it has been dried. When the moisture has entered from the outside, the white exterior color is usually left in a lusterless, chalky condition.

Fuse may become injured in transit, storage or handling, and it is important that it be stored in a cool, dry place. Fuse stored in too warm a place is liable to be affected by the melting of the waterproofing material and their penetration to the powder. Fuse should be warmed to a temperature from 60° F. to 70° F. before uncoiling, because in cold weather the waterproof material becomes brittle and will crack unless the fuse is carefully handled. Moisture kills the powder, and ever

*From the "Du Pont Magazine."

when insufficient actually to kill it, its presence retards the burning speed. While the waterproofing covering may protect the interior of the coils, the ends absorb sufficient dampness to kill the powder, or at least make it difficult to light.

When fuse is so stiff and brittle as to break open in being handled, its water-resisting qualities are impaired. If fuse is allowed to become too old before it is used, there is danger that the varnishes will be dry and hard or that the powder may have become impaired by age, although such results are not likely to occur for several months if the fuse is properly stored. Gutta-percha fuses are the most subject to deterioration for the reason that gutta-percha, rubber and other vegetable matter of this nature are subject to oxidation from contact with air.

The uniformity of burning speed is a desirable quality, but fuse that burns in the open air with a maximum variation of 10% up or down from standard is within reasonable limits. The generally accepted standard is 90 sec. per yd., or 25 min. per 50 ft. This is fast enough to preserve a fair degree of regularity and slow enough to produce quiet burning.

The exterior appearance of the fuse has become of considerable importance. If the fuse is of extremely dingy appearance, it may be most excellent in quality, while on the other hand the reverse has been proved. Some kinds of waterproofing will absorb the white material put on the outside when subjected to the heat of summer, causing it to appear black or of a dingy yellow color. Either bad storage or transportation conditions, particularly too much heat, turn the outside of the fuse dark. This gives it an unfavorable appearance, but a test should be made and this will easily determine its condition.

An absent center thread will not alter the burning speed of fuse. Its purpose is merely to make certain the powder flow in the fuse machine, and if the powder is present in proper quantities the center thread is unnecessary. The size of the powder core does not in itself alter the burning speed. The properties of the powder and the mechanical and constructional effects employed govern this.

In tape fuse, places may be found where the diameter is slightly enlarged for about an inch in length. These are caused by the overlapping of the ends of the tape where two pieces are sewed together to make a continuous length. They are perfectly harmless.

Cut off about 2 in. from each end of the coil before using to be sure that the ends are dry, as the powder may have absorbed moisture from the air. For this same reason it is unwise to cut up the fuse lengths much ahead of actual need unless they are stored in a dry place. Cut off the ends of the fuse squarely, especially where they are to be inserted in a blasting cap. One cut diagonally is apt to fold over and interfere with the spit. For wet holes, the joint of the cap should be made waterproof by an application of P. & B. paint, heavy axle grease[1] or Kapseal.

In tamping use a wooden tamping bar and a stemming material that is free from sharp bits of rock or anything that will cut the fuse. Be careful not to kink or double it over in the holes.

[1]The Coast Manufacturing and Supply Co., manufacturer of much of the fuse that is used in the Butte mines, has published a pamphlet which contains the following: "Grease and oil, being solvents of the fuse varnishes, destroy the powder train in the fuse with as great, if not greater, rapidity than would the water which the miner is trying to exclude."—Editor.

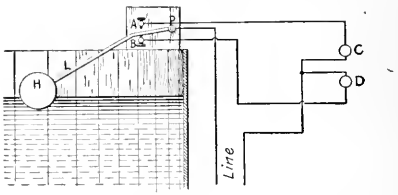
The kind of stemming material used is important because considerable gas is generated by burning fuse, and if it is too closely confined by a material that is not porous, the pressure of the gases rises to such an extent that the speed of burning is much affected. Usually the speed is increased as the pressure rises. In experiments made of moist fireclay as a stemming material, the rate of burning of the fuse was increased over 50%; but with dry sand, moist sand, and dry fireclay, the increase in the burning rate was comparatively small.

Signal for Water-Supply Tank*

Now that cold weather is once more with us every power-house engineer who has to look after a water tank placed on a hill to supply water to the town knows how unpleasant it is to go out of a warm engine room to find out how much water he has in the tank. Many such engineers let the pump run most of the time at full speed, in which case it generally happens that the tank overflows.

This is a waste of power, for at a small cost a signal system may be installed that would take care of the water-supply. Such a system is shown in the accompanying sketch. It is designed to work on either a 110- or 220-volt circuit; however, should only 550 volts be available, two 250-volt lamps in series at *C* and two at *D* would be all the changes necessary. *H* is a hollow ball, which may be made of copper or of cork.

This ball is fastened at the end of level *L*, which is pivoted at *P*, its rise or fall completing the circuit of *C*



SIGNAL FOR WATER-SUPPLY TANK

and *D*. If rising, *L* makes contact with the adjustable screw *A* and will light lamp *C*; if falling, it makes contact with *B* and lights the lamp *B*. The latter lamp should be red. A means must be provided so that any undue rise will not bend the lever. This may be accomplished by using contact springs instead of contact screws. It might be well to solder a small piece of silver at the contact points *A* and *B*. Lights *C* and *D* should be so placed in the engine room that the engineer's attention will be readily drawn to them.

Should no current be available, the signal could be arranged to work with bells, by placing 4 or 5 dry-cells across the lines, with a small bell at *C* and another at *D*. Of course the ring of these bells should have different sounds so that the engineer will know whether the water is high or low, thus indicating to him whether he should slow down or speed up the pump.

Cages for Hoisting Men—No operator of any mine should permit the hoisting or lowering of men through a vertical shaft deeper than 300 ft. unless an iron-bonneted safety cage be used, except during the process of sinking.

*C. F. Fuetter in "Coal Age," Nov. 13, 1915.

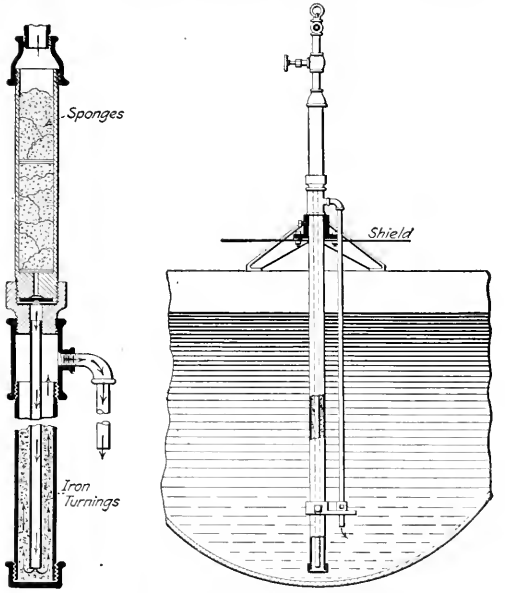
Details of Milling and Smelting

Bardill Drossing Apparatus

By J. O. Bardill*

The sketches accompanying this description illustrate a device for agitating the molten lead in the drossing kettles in the refinery of the St. Joseph Lead Co.'s smelting plant at Herculaneum, Mo. It has been in use there for the past four or five years.

When the archaic method of using "a green pole of ze fir (or willow) tree zat shall be perfectly dry," etc., was discarded, live steam from the boiler plant was substituted. It was conducted through a pipe line about



THE BARDILL DROSSING DEVICE

600 ft. long, weirdly devious in its course, besides possessing other features that make for general inefficiency and grief in operation.

This new device operates on the flash-boiler principle. The flow of water entering the generating chamber is fixed by an aperture about 0.020 in. in diameter in a diaphragm which separates it from a filtering compartment. The heat of course is derived from the molten lead. The filtering compartment is filled with a very cheap grade of sponges, with several thicknesses of copper-wire gauze placed above the diaphragm.

The iron lathe turnings in the generating chamber, for increasing the heating surface, were found to be unnecessary. The circular shield that is usually attached to the generator barrel at a point above the top of the kettle is also unnecessary. As the cost of these devices is low, an extra one is always kept in readiness for use in case the diaphragm's opening should become clogged.

Facilities for handling these agitators consist of a small chain block and trolley operating on the same I-beam track used in making kettle replacements. After submerging the generator, the filter compartment is connected to the water main by means of hose and coupling. This device is proof against accidents from blow-ups such as frequently occur through entering water when steam is obtained from some outside source. It is not so mussy, since there is no condensation to take care of as when the old system of steam is used.

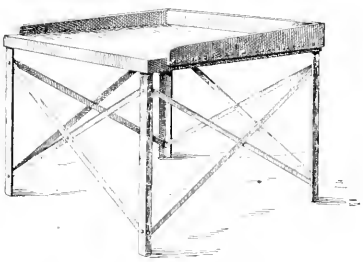
Compared with compressed air, as used in some plants, it is cheaper, particularly if a compressor must be installed and operated solely for this operation in refining.

*450 Lafayette Ave., Palmerton, Penn.

Steam-Jacketed Drying Table for Tailing Samples

The rapid drying of the considerable number of tailing samples taken daily at the mill of the Miami Copper Co. at Miami, Ariz., is effected by the simple steam-jacket table shown in the illustration.

The jacket has an internal steam space of about 3 in. and is 24 to 30 in. square. It is supplied with steam at 45 to 60-lb. pressure. The jacket is supported on



STEAM-JACKETED DRYING TABLE

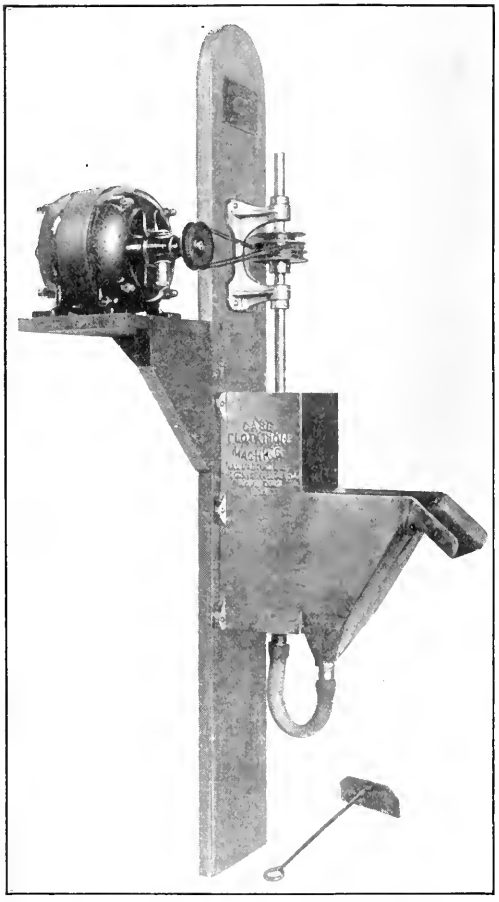
a stand of light 1-in. angle irons at a convenient height and slopes at a low angle to the back. Around two sides and across the back, there is riveted a steel edge that stands about 4 to 5 in. high at the back of the table, sloping to about 2½ in. at the front of the sides.

The tub of tailing sample is held on the edge of the table and all the sample is washed on the jacket by a stream from a hose with a small-diameter nozzle but with water at high pressure. The greater part of the water evaporates immediately upon striking the table, the temperature of the plate being considerably above the boiling point. In a few minutes all water is evaporated, and by the time the operator has loaded the sixth table the sample on the first is dry and ready to be removed. The rapid drying is extremely convenient for handling tailings, but probably the temperature would be too high to dry concentrated fine sulphides safely.

Laboratory Flotation Machine

To meet the demand for a simple and efficient machine for making flotation tests, the device illustrated here has been produced by the Denver Fire Clay Co., of Denver, Colo. The machine may be installed on any wall or post and is ready for immediate use.

The main, or cell, portion of the machine is made of cast aluminum, as is also the impeller. A feature introduced is the closed-circuit arrangement by means of a short length of high-pressure rubber hose, it being thereby possible to attain the same repetition in treatment as is otherwise accomplished in a multiple-cell machine. When this circuiting is not desired, a simple pinch-cock is applied to the hose.



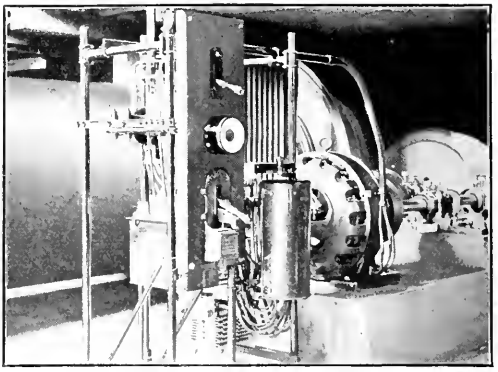
FLOTATION MACHINE FOR THE LABORATORY

The motor is rated at $\frac{1}{8}$ hp., has variable speed up to 1,800 r.p.m., is reversible and may be supplied for any electrical specification. The impeller shaft runs in bronze bearings and is provided with collars permitting the adjustment of the impeller to run at any desired depth in the agitation compartment.

Unit Tube-Mill Control

The tube mill illustrated is one of the regrinders used by the Homestake Mining Co., at Lead, S. D., and is one of the exceptional installations having individual motor and control.

At the top of the panel is the regular switch and just below it, an induction-type ammeter. At the bottom is an electromagnetic blowout switch. At the right is a controller of the street-car type, somewhat unusual in milling plants. The entire installation is of Westinghouse manufacture.



TUBE-MILL CONTROL AT HOMESTAKE MILL

New Zirconia-Carborundum Refractory Material

A new material said to be highly refractory has been patented by August Pfaff, of Freiberg, Germany (U. S. Pat. 1,159,264), consisting of a mixture of zirconia and silicon carbide, or carborundum.

This mixture has the advantage over zirconia in that it is not subject to cracking during alterations of temperature, nor does it become brittle and lose its mechanical coherence, while it withstands oxidation by air where the silicon carbide does not. If it is desired to obtain the maximum of refractoriness, the silicon carbide should be employed in the form of a powder coarser in grain than the zirconia.

The highly refractory qualities of the new material make it adapted for the manufacture of electric resistances for use in cases where it is imperative that the resistances shall be efficacious at high temperature. The material is molded into the form desired and then burned before using. A considerable shrinkage must be counted on in the burning operation.

Melting Aluminum Chips

H. W. Gillett, at the American Institute of Metals meeting, emphasized the great improvement in aluminum recovery in melting aluminum chips, if the chips were mechanically clean. As fluxes, zinc chloride, ammonium chloride or a mixture of salt and fluorspar is recommended. A reducing atmosphere helps, but the great difficulty is not oxidation but prevention of coalescence by the dirt mixed with the metal.

Mining & Metallurgical Machinery

The "Little Tugger" Hoist

A new type of hoist has been placed on the market by the Ingersoll-Rand Co., New York City. It is intended for light lifting and has a capacity up to half a ton. Owing to its light weight, which is under 300 lb. complete, it is particularly suitable for use as a portable hoist for mines, contract work and power houses.

The main base of the hoist is arranged so that it can be bolted to a timber, and by means of a cap that comes

"LITTLE TUGGER" HOIST PULLING CAR IN TUNNEL

with the hoist, it can be clamped to a circular member, as a mine column or arm, shaft bar or pipe. The adjustment can be made quickly. Mines are using it in winzes, stopes and raises, clamped to a drill column or stretcher bar, shaft bar or timber, for various purposes. The dimensions of the hoist are $21\frac{1}{4}$x$16\frac{1}{2}$ in., and the height is $20\frac{1}{8}$ in. The drum is 6 in. in diameter, with a space of 7 in. between flanges. This will accommodate a length of 700 ft. of $\frac{1}{4}$-in. rope or 450 ft. of $\frac{5}{16}$-in. rope. It operates with either compressed air or steam and has a capacity of 1,000 lb. at a rope speed of 85 ft. per min. and a pressure of 80 lb.

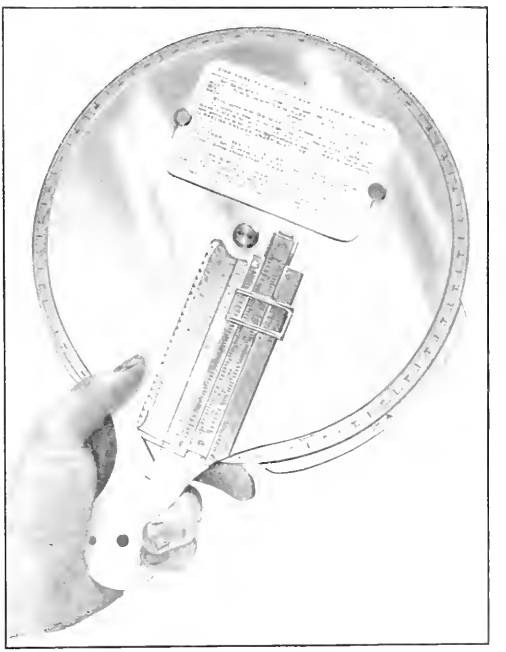
The motor, or engine, is of the reversible square piston type, giving four impulses per revolution of the engine. There are no dead centers and the "Little Tugger" will start in any position. Safety is provided for by a powerful worm-operated band brake lined with "Raybestos."

There are no moving parts exposed on the "Little Tugger" except the drum, all gears and shafts being covered.

Graduated-Spiral Slide-Rule

A slide-rule that may be directly read to four places and estimated to a fifth has been put on the market under the name of the Ross Precision Computer as an attempt to get the convenience of a slide-rule with the accuracy of a five-place logarithmic table. It is designed to be particularly useful for engineering computations and is the invention of Louis Ross, of San Francisco, who invented and now manufactures the "Meridiograph," described in the *Journal* of Aug. 1, 1914. The new device is manufactured by the Computer Manufacturing Co., 268 Market St., San Francisco.

The graduations are along a 29-ft. spiral on a disk about 8 in. in diameter, the upper members, 9 to 10, oc-



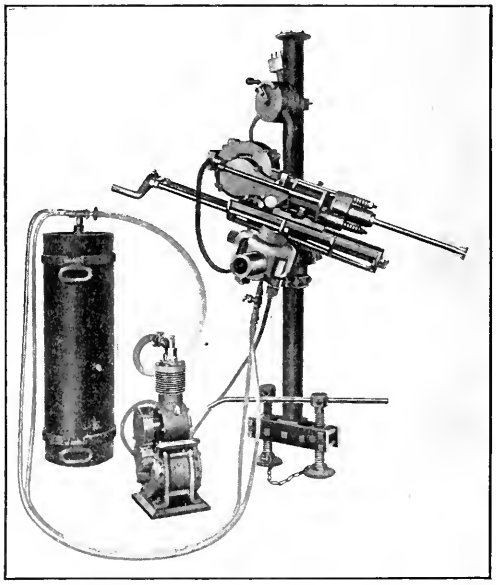
ROSS PRECISION COMPUTER—A SLIDE-RULE WITH GRADUATION ON A SPIRAL

cupying the outer portion of the scale. As a consequence the spacing is spread out by the increasing length of the spires, so that the 29-ft. scale is the equivalent of a 100-ft. rule. So great is this effect, that if the ruling were reversed, the scale would be equivalent only to a 16-in. rule. The outside ring of graduations is used in connection

with the quadrant scale to give five-place logarithms and antilogarithms for solving powers, roots and exponential problems. The operations of multiplication and division are as simply performed as with any logarithmic scale. The auxiliary 4-in. slide-rule on the face gives logarithmic numbers on the left-hand fixed scale and corresponding square and cube roots on the right-hand fixed scale. On the slide between are two logarithmic scales, both corresponding to the left-hand fixed scale but graduated in reverse directions. The computer is made of aluminum and german silver.

Denver Electric Rock Drill

An electric rock drill has been placed on the market by the Denver Rock Drill Manufacturing Co., Denver, Colo., in which it is claimed there are embodied some entirely new principles, which it is hoped will obviate the structural deficiencies and difficulties that have made mining men skeptical heretofore as to the benefits of the



DENVER ELECTRIC ROCK-DRILL OUTFIT

electric drill. This new device has been tried out by more than two years of practical service in mining.

The machine is a self-contained, direct-connected motor and cylinder unit and includes a small auxiliary electric-driven air compressor and an ordinary water tank, the function of the compressor being merely to supply air for cleaning the drill hole and to maintain pressure on the water in the tank used for drilling.

These drills require three-phase 60-cycle current, which may be used at 110, 220 or 440 volts, and transformers must be provided accordingly. The rotor shaft runs in ball bearings. Power is transmitted to the drilling mechanism by an internal reduction gear.

There are two cylinders in the main part of the drill. One contains a piston called the pulsator, mechanically reciprocated by the gears and a connecting-rod. Air is compressed in both ends of this cylinder and intermittently passed through end ports to the hammer cylinder (alongside) where it causes the hammer (not mechanically connected to any other part) to oscillate in step with the pulsator, striking about 1,200 blows per min.

On the outer side of the pulsator cylinder is a bypass device, by which the air in the pulsator cylinder is shunted from the hammer cylinder and caused to pass back and forth to opposite sides of the same cylinder. By this means the hammer may be stopped instantly or its blow may be adjusted to any degree without shutting off the electric current or interrupting any other function of the machine.

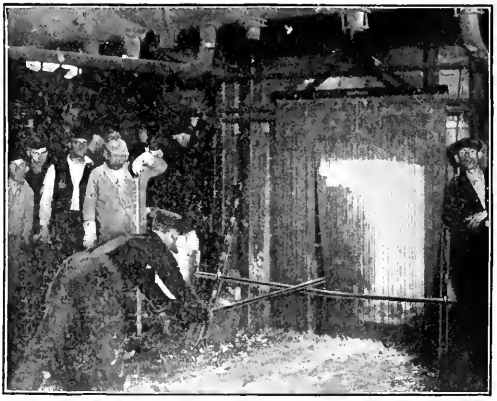
Rotation of the drill steel is effected positively by a ratchet and slip friction gearing. The steel will continue turning if the hammer be stopped by the bypass, and the machine as a whole may then be used as a boring tool. The loss of a hole by "fitchering" is rendered practically impossible. The drill steel is round and hollow, and a portion of the shank about 1 in. long is forged square.

The feed is by means of the usual screw and shell. The switch is so made as to render the drill runner safe against electric shocks.

Among the advantages claimed by the manufacturers for this machine are: Small power consumption, drilling speed, freedom from fitchering, lack of freezing trouble and low original cost.

Wiegand Chain Screen Door

A decided metallurgical novelty seems to be contained in the Wiegand chain screen door manufactured by the E. J. Codd Co., of 700-708 South Caroline St., Balti-



WIEGAND CHAIN SCREEN DOOR

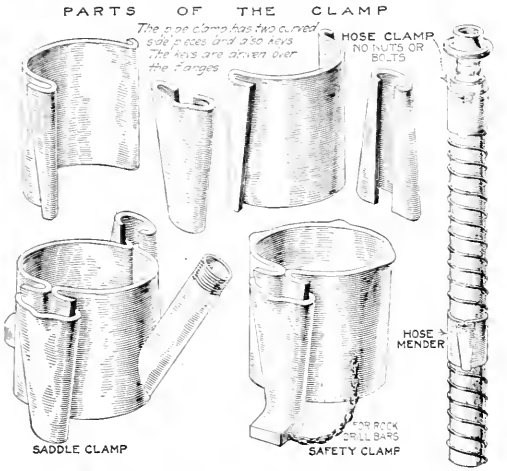
more, Md. This door consists of a number of freely suspended individual strands of steel chains, which form a curtain not unlike the familiar Japanese screen.

This screen to a great degree protects the workmen from the rush of hot air and furnace gases and from the glare of the interior of the furnace when the door is open. It also prevents undue chilling of the furnace by an inrush of cold air. Yet it can be seen through and can readily be pushed aside to introduce tools. So far this device has been chiefly used in connection with glass

furnaces and glass pots, and boiler furnaces, but there seems to be no reason why there is not a wide adaptability to refining and reverberatory smelting furnaces.

Underground Pipe Fittings

Such fittings as are shown in the accompanying illustration have proven economical and useful in the Rand mines. They facilitate repairs with speed and safety

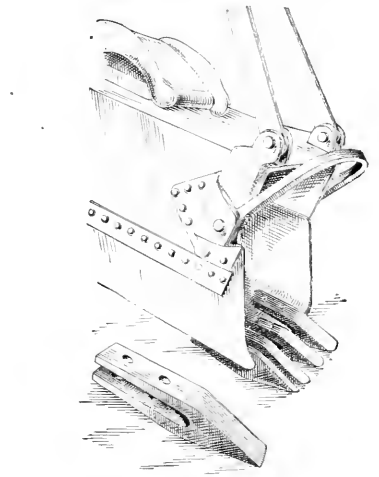


SIMPLE CLAMPS FOR UNDERGROUND USE

on water and air pipes and air hose. They are known in South Africa as the Ussher fittings and are patented there.

Easy-Loading Dipper Tooth

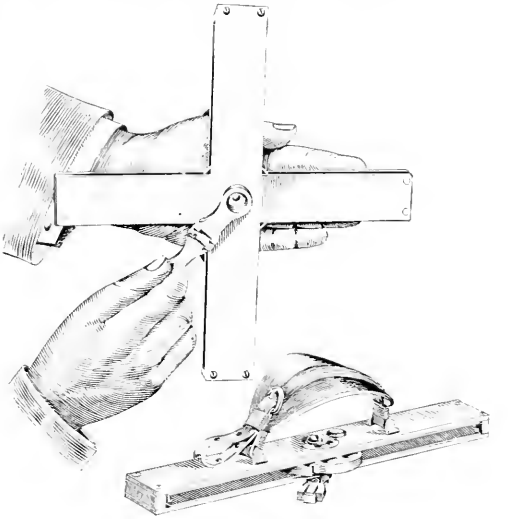
An easy-loading style of one-piece tooth for steam-shovel and dredge buckets has been designed and is being manufactured by George P. Chambers, 110 North Madison Ave., La Grange, Ill. The device is shown in the accompanying sketch. The tooth is made of carbon steel for resharpening or manganese steel for especially severe service. The teeth are reversible, so that when worn on one side they may be turned over and re-used. It is claimed that a bucket equipped with these teeth loads more material than with any standard tooth, and that particular benefit has been shown in picking up large stones on level ground. These teeth are used at several quarries in Illinois.



CHAMBERS REVERSIBLE DIPPER TOOTH

New Reel for Flat Wire Tape

A new four-arm folding reel has been put on the market by the Keuffel & Esser Co., of New York. When using tapes over 100 ft. long, it is customary to use the tape without a reel, the latter being carried separately. This is generally inconvenient, especially if the reel is bulky.



FOLDING REEL FOR 100-FT. TAPE

The present device has therefore been designd to obviate this advantage.

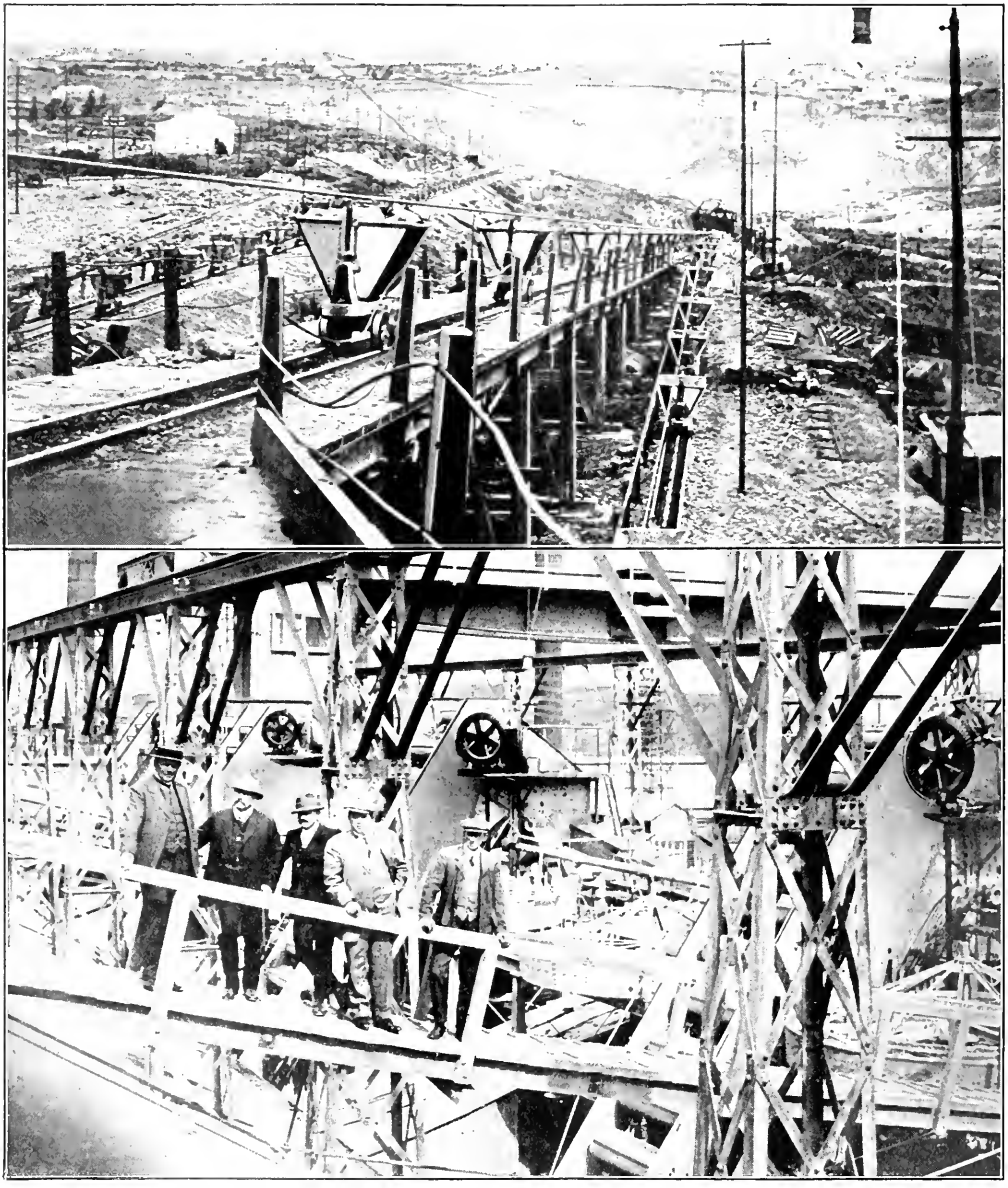
When the tape is off, the cross-piece can be folded into the frame and the reel, now a single flat piece, can be conveniently carried in the pocket, so that it is immediately available when the tape is ready to be wound up again. The frame is made of nickel-plated steel, in three sizes, holding $\frac{1}{4}$-in. steel tape from 100 to 500 ft. long.

Globe Patent-Lock Roofing

A new kind of lock roofing is being offered by the Globe Iron Roofing and Corrugating Co., of Cincinnati. The novelty is in the lap lock, which is so designed that the joint can be promptly and easily made, and will stay waterproof. The roofing may be had in plain or corrugated sheets or in the shingle-cluster form.

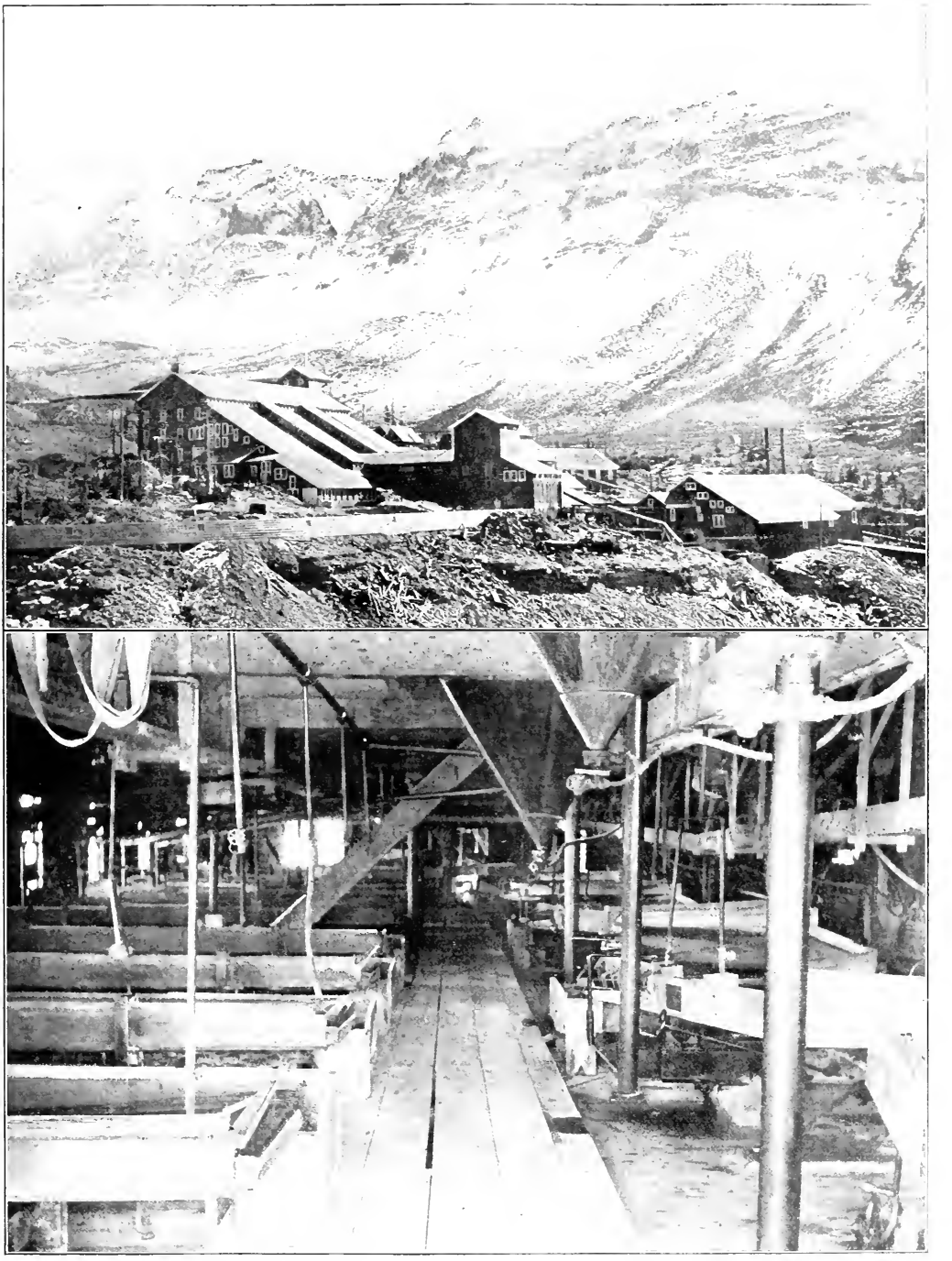
The Denver Engineering Works Co., of Denver, Colo., has published a bulletin (No. 1078) on ball mills, in which some interesting data are given. The special feature of these mills is the tire-and-roller type of bearing at the discharge end, permitting the use of a large discharge opening. This removes the necessity for screens, diaphragms, etc., and makes a simpler machine. The discharge opening is fitted with the Neal reverse spiral to permit escape of the balls.

Photographs from the Field



TWO VIEWS OF DIAMOND-MINING OPERATIONS ON THE SOUTH AFRICAN FIELDS

The upper illustration gives a general view of haulage operations. Cars of diamond-bearing ground are taken from the opencuts by a rope-haulage system, a continuous stream being carried to the dumping point and returned to the cut on a lower level. The lower illustration is a general view of the washing plant.



EXTERIOR AND INTERIOR OF THE TOMBOY MILL NEAR TELLURIDE, COLO.

Pulmonary Disease Among Miners

That the inhalation of sharp particles of dust injures the mucous membrane of the lungs and in this way lessens the resistance of the lungs to pathogenic germs, especially the bacilli of pulmonary tuberculosis, has been proved by investigations of morbidity among workmen in dusty trades and by study of the prevalence of lung diseases in South Africa and other foreign countries. The matter is one of deep public concern, and attention has been called to it from time to time.

Recently, with a view to affording some measure of relief through suggested educational work and through state legislation, the Bureau of Mines has undertaken, in coöperation with the Bureau of the Public Health Service, preliminary investigations of the production of dust in metal mines in various parts of the United States and the relation of the prevalence of dust to silicosis, or miner's consumption, and pulmonary tuberculosis among miners. Passed Assistant Surgeon A. J. Lanza, detailed to the Bureau of Mines, and Edwin Higgins, a mining engineer of the bureau, coöperated in making a survey of conditions in various metal-mining districts of the United States and made a report[1] dealing with the prevalence of tuberculosis among the miners of the Joplin district, Missouri. The following summary of conclusions and recommendations was made:

Summary of Conclusions Arrived At

1. The death rate from pulmonary diseases is unusually high among the miners of the Joplin district.

2. Poor housing, exposure, alcoholism, the use of common drinking receptacles and overwork, all tend to spread infection and lessen the power of the miner to resist disease, but the prime factor in causing pulmonary trouble is the rock dust in the mines.

3. Rock dust in the sheet-ground mines, although not made in great quantity as compared to mines with more restricted working places, is harmful to the miner for two reasons—because he is exposed to it practically during his entire shift, and because the dust is made up chiefly of particles of insoluble flinty chert with splintered and knifelike edges.

4. This rock dust is produced by the blowing of dry holes, squibbing, boulder popping, drilling without water, shoveling, tramming, roof and pillar trimming, and the dumping of the bucket at the surface.

5. By observing certain precautions rock dust in the mines can be almost completely abated.

6. There are certain abuses connected with the piece system of work that demand attention and correction as far as practicable.

Recommendations for Allaying Rock Dust

1. The following means should be employed for the abatement of rock dust in the mines:

a. Provide a water-supply for every working face by the laying of a separate water line.

b. Where drills are operated without water, attach to the hose leading to the face a 5- or 6-ft. length of pipe with a nozzle from $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter. Make and enforce such regulations as will insure the use of this water spray for the purpose of wetting drill holes, the face, and the broken rock about the face. For the purpose of washing drill cuttings from drill holes, this hose may be attached to the long pipes now in use for blowing-out drill holes.

c. Where there is in use some type of drilling machine that provides for water passing through the core of the drill steel into the drill holes, make and enforce regulations that will insure the spraying of the face and broken rock for short periods at such times as the drill may not be in operation. For this purpose the water hose must be uncoupled from the drilling machine unless separate water connection is provided.

d. Make and strictly enforce rules against squibbing and boulder popping while the shift is underground and against the blowing of dry holes at all times.

e. Improve ventilation by the opening of new shafts whenever practicable.

2. Do away with common drinking cups and kegs, and water pipes that allow the miner to bring his lips in contact with the orifice. Substitute the well-known sanitary drinking fountain when practicable, or have miners bring their own drinking water in individual containers.

3. Do not employ as shovelers men under 20 years of age.

4. Through coöperation among the operators, stipulate a maximum daily tonnage for shovelers, so that they cannot injure their health through overwork.

5. Provide a warm, dry and clean place in which the miners may change their clothes.

6. Through intensive educational campaigns in the public schools and among the miners themselves, disseminate information as to the harmful effects of insanitary practices and conditions, such as crowded living quarters, overwork, exposure, dissipation, the breathing of air polluted by powder fumes and rock dust, and the use of common drinking devices.

[1]Technical Paper 105, Bureau of Mines.

A One-Leg Ore Trestle

Brainerd Correspondence

A new ore trestle just completed at the Wilcox mine, Woodrow, Minn., presents some features novel, at least, to Cuyuna Range operators. It is of the one-leg type, the legs being 6-in. wrought-iron pipe 36 ft. long set in concrete foundations and themselves filled with cement. A flange coupling at top and bottom permits connection with foundation and crosscaps. The legs are then guyed with $\frac{5}{8}$-in. cable.

This constitutes the permanent trestle, beyond which are two bents of wooden-post trestle, where the ore is dumped. End-dump cars are used until the ore pile is of sufficient length, when side-dump cars will be used to make additions alongside.

Such arrangement leaves a stockpile free from timbers to interfere with steam-shovel loading.

More Dredges in Colombia

The Anglo-Colombian Development Co., which is operating in the gold-platinum region in the western part of Colombia, contemplates the installation of more dredges on the Condoto River. At the recent annual meeting in London of the Consolidated Gold Fields of South Africa, Lord Harris stated that the dredge which has been in operation since July had obtained results

that fully justified considering ways and means of producing gold and platinum on a larger scale by the provision of more dredges. An engineer has been sent to Colombia to investigate the conditions affecting the development of power for additional dredges and an enlarged scale of operation.

Besides this prospective increase, mention has previously been made of the program of construction contemplated by the Oroville Dredging Co.'s subsidiaries in the Nechí Valley in central Colombia.

The Deepest Gold Mine, Morro Velho

The deepest gold mine in the world—the deepest mine of any kind, it is believed—is the Morro Velho in Brazil, owned by the St. John del Rey Mining Co. Some particulars about it are given in the annual report lately published in London.

For the past three years the lowest developed horizon has been the 18th, at a 4,900-ft. depth from adit level, equal to 5,226 ft. from surface. For the purpose of attacking ore at greater depth shaft G has been sunk from the end of a tunnel at the 16th horizon, and from this shaft horizons 19 and 20, respectively 5,202 and 5,502 ft. below adit level, have been commenced. The 19th horizon is expected to be developed and ready for raising ore by June next, and the 20th horizon by April, 1917. The opening up of these two new levels is expected to add something like 600,000 tons to the ore supply, and it is believed that values will be maintained.

If the mine could be worked down to the 20th horizon only, it might be assumed that its life would not be longer than about six years. However, there is no intention to stop work at the depth attained by the 20th horizon. The superintendent's last annual report deals very exhaustively with this subject. He says, in effect, that except for the rapidly increasing temperature of the mine, supposing the lode continued the same size and value to horizon 26 (vertical depth 7,626 ft.), it could be worked profitably to that point and even to a greater depth, but from the temperature chart the rock at horizon 26 would be no less than 126.5° F. at the moment of opening. It is not believed that much more can be done in present circumstances in the matter of increasing the volume of ventilating air, but the opinion is advanced that by artificially cooling the air passed down the mine the difficulty can be overcome and the mine worked to considerably greater depths than yet reached. An air-cooling and drying plant has been designed which, it is stated, "represents a thoroughly practicable scheme that will effectually remove the one serious obstacle against the company being able to work the mine to a great depth."

Molybdenum and Tungsten in Chile

A report from United States Consul J. W. Voetter at Antofagasta, Chile, mentions recent reports that at the mining community of Campanany, in the Province of Tacna, Chile, there exist considerable deposits of molybdenum and wolfram, in addition to copper sulphides. While the mines have not been developed, samples of the ores have been sent to Europe for the purpose of finding a market for the minerals. The address of the president of the mining community is Sr. Jorge Romussi, Iquique, Chile.

Newspaper reports also state that a good vein of wolfram has been discovered in the property of the Cia. Estañifera del Llallagua, at Llallagua, Bolivia. The principal office of this company is at Santiago, Chile.

Lake Superior Iron Outlook

ISHPEMING CORRESPONDENCE

Navigation will be about at an end within a few days, and the mining companies and boat companies are already making their plans for 1916. Never in the history of the iron-ore business has there been such optimism as one hears in the Lake Superior district today. The question is not how much ore can be mined, but how much the lake fleet will be able to transport to lower lake ports. It has been estimated that 55,000,000 tons will go down next year, but other opinion doubts that the boats will be able to handle any such tonnage. However, it is probable that the record of 50,000,000 tons, made in 1913, will be surpassed. There has been an advance of 10c. a ton for carrying ore next year, and a large number of the boats have already been chartered. The Steel Corporation entered the field first and chartered a great deal of tonnage, in addition to its own fleet operated by the Pittsburgh Steamship Co.

Just what prices will be received for iron ore in 1916 it is impossible to forecast now. A dollar advance is predicted, while 50c. advance seems certain.[1] The operators are making preparations to get out a maximum tonnage, and nearly all of the underground mines in the Lake Superior district will be worked this winter. New mines are being developed and opened. The Arthur Mining Co., which took over the Hill properties on the Mesabi, is ordering equipment and doing a lot of stripping. The same is true of other Mesabi concerns. Oglebay, Norton & Co. are to put the Meteor shaft, on the Gogebic range, down so that the ore can be tapped. The Hanousack, on the same range, is to be stripped; Butler Bros. have the contract. The Cleveland Cliffs Iron Co. is to sink a shaft and mine ore on what is known as the Junction Forty, on the Marquette Range. Corrigan, McKinney & Co. are to sink on the Adgers lands on the Menominee range.

The concerns that furnish machinery for the mines of the district are flooded with orders. Rock drills, compressors, hoists, steel, etc., are badly needed. The companies have kept their purchases at a minimum during the dull times, but now that they know that they are going to be able to sell all they mine, and at better prices, they want the necessary tools.

It is feared that there may be shortage of labor next season. Many foreigners have gone from the Minnesota ranges to Europe during the past year, and many miners have left the district for other camps when things were dull on the iron ranges, being attracted by the high wages being paid to copper miners in Butte, Bisbee and other Western copper camps. There will probably be plenty of common labor for surface work and work in the pits, but a scarcity of first-rate underground men would not be surprising.

[1] According to telegraphic reports of Dec. 8 the advance is about 75c.—Editor.

Lake Superior optimistic operators expect 1916 to be a big year in the iron ore business, but 1917 and 1918 to be still bigger.

Chronology of Mining for November, 1915

Nov. 1—Canadian Copper Co. adopted eight-hour day for all men at smeltery and shop, and granted increase to men in mines working on an hourly rate.—Gaylord mill, Cripple Creek, burned to the ground.

Nov. 2—Strike at Thetford mines, Quebec, settled.

Nov. 5—Concentrator of Arizona Copper Co., Clifton, Ariz., destroyed by fire.

Nov. 6—Strike at Nichols copper refinery.—Ray-Jefferson stockholders voted to increase capital stock from 1,500,000 shares to 2,000,000, par value, 25c.

Nov. 9—Strike at Silver King Coalition mine settled.

Nov. 10—Alice mine, Butte, reverted to Anaconda company, no offers having been made when offered at public sale.

Nov. 11—Mill of National Copper Co., Idaho, started operation.

Nov. 14—Law enacted in Peru levying export duty on gold, silver, lead, copper and other metals, and on borax and petroleum.

Nov. 16—Commencement of suit between Alameda Mining Co. and Success Mining Co.—Strike at Nichols refinery settled.—Explosion in mine of Northwestern Improvement Co., at Ravensdale, Wash.; 34 men entombed, of whom three were rescued.

Nov. 17—Announcement of Kennecott-Braden consolidation.

Nov. 22—Federal investigation of Clifton strike begun.—Villa reported driven out of Cananea.

Manganese Developments in Virginia

ROANOKE CORRESPONDENCE

The actual results, so far, accruing from the renewed interest in the manganese deposits of Virginia, due to the war market for the ore, have not been so satisfactory as was hoped for a year ago. There have been a great deal of negotiating and several attempts at financing, and engineers, ore buyers and investors have worn quite bare the trails in the best known manganese-bearing areas.

The Crimora mines properties at Elkton, one in Rye valley and several others have, however, received serious attention, and with good results as far as development has progressed. The Piedmont Manganese Co.'s mine, near Lynchburg, has been reopened and promises soon to resume shipments. At Crimora the consummation of the very extensive equipment and financial program has delayed actual output. At Elkton litigation as to title has kept back recent negotiations. In Rye valley, financial mishaps in Philadelphia postponed the completion of what promised to be a successful operation to mine manganese and manganiferous iron ore. Numerous smaller operations have realized small shipments. On the whole, outside capital has not yet come to take the Virginia deposits very seriously, and local capital is not available ordinarily for even the prospecting of the many promising deposits in the Piedmont, James-Staunton River, and the southwest Virginia districts.

United States Motor Trucks for Bolivian Tin Mines

SPECIAL CORRESPONDENCE

Alexander Grosberg, of the Patiño tin mines, recently left St. Louis for Uncia, Bolivia, where the mills and mines of the company are situated. While in the United States Mr. Grosberg arranged for the construction and purchase of a large number of motor trucks to be used in transporting tin and concentrates from the mills to the railroad. The transportation problems there are unusual, and the introduction of motor trucks of American make is of great importance to manufacturers in the United States.

The contract for transporting the concentrates of the great tin mines of the Llallagua and Patiño companies is now held by a single transporting company. The distance from the mills to the railroad is about 60 mi., the average grade 4½% and the maximum grade 15%. During eight or nine months the roads are good, but during three or four months of the rainy season the constant and heavy traffic makes the roads almost impassable. During the dry portion of the year six mules are used on each cart carrying 8,000 lb. of ore, with an addition of six more mules at the worst grades. During the wet season six mules are used for each cart carrying 4,000 lb. of ore, with an addition of 12 mules at the points of worst grade. The contract specifies that all concentrates produced during a given week must be delivered at the railroad by the end of the following week, heavy penalties being imposed when this part of the contract is not fulfilled.

It is now proposed to substitute motor trucks for this work. Trucks for this use must have special features, especially in connection with the cooling system and traction. For the latter a four-wheel tractor is proposed. The first order of trucks will be for about 30. If these are successful, it means that motors will supplant all other methods of transportation on the Oruro plateau, and that thousands of American-made cars will be required for this work.

It is evident that one of the best methods of securing South American trade is the education of American engineers for this field. Mr. Grosberg was graduated from the Missouri School of Mines in 1911.

Porphyry Copper Dividends

At the meetings of the porphyry copper companies held on Dec. 8 the following dividends, payable Dec. 31, were declared: Chino, $1 quarterly; Nevada Consolidated, 37½c. quarterly and 12½c. extra; Ray, 50c. quarterly; Utah, $1.50 quarterly. Butte & Superior declared a regular quarterly dividend of 75c. and $7.50 extra.

Phosphorite Deposits in Russia are being investigated under the direction of the Ministry of Agriculture. So far the only deposits found to be of any commercial value are those on the Upper Kama River. These, containing 27 to 28% of phosphoric acid, are worthy of consideration for both quality and quantity, as well as the fact that they are situated near the deposits of iron pyrites in the Ural Mountains.

Editorials

Carrie Everson

Ever since the flotation process established itself the name of Carrie Everson, the first patentee of a flotation process that bore the earmarks of experimentation, has been on the lips of all metallurgists. Many efforts to learn something about her have been made, all of them unsuccessful until recently, when some members of the Colorado Scientific Society traced her. Most of the searchers had previously come to the conclusion that probably she had died long before. Strange to say, she was living at that very time and had failed to make herself known during the excitement of patent litigation and the common talk about her. Unfortunately she died only about a year ago, but before anybody had been able to interrogate her about her invention.

According to the Denver *Times*, Carrie Everson was the wife of a Doctor Everson, a physician who had been practicing in Chicago. She was born in Sharon, Mass., in 1842, her maiden name being Carrie Jane Billings. Early in the '80s the Eversons moved to Denver on account of the doctor's health. He died a short time afterward. Everett A. Fay, a bookkeeper in the Denver National Bank, who knew the Eversons, is reported as saying that the discoverer of the flotation principle was Doctor Everson. After his death his widow pursued the idea, took out the patents, and for his aid in promoting the process let Criley, a Denver blacksmith, become associated with her. She continued her experimental work for several years. She lived in Denver until 1909, when she joined her son, John L. Everson, in San Anselmo, near San Francisco, where she died Nov. 3, 1914.

Members of the Colorado Scientific Society are now trying to get at the facts of the Eversons' discovery and will propose some fitting testimonial to them. The legend of the Denver spinster-schoolteacher washing the ore-sacks of her assayer-brother seems to have been destroyed. In this interesting history there stand out two things, namely, the quiet life of Mrs. Everson in the time when she had become an international figure, and the unanimity with which she is hailed by Americans as the real discover of the flotation process, although the owners of certain patents deny it.

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The Situation in Copper

The little recession that has occurred in the price for copper during the last fortnight is devoid of any broad commercial significance. The users of copper have bought very liberally, and most of the producers have sold—at fine prices—their expected output for a length of time ahead that is far beyond their ordinary hopes. The users naturally cannot keep on buying indefinitely; on the other hand, producers when sold ahead so well as they are now are indifferent whether they do new business every day or not. Indeed, they do not expect to.

However, there are many small producers of crude copper, not in a position to enter into contracts for the delivery of refined, who need to sell their output right along in order to keep going. This copper is often to be had by traders and refiners on favorable terms, and against such purchases refined copper may be sold at only a slight advance. Persons trading thus in copper will sell it for what they can get, so long as there be any profit in the transaction. Consequently prices are apt to sag off in a narrow trading market, but when a large demand for copper develops again, the market is likely to rise to the terms of the big producers, if the statistical position be sound. If the statistical position be hollow, a sagging in prices after the culmination of a big advance is apt to foreshadow a pronounced downward trend, the big producers usually coming into the market again at a much lower level, after the old orders on their books have been exhausted. At the present time it is believed that the statistical position of copper and all of the fundamental conditions are of very strong character.

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How the Metals Are Sold

The quantity of the principal metals—iron, copper, lead and zinc—that is sold to consumers out of warehouse, or "on the spot," is relatively insignificant. The bulk is sold on contracts for delivery during the ensuing two or three months, the buyer covering what he expects to use during that period and taking delivery more or less at the mutual convenience of himself and the seller. Thus he may request the seller to advance or delay the stipulated delivery, and in general the latter is glad to oblige his customer and does so if it be possible. In lead only does an essentially different method prevail. The principal producer of this metal has long maintained the custom of selling only for shipment within 30 days, although its competitors sell their lead just as other producers sell their copper and spelter. However, a very large part of all the lead used by consumers in the United States is sold to them on long-running contracts, settlements being made on the monthly quotational averages.

In making the usual contracts for copper and spelter there is ordinarily no discrimination as to prompt and futures—that is, within the ordinary deliveries in the trade—or if there be any, they are but trifling. At certain times when stocks have been reduced to a small figure—for example, in the case of copper in 1906-7—the belated buyer who had to have immediate delivery was obliged to pay a premium, but such of course was no more representative of the broad commodity market than the expenses of a belated traveler who has to hire a tugboat to put him aboard the steamship are a measure of the current fare to Europe. Lumped with the whole volume such premium business figured disappearingly small.

There is of course at all times some freakish business that partakes of the nature of a betting transaction. Thus, copper being at 15c., somebody may offer to buy at 13c.

a large quantity to be delivered during the next 12 months and may find somebody to take him up. In such a case the buyer may be covering his requirements for manufactured wares previously sold, while the seller may figure that the trend of copper is downward and that his sale would look good if the metal should happen to sink to 12c. or 11c. But transactions of this sort are unusual.

The uncertainties and extraordinary conditions produced by the war, however, have led to a great many transactions that are unusual. The most remarkable exhibitions of these have been in spelter. In this metal we witnessed first a practical disappearance of stocks, a loss that always deprives a market of its balance wheel. This was followed by the payment of large premiums for prompt delivery, while the ordinary two months' and three months' contracts could hardly be made at all. Then there was a wild rush for the metal and contracts covering six months or more were made, there being practically no limit to what buyers would do. At some times there would be a backwardation in price for future months, and at some times there would not be any to speak of. It was all a grand mix-up.

Recently there was a new feature, in that for a while there was scarcely any business for the quarter immediately ensuing, while rather a large business was transacted for delivery in the quarter next following. This produced a condition of spelter being sold at 13@14c. for one quarter and 10@11c. for the next. A pronouncement of what is the spelter market under such conditions was necessarily arbitrary. For the first quarter spelter was difficultly salable, but producers maintained a relatively high price. For the second quarter they were glad to take 3c. less, believing that when the time came the contract prices would look very high. On the other hand, there were buyers, chiefly foreign, who were willing to engage large tonnages at the figures named.

The copper business has at times exhibited irregularities, but none so erratic as in the case of spelter, for the copper market never lost its balance wheel of an available stock of the metal. At one time—in the height of the great selling movement of May-June—contracts for copper a very long way ahead were entered into, but these were at the prevailing price. Not long ago there was some maneuvering by producers to get some good contracts for distant deliveries on their books at the expense of apparently less advantageous sales of early supplies. However, abnormal transactions of all sorts are to be expected while the entire commercial machinery of the world is disarranged in the way it is and while speculation of all kinds is so rampant.

The Situation in Mexico

The warfare in Mexico appears to be all but over. Carranza and his followers have won. The victors are now trying to restore order in the land. This will be a matter of some time. There will no doubt be maraudings and guerrilla operations for many months, but gradually those should cease.

The big mining and metallurgical companies are taking active steps to resume operations. They report surprisingly little destruction of their properties. However, they are hampered, and will be for a while, by the destruction of railways and railway equipment. Probably they will be obliged to help the Government supply the latter, the Government having but little money of its own to spare. In other words, the larger companies, which must move freight, will no doubt buy locomotives and cars for the railways and accept reimbursement in the form of deductions from their freight bills.

Some private traders of more adventurous instinct than others are already going into Mexico. These early birds may reap large profits, but of course they will be exposed to great risks. We have been asked by numerous machinery manufacturers whether the time is yet ripe for them to send their travelers into Mexico to go after business. Great business is going to come to them from Mexico, but we think it is still premature to inaugurate regular measures for getting it. However, the time for them will come ere long.

Mine Taxation Problems

The enormous profits realized by some of the companies supplying military material were bound to attract the attention of the tax gatherers. Thus some persons in New Jersey are getting excited over the New Jersey Zinc Co., whose Franklin mine is assessed for taxation at a valuation of about $2,500,000, it is alleged, while the company pays annually many millions in excess of that sum as dividends. The system of taxation that prevails in New Jersey requires mines to be assessed at an absolute value, just like real estate, the New Jersey tax laws being similar to those of Michigan and a few other states.

An absolute valuation of the Franklin mine would be something of a job. Experts would be rather reluctant to undertake it. However, the inexpert are wont to rush in where the experts fear to tread. The ore of the Franklin mine is taken over into Pennsylvania for smelting, wherefore it is a puzzle to discriminate between mining profits and smelting profits, besides which there are some knotty problems in between. Moreover, the New Jersey Zinc Co. has extensive mining and smelting interests in many other states.

Prospects for the American Consulting Engineer

Note has previously been made in the *Journal* of how seriously the mining companies of Great Britain are being affected by the new taxes, which in certain cases are figured as taking two-thirds of the profits, when they are added to the older and local taxes. Obviously there exist but few mining companies that can stand such a burden, and it is only natural that some of them are considering the transferal of their headquarters to New York. Especially would such a transfer seem to be logical when the properties are situated in this country or in its neighbors to the north and south.

We may look also for a migration hither of Anglo-American and British engineers. If the mining companies come they will naturally have to come too. Another incentive will be the probability that American capitalists will soon begin to participate in foreign enterprises, especially in Russian, in which these men are experienced. There may be, indeed, a revival of the practice of consulting engineering, which for many years has been a dead profession in New York.

BY THE WAY

A geological map of Tennessee has just been issued by A. H. Purdue, state geologist of Tennessee. A copy may be had by sending 10c. in stamps to him at the State Capitol Annex, Nashville, Tenn.

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Capt. Laurance Angel, U. S. A., according to the "Boston News Bureau," estimates taxable property in New York City at $10,000,000,000, of which amount at least $5,000,000,000 is subject to destruction by an enemy. He believes it is cheaper to insure this property by increasing the army and navy than to pay the ransom which a conqueror of the city would demand.

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War and war conditions have had a disastrous effect on the diamond business. An evidence of this is found in the statement that during the first four months of 1915 only 64,977 carats of diamonds were exported from British South Africa, against 1,524,640 carats in the corresponding months of 1914 and 1,862,126 carats in 1913. Diamond mining in German Southeast Africa has ceased entirely for the present.

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The first tube mill was introduced into the United States by J. R. Alsing in the late '70s. These machines were known at that time as "pulverizing cylinders," and those who imagine that the short tube mill is a modern development will be surprised to learn that the size of the early mills was 6x6 ft., according to our informant. The first pulverizing cylinder was made by the firm of Ball & Jewett and was installed in the Union Porcelain Works at Greenpoint, Brooklyn, where it was used for grinding pottery material such as feldspar and similar minerals. About 1880 some mills were built that were 6x8 ft. These were called "Jumbos" at this period. The pulverizing cylinders were soon introduced into the talc industry at Gouverneur, N. Y., but have not received such wide adoption in this industry as they have in metal mining, where the practice in some branches seems to be veering back to mills of practically the original proportions.

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Miss Anna List, the famous syndicated lady psychologist, has at last completed her great life work—a delicately wrought analysis of Success, says *Judge*. For years the unsuccessful portion of humanity, comprising in all somewhat over 99% of the population of the globe, has waited impatiently for some authoritative information in regard to the chimerical composition of this irresistible force in business, political and religious circles.

SUCCESS

Honest work	1.027
Other work	25.878
Honest advertising	00.023
Ordinary advertising	17.101
Finesse	6.008
Surreptitious credit-taking	19.020
Ruthlessness	9.009
Luck	13.013
Hypocrisy	8.921

With this heretofore carefully concealed information now in the hands of Tom, Dick and Harry, a great injustice will soon be dissipated. Instead of a favored few being blessed with a lion's share of Success, Success will be equally divided among all, and nobody will have any to speak of.

Eureka, Nev., has been dying by inches ever since the furnaces and refineries closed down 25 years ago, writes Charles E. Van Loan in the *Saturday Evening Post* of Sept. 4, 1915. She may linger on for years to come, but so long as breath remains in the last inhabitant it will not be safe for the stranger to say Eureka is dead. Ore? They have trainloads of it—not so rich as it used to be, of course, for the old companies got the cream of it; but they only skimmed the top. Nobody knows what lies under the water in the Locan shaft on Ruby Hill. So Eureka waits. A traveling man passed through the town during Mr. Van Loan's visit. It was his first trip, the weather was very warm, the altitude bothered him, there was no ice to be had, his sales did not amount to much, and he had time to listen to the old men on the street corners. He paid them an entirely mistaken compliment before he cranked his roadster and sprinkled them with the dust of his departure. "The place is dead, but they don't know it," said he. "They can kid themselves along if they like, but they can't kid me. At that I've got to hand it to 'em—they're the greatest boosters in the world!" Thus he proved he knew neither the country nor the people.

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An advertising circular of a recent book on Peru has been received, from which we purpose to quote at length. "All of the data in it is compiled from official sources of the Peruvian Government, and large quantities of gold dust have been panned out and obtained by the author's associates in Peru, and thousands of dollars of pure flake gold dust have been sold by the author at the United States Mint in Philadelphia, all of which has been panned out by hand from the golden streams of Peru." An illustration showing a large number of moving-picture actors, all looking proud, pleased and happy, is said to show "the art of panning gold from the sand and gravel of streams. Special instructions are given in the Guide enabling a greenhorn to successfully pan gold from the river-bed. The instructions are plain and simple, and easily learned by anyone. Working examples are given, so that the student may practice gold panning in his backyard by means of a wash-tub, from sand and gravel and a few grains of lead. This will make him expert enough so that when he reaches the field he will be able to pan and find color on any of the streams with ease." Except, of course, the gold be of the Santo Domingo variety, which can only be panned out by one who is used to that particular locality. We also learn that "the chinchilla is a native of the mountains of Peru and is worth $75 a dozen in New York City. Hundreds of these may be shot by any man handy with a shotgun," and shipped by wireless, we imagine. "The land cleared of its trees, with the exception of rubber trees, and other rubber trees planted in the same ground will produce on a 40-acre farm an income of $10,000 a year with little labor, and will support a family while waiting for the new trees to produce, which takes from five to eight years' time. Land may be purchased at $1 an acre." Now again we call your attention to the fact that all of this is not put forth with the idea of getting tourists, prospectors or rubber planters in South America, but merely for the sake of selling a book, at the small sum of $1.50 per volume. Do your Christmas shopping early while the first edition lasts.

PERSONALS

S. F. Shaw is visiting mines at Grass Valley, California.

Charles M. Schwab has been chosen a trustee of Cornell University at Ithica.

Charles A. Chase has changed his address to Suite 812-824, Cooper Building, Denver, Colorado.

E. Norris Hobart has been examining tungsten prospects in the Oscura Mountains in New Mexico.

Stanley G. Bullock, of the Poderosa Mining Co., Chile, has sailed for England to offer his services in the war.

H. Numato, engineer in charge of construction in the Imperial Steel Works, Japan, is a visitor in Baltimore.

Harlan H. Bradt is doing special work on iron ores for the Wisconsin Geological Survey. His present address is Lake Mills, Wisconsin.

Henry P. Day, superintendent of blast furnaces for the Tata Iron and Steel Co., Satchki, India, is making a vacation visit in this country.

George Kingdon, who had been spending a few days in Globe, Ariz., left Nov. 28 for the border to prepare for resumption of work at Cananea.

B. Magnus is on a trip which will take in Montana, Utah, Arizona and Tennessee to study modern practice at American copper mines and smelting works.

N. O. Lawton was in New York last week on professional business. He left Dec. 4 to examine and report on some mining properties, and will return to New York next week.

Dr. L. D. Ricketts and W. D. Thornton, vice-president of the Inspiration Consolidated Copper Co., have just completed an inspection tour of the property and of the International smeltery at Miami.

Dr. Charles R. Van Hise, the eminent geologist and president of the University of Wisconsin, is chairman of the commission appointed to investigate the slides in the Panama Canal and the probable causes.

Durward Copeland, professor of metallurgy at the School of Mines and Metallurgy of Missouri, sailed from New York Nov. 27 on the "St. Paul" for London, England, where he goes to make a study of the tin industry in Wales.

Edwin Higgins, engineer for the Bureau of Mines in the Lake Superior district, has been transferred to California, where he will take charge of the work for the bureau, which coöperates with the state in mine inspection work.

P. H. Mynahan, of Pittsburgh, formerly manager of the Louckes Iron and Steel Co., Roanoke, Va., is in Vancouver, B. C., engaged in the erection of a rolling mill for the Port Moody Steel Works Co., of which he has been appointed manager.

Benjamin B. Lawrence, a member of the class of '78, has purchased the Pelton-Doble water wheel and the Pelton-Francis turbine which were exhibited by the Pelton Water Wheel Co. at the Panama-Pacific Exposition, and has presented them to the Columbia School of Mines.

Herbert F. Black, who last week was elected a director of the Cambria Steel Co., has been with the Cambria company since 1912, in the capacity of ore agent, with offices at Pittsburgh. He is in charge of the production and shipment of materials entering into the manufacture of the company's products, including ore, coke, limestone, coal, ferromanganese, spiegel, etc.

OBITUARY

William Simpson Lyle died in San Francisco, Nov. 26, aged 78 years. He was born in Maine and went to California in 1852. He early began to invest in mines and owned many valuable properties. At one time has was associated with Clarence Mackay and James Fair. He was one of the earliest investors in Arizona mines.

Charles Edward Stafford died Nov. 27 at Haverford, Penn., aged 61 years. For many years Mr Stafford was chemist at the plant of the Pennsylvania Steel Co. He was widely known for his improvements in openhearth furnace design. From 1885 until 1896 he was manager of the steel department of the Shoenberger Steel Co., Pittsburgh. He was also connected with the South Chicago plant of the Illinois Steel Co., and at one time was president of the Tidewater Steel Co., at Thurlow.

John Shaw Scott died at Salt Lake City, Utah, Nov. 30, aged 87 years. Born in Massachusetts, he went to California when a young man and lived in San Francisco for 10 years. In 1871 he went to Utah, where he formed the firm of Scott & Anderson, samplers and ore buyers, which for a number of years owned the Johnson Sampling Works at Sandy, Utah. He also owned interests in many Utah mines, especially those at Alta.

Adolphe Greiner, managing director of the John Cockerill Works, the important steel and ordnance works of Belgium, at Seraing, near Liège, and president of the British Iron and Steel Institute, died Nov. 20. It is generally understood that he refused to comply with German demands with regard to the operation of the works when the Germans gained control of that part of Belgium in the fall of 1914 and for a time at least was practically a prisoner in his own house. According to the report of the council of the Institute, printed in its 1915 volume, he "remained at his post, continually encouraging with his unfailing spirit the members of the staff of the Cockerill company and his workmen, and organizing means for the alleviation of the distress of the large industrial population dependent on the company for employment." Doctor Greiner's elevation to the presidency of the Institute was announced at its meeting in September, 1913, in Brussels, and he assumed office at the meeting in London, in May, 1914. His notable presidential address had to do with coke ovens, coke-oven gas and coke-oven byproducts, and with blast furnaces, blast-furnace gas and slags, cements, bricks, etc. He was 71 years of age. Since 1887 he had been managing director of the Cockerill Works, but his whole business life was devoted to this company, which he entered in his youth as a chemist after training at Liège School of Mines. The company adopted the basic bessemer process under his directorship. He was a pioneer in the utilization of blast-furnace and coke-oven gases for the generation of power in iron and steel works. He was president of the Central Committee of Industrial Labor of Belgium, president of the Geological and Mining Society of Belgian Engineers and an officer of the Legion of Honor. He was also past president of the Society of Engineers and of the Société d'Ingenieurs Sortis de l'Ecole Polytechnique. He held the Bessemer medal of the Institute and was the second foreigner on whom the Institute's presidency has been conferred, the other being Andrew Carnegie.

SOCIETIES

National Rivers and Harbors Congress—At the 12th annual convention in Washington, D. C., Dec. 8-10, a moving picture will be shown depicting the iron ore industry on the Mesabi Range, dockage facilities and methods at Duluth, and the manufacture of the metal in Eastern furnaces and mills.

University of Illinois—The members of the senior class of the department of mining engineering, have returned from their annual inspection tour of mines, which was in charge of Prof. E. A. Holbrook. This year, through the courtesy of the various companies, studies were made at the mines and plants of the Paradise Coal Co., Duquoin; Old Ben Mining Co., West Frankfort; Chicago & Carterville Mining Co., Herrin; and Peabody Coal Co., Mine No. 3, Marion. Afterward the party visited the offices of the Western Coal and Mining Co., St. Louis, where the office end of coal mining was explained. Following this several days were spent studying the lead mines and concentrators of the St. Louis Smelting and Refining Co., St Francois, Mo.; St. Joseph Lead Co., Rivermines; and the Federal Lead Co., Flat River, Mo. The lead smeltery of the St. Louis Smelting and Refining Co., at Collinsville, Ill., was also visited. A similar trip is a yearly requirement for all students at the University expecting to receive the degree in mining engineering.

INDUSTRIAL NEWS

A series of three industrial motion-picture films, illustrating the manufacture of "National" pipe, from ore to finished product, will be shown before the Princeton Engineering Association at the Princeton Club, 121 East 21st St., New York City, Wednesday evening, Dec. 15, at 8:30 o'clock. No admission will be charged.

The Western Electric Co. has changed its Detroit headquarters from 263 Franklin St. to Kirby and Dequindre St. The new building is two stories high and has a frontage of 150 ft. and a depth of 130 ft. adjoining the Grand Trunk Ry.

in the section that forms a part of the inner belt railway of Detroit. The total floor space is 50,000 sq.ft., and the yard area 54,000 sq.ft.

The American Refractories Co., of Chicago, has leased the plant of the Buckeye Portland Cement Co. at Harper, Ohio, which is now being equipped and machinery installed for the calcination and production of dead burned magnesite on a large scale. Large tonnages of California magnesite have been purchased, and it is expected the plant will be in operation early in December. It will be run continuously until conditions in Europe permit a resumption of shipments from Austria.

The Russian Society for Electrical Enterprises, Ltd., 5 Marsowa Polje, Petrograd, which is the concessionaire for electric-lighting stations in Pawlowsk, Uman and Kamenetz-Podolsk and of tramways in Elizabethgrad and Uman, has opened a branch for resale of electrical machines and apparatus, and insulating materials, and also of steam and naphtha engines as well as of water-turbines, and desires to enter into relations with first-class factories in the United States producing these goods with the view of becoming their agents in Russia. The company belongs to the Russian and French Bank, and offers the complete guarantee of this bank.

On Dec. 1 the Buffalo Foundry and Machine Co. opened an office in New York City in the Whitehall Building, 17 Battery Place. The company manufactures vacuum dryers of all types, dry vacuum pumps, condensers, vacuum drying and impregnating apparatus, Buflokast chemical apparatus, including complete plants and apparatus for the manufacture of aniline, phenol, beta naphthol, picric acid, caustic soda, acids, chemicals and kindred organic materials and "Bell" steam hammers. It also does a general jobbing, foundry and machine business, and can quote on castings up to 200 tons in weight each, including all necessary pattern and machine work.

At the Chemists' Club, New York City, on Nov. 10, a dinner was held to discuss plans for the next National Exposition of Chemical Industries, at which the following were present: Raymond F. Bacon, Chas. H. Herty, Henry B. Faber, A. D. Little, E. F. Roeber, George D. Rosengarten, T. B. Wagner, L. H. Baekeland, M. C. Whitaker, B. C. Hesse, Adrian Nagelvoort and Chas. F. Roth. R. G. Hollaman and F. W. Payne, all of whom will serve on the Advisory Committee for the 1916 National Exposition of Chemical Industries to be held at the Grand Central Palace, New York City, week of Sept. 25, 1916. At this meeting Dr. Charles H. Herty was elected to serve as chairman of this committee for the coming year. Plans for enlarging and increasing the scope of this coming exposition were laid. The plans include using several floors of the Grand Central Palace, with speakers in the evening and motion pictures during the day from 11 a.m. to 7 p.m.

The Wheeler Condenser and Engineering Co., of Carteret, N. J., has just issued two booklets, "Psychrometric Tables for Cooling Tower Work" and "Steam Tables for Condenser Work." The former includes in its contents an introductory discussion on psychrometry and tables giving the dry- and wet-bulb thermometer readings with the corresponding dew point, percentage of humidity, and pounds of water per thousand cubic feet of air over a wide range of temperature, together with an appendix on the sling psychrometer, with directions for its use in obtaining dry- and wet-bulb thermometer readings. The second contains a table of properties of saturated steam from 29.8-in. vacuum to atmospheric pressure, and the properties of saturated steam from 32° F. to 212° F.; in a third table the properties of saturated steam from 0-lb. gage pressure to 200-lb. gage pressure; with an appendix on the use of the mercury column for measuring pressures. These are both well gotten up, and are for free distribution to interested engineers.

TRADE CATALOGS

M. Smolensky Mfg. Co., Cleveland, Ohio. Catalog, Suction and Check Valves. 16 pp., illus., 6x9 inches.

The Denver Engineering Works Co., Denver, Colo. Bulletin No. 1,076, Ball Mills. 8 pp., illus., 8½x10½ inches.

The James Leffel & Co., Springfield, Ohio. Catalog No. 65, Steam Engines and Boilers. 32 pp., illus., 8½x11 inches.

The Gardner Governor Co., Quincy, Ill. Pamphlet, "Helpful Hints on Air Compressor Installations. 8 pp., illus., 4x9 inches.

Richardson-Phenix Co., Milwaukee, Wis. Bulletin No. 50, Phenix Force Feed Lubricators. 12 pp., illus., 8½x11 in. Bulletin No. 60, Richardson Model M Sight Feed Oil Pump. 20 pp., illus., 8½x11 inches.

Arthur H. Thomas Co., West Washington Square, Philadelphia, Penn. Bulletins of Chemical Apparatus. Illus., inches.

The Dobbins Core Drill Co., Inc., Singer Bldg., 149 Broadway, New York, N. Y. Catalog No. 16, the Dobbins Core Drill. 46 pp., illus., 8½x5¼ inches.

Harrison Safety Boiler Works, Philadelphia, Penn. Pamphlet, "Finding and Stopping Waste in Modern Boiler Rooms by Use of Cochrane Meters." 68 pp., illus., 6x9 inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1,097, Power Transformers. 24 pp., illus., 8x10½ in. Bulletin No. 1,036, Hydraulic Turbines and Accessories. 56 pp., illus., 8x10½ in., Bulletin No. 1,801-A, Isbell Vanner. 22 pp., illus., 8x10½ inches.

NEW PATENTS

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

BLAST-FURNACE FLUE DUST—Pigment. Frank Orth, Indiana Harbor, Ind. (U. S. No. 1,161,790; Nov. 23, 1915.)

COATING IRON AND STEEL SHEETS with Lead and Lead Alloys. Reginald Hazeltine, Wheeling, W. Va., assignor to Wheeling Corrugating Co., Wheeling, W. Va. (U. S. No. 1,161,475; Nov. 23, 1915.)

DRILLING MACHINE. Mather W. Sherwood, Franklin, Penn., assignor to Chicago Pneumatic Tool Co., Chicago, Ill. (U. S. No. 1,161,259; Nov. 23, 1915.)

DRILLS—Means for Mounting Rock Drills. Otto Stuhaug Tonnesen, Johannesburg, Transvaal. (U. S. No. 1,160,672; Nov. 16, 1915.)

ELECTRIC FURNACE. Alex Dow, Detroit, Mich. (U. S. No. 1,161,634; Nov. 23, 1915.)

ELECTRIC FURNACES—Treating Materials in Electric Furnaces. Edward Salomon Berglund, Trollhattan, Sweden. (U. S. No. 1,160,244; Nov. 16, 1915.)

EXPLOSIVES—Apparatus for Testing Mining Powder. Francis I. du Pont, Wilmington, Del., assignor, by direct and mesne assignments, to Ball Grain Explosives Co., Wilmington, Del. (U. S. No. 1,161,462; Nov. 23, 1915.)

FUEL—Comminuted-Fuel Feeder. John F. Hay, Erie, Penn. (U. S. No. 1,160,283; Nov. 16, 1915.)

HOT-BLAST STOVE. Thomas Coultas and Thomas I. Coultas, Pittsburgh, Penn. (U. S. No. 1,161,031; Nov. 23, 1915.)

LAMP—Portable Acetylene Lamp. Augie L. Hansen, Evanston, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. No. 1,161,209; Nov. 23, 1915.)

LIQUID-FLOW MEASUREMENT—Balancing and Measuring Apparatus. George H. Gibson, Montclair, N. J., assignor to Joseph S. Lovering Whalton, William S. Hallowell, and John C. Jones, Philadelphia, Penn., a firm doing business as Harrison Safety Boiler Works. (U. S. No. 1,160,275; Nov. 16, 1915.)

MAGNETIC ORE SEPARATOR. Samuel N. Smith, New York, N. Y., assignor of one-half to Herman W. Hoops, New York, N. Y. (U. S. No. 1,161,351; Nov. 23, 1915.)

NITROGEN COMPOUNDS—Method for Producing Nitrogen Compounds. Charles E. Acker, Ossining, N. Y., assignor to The Nitrogen Co. (U. S. No. 1,160,811; Nov. 16, 1915.)

PHOSPHATE—Method of Drying and Enriching Phosphate Material and the Like. Maximilian Mattheus Haff and Thomas Leopold Willson, Ottawa, Ont., Canada, assignors, by direct and mesne assignments, to Southern Investment Co. of Canada Ltd., Montreal, Canada (U. S. No. 1,161,473; Nov. 23, 1915.)

PNEUMATIC TOOLS—Handle and Inlet-Controlling-Valve Construction for Pneumatic Tools. Francis A. Jimerson, Athens, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,160,617; Nov. 16, 1915.)

POTASSIUM SULPHATE—Process of Producing Potassium Sulphate. George S. Morgan, Toledo, Ohio. (U. S. No. 1,161,239; Nov. 23, 1915.)

REDUCTION—Method of Reducing Metals. John Woods Beckman, Berkeley, Calif. (U. S. No. 1,160,822; Nov. 16, 1915.)

SAFETY GLASSES—Eye-Shield Protecting Spectacles. Frederick Willson and Numa Bourquin, Reading, Penn., assignors to T. A. Willson & Co., Inc., Reading, Penn. (U. S. No. 1,161,166; Nov. 23, 1915.)

SLAG—Means for Utilizing the Heat of Molten Slag. Ralph Baggaley, Pittsburgh, Penn. (U. S. No. 1,160,817; Nov. 16, 1915.)

SMELTING—Method of Smelting and Incinerating. William R. Heslewood, Oakland, Cal., assignor, by mesne assignments, to Hydro Vacuum Smelting Co., Oakland, Calif. (U. S. 1,160,509; Nov. 16, 1915.)

SMELTING—Process of Smelting Ores. John H. Klepinger, Milo W. Krejci, and Charles R. Kusell, Great Falls, Mont. (U. S. No. 1,160,621; Nov. 16, 1915.)

SODIUM ALLOYS—Electrolytic Production of Sodium Alloys. Edgar Arthur Ashcroft, London, England. (U. S. No. 1,161,585; Nov. 23, 1915.)

STACK—Transversely-Bracing and Interlocking Hot-Air Stack of Rectangular Cross-Section. Albert G. Scherer, Chicago, Ill., assignor to The Excelsior Steel Furnace Co., Chicago, Ill. (U. S. No. 1,160,202; Nov. 16, 1915.)

TIN—Electrolytic Process of Detinning. Hans Goldschmidt, Essen-on-the-Ruhr, Germany, assignor to Goldschmidt Detinning Co., New York, N. Y. (U. S. Nos. 1,160,400 and 1,160,401; Nov. 16, 1915.)

Editorial Correspondence

SAN FRANCISCO—Dec. 1

Silver-Producing Camps in California and Nevada are encouraged to a point of enthusiasm by the rise in the price of silver. The recent strikes of high-grade ore in the Comstock mines and the continued development of ore of high value together with the price of silver, puts the Comstock in the best position that it has been for a number of years. Mining men from Tonopah and Virginia City declare that the production of those camps will be doubled in case the price of silver is maintained at the high figure now quoted. The principal silver-producing mines in California are in Shasta, Inyo, Calaveras, San Bernardino, Nevada, Amador and Tuolumne counties. Other counties producing silver and capable of increased production to an appreciable amount are Imperial, Kern, Mono and Yuba.

The Oil Industry Association, recently organized, is making strong efforts to induce the Government to withhold the filing of further withdrawal or other legal actions against operators of oil land in California, pending remedial action by Congress. There are 25 suits now pending in the U. S. Courts. In most cases receivers have been appointed. The filing and hearing of such suits has become so common as to attract but little attention outside the oil industries. The proposition of withdrawal of oil lands is obviously to conserve the oil in place for the benefit of the U. S. Navy. Two such Naval reservations have been made in the California oil fields, one of which embraces 30,000 acres of undeveloped land. In these cases the oil measures may be conserved without detriment to adjoining land; but to shut in fields developed by private enterprise and conserve such ground for the benefit of the Government would mean the loss of the oil instead of conservation of it, because such developed lands would be drained by adjoining operations, in most of the cases where the Government has brought suit. The enterprise and expenditures of oil men has made it possible in many instances for the Government to select undeveloped land. From such fields the Government can secure sufficient conservation for Naval supply. In one of these suits it was shown in the evidence that the operators had expended approximately $20,000 in sinking wells from March till January, 1909; and because they suspended work in August and did not resume until January, 1910, it would appear that the Government must take the land away from them and conserve it to the uses of the Navy. The interested oil men are slightly encouraged by the recent expression of Secretary Lane, that if the full measure of the Government rights is acted upon it will bankrupt many oil companies and do unnecessary injustice to men who have invested millions of dollars under a mistake as to the law. He believes that Congress should so act as to recognize the equitable rights of such operators. Secretary Lane offers no remedy, but merely says what might be done, then declaring that such plan is too liberal. What he suggests as might be done is that those who would today be entitled to patent, were the land not withdrawn, might have leases under which they will pay a liberal royalty to the Government.

BUTTE—Nov. 30

The City of Butte Will Be Compelled to Pay the damages sustained by property owners and business men who suffered loss when Miners' Union hall was dynamited on the night of June 23, 1914. In the District Court Judge Lynch instructed the jury to that effect in the case of Thomas Duffy, who had a saloon in the Miners' Union hall building at the time of the dynamiting. He had brought suit against the city of Butte for $7,100 to reimburse him for losses sustained when the enemies of the old Butte Miners' Union No. 1, attacked the hall and wrecked the building.

The Advance in the Price of Silver from 48c. per oz. to 56c. per oz. within a week's time has resulted in a boom in all of the north and west Butte districts. Fully 200 leasers have secured options on claims in the so-called silver district and are already beginning operations. Many of the abandoned mines are showing renewed life. If silver continues to rise in price and should go above 60c. per oz., silver production will easily be increased to 2,000,000 oz. per month. The Nettie mine in the western district which is now being unwatered has vast quantities of ore that runs high in silver. By the first of the year the Anaconda company will have this mine almost in readiness for operation. The Hibernia and other silver-mining properties close to it will probably be started soon after the Nettie resumes. W. A. Clark's new shaft at the Eveline is being sunk rapidly and this will open up some valuable silver-zinc orebodies, according to the expectations of the engineers who passed upon the property. Not since the early '90s has the activity in the silver properties been so great as at present.

DENVER—Dec. 2

Tungsten Has Been Known as one of the Silverton district's minerals for years, but no important effort to market the material was ever attempted until the recent advance in the market made the idea attractive. The new Colorado Metal Co. has rented the Yukon mill, on Cement Creek, and will use it to concentrate its ore from the Dawn of Day mine near Gladstone.

Cripple Creek's Total Production during November is placed at 82,830 tons of an average gross value of $15.66 per ton; the gross bullion value being $1,297,441. As usual, the great Golden Cycle plant at Colorado City handled far more than any other mill or smeltery, its tonnage for November being 37,500 or at the rate of 1,250 tons daily. The Portland mill at the same place treated 11,000 tons. The two Portland mills in the district are credited with the treatment of 27,500 tons of ore running $2.50 to $3 per ton.

SALT LAKE CITY—Dec. 3

The Utah Metal and Tunnel Co. of Bingham has taken formal possession of the Bingham-New Haven Copper and Gold Mining Co.'s property adjoining. The capitalization of the Utah Metal has been increased by 225,000 shares, the present authorized capitalization being 725,000 shares; the increase is to be used to take up the Bingham-New Haven shares. Before the increase there were 463,128 shares outstanding and 36,872 shares in the treasury. The company has a bonded indebtedness of $359,500, which it assumed when it took over the Bingham Central Standard ground. A final dividend of 20c. a share is being distributed by the Bingham-New Haven, amounting to $43,738. There will still remain $250,000 cash in the treasury, which will go with the property. The Bingham-New Haven stockholders will receive share for share of the Utah Metal stock. For the present the two companies will be operated separately, with E. P. Jennings and W. A. Barnes in charge of the Utah Metal end, and C. H. Doolittle, general manager of the Bingham-New Haven in charge of that end of the property. The work of the two companies will be gradually merged. W. E. L. Dillaway, secretary and treasurer of the company has been here looking over the affairs of both companies, and working out the details of consolidation. Shipments from the Bingham-New Haven at present amount to 230 tons of ore and concentrates a day. The company is milling 130 tons. The Utah Metal is shipping 110 tons a day, and it is hoped to have the combined output of the two companies up to 400 tons a day soon. The Bingham-New Haven ores are being shipped over the Utah Consolidated tramway to the International smeltery under a favorable contract, with several years still to run, and shipments from this end will be continued as heretofore. The Utah Metal end has been making arrangements for the extension of a railroad spur to its ore bins, which will cut out the half-mile wagon-haul down to the Utah Apex siding. This would mean a saving of upward of $10,000 a year. The orebodies in the two properties are closely associated, a recent strike of copper ore in the Bingham-New Haven making over into Utah Metal ground, and the large orebody in the Utah Metal being close to the line. The consolidation will be of benefit to all concerned, and will prevent possible litigation.

WALLACE, IDAHO—Nov. 30

The Bunker Hill & Sullivan company is still "up in the air" with respect to the location of the smeltery. With satisfactory freight rates there appears to be no doubt that it will be located adjacent to the mine at Kellogg. It is understood that the management prefers Kellogg, and will place the plant there unless there is too great a disparity in the bullion freight rate between Kellogg and the coast. Strong pressure is being brought to bear to secure a favorable rate for Kellogg, and in this the business men of Spokane are heartily coöperating. It may be several weeks before the question is settled, but it looks like Kellogg.

DULUTH—Dec. 4

Navigation Will Close at the Head of the Lakes on Dec. 6. Every dock but the Great Northern showed a substantial increase over 1914. The following tonnage figures are subject to slight corrections, but are substantially correct.

Dock	1915	1914
D., M. & N.	15,437,419	6,318,295
D. & I. R.	8,642,942	5,579,929
N. P.	173,047	137,664
Northwestern (Ashland)	4,134,000	2,605,275
Soo (Superior, Wis.)	960,595	721,662
Soo (Ashland, Wis.)	1,012,773	758,144
	30,360,776	16,120,969

The docks at Marquette and Escanaba, Mich., will continue shipping for another week, which prevents securing grand total of tonnage at this time.

Litigation Is Expected as a result of a recent decision by the U. S. Supreme Court that the natural channel of the St. Louis River was the boundary between Minnesota and Wisconsin. The large modern coal docks of the Carnegie Coal Co. and the Zenith Coal Co., on the Minnesota side, extend beyond this line as originally surveyed. Litigation is now expected wherein the property owners on the Wisconsin side opposite will claim ownership of the ends of these docks, because of riparian rights from the water line to the center of the channel.

The Railroads that Haul Iron Ore from the Minnesota ranges to the docks at the head of Lake Superior are figuring on a greatly increased tonnage next season. Heavy orders are being placed for rolling stock. Cars were greatly in demand this year, but it is predicted that 1916 will be the banner year in the iron-ore trade, and every ton of ore that the boats can handle will be taken down to lower lake ports. The Duluth, Missabe & Northern road placed orders this week for two grade-climbing Mallet compound locomotives, six locomotives of the Santa Fé type, similar to those used on that road's mountain division, 1,000 steel hopper ore cars and 200 steel hopper coal cars. The ore cars will be furnished by the Western Steel Car and Foundry Co., of Hegewison, Wis., and the Pullman Car Co. will make the coal cars. The Duluth & Iron Range road has ordered 750 steel hopper ore cars from the American Car and Foundry Co. and the Standard Steel Car Co., and three Mikado locomotives for heavy freight service. One new dock is to be erected at Two Harbors by the Duluth & Iron Range road, as there is not storage space enough at the present time to take care of any great tonnage. One of the old wooden docks will be torn down and replaced by a larger one of steel and concrete. Considerable money will be spent by the Missabe road in improving and increasing the road's terminals at Proctor, and putting in additional track scales, which will be needed to meet the demand. The year 1916 is going to be an interesting one for the iron ore operators, the railroads and the boat lines, as there will be increased rates for hauling for the lake carriers, and the mining companies expect to receive at least 75c. more for their product than they have been getting the last two years.

GLOBE, ARIZ.—Nov. 30

Asbestos Mining on Ash Creek, 40 mi. northeast of Globe, is on the increase. The best-developed property is that of Fisk and Snell who have just completed a mill and are preparing to extract asbestos on a large scale. Altogether 3,400 ft. of development work has been done. Shipments averaging one ton per day have been going out on burros to Globe and to Rice on the Arizona Eastern R.R. Another property, part of which adjoins the Fisk and Snell claims and in which H. Kenyon Burch is said to be interested is to be opened up; work is scheduled to start next week.

A Shipment of Tungsten Ore was recently sent to the Primos Chemical Co. by Victor Jackson, who is leasing on the claims of the Powers Gulch Development Co. Jackson was employed to do assessment work on the company's property of 22 claims on the Gila and Pinal County line. He recognized as tungsten ore what had formerly been mistaken for rich copper ore and sent a sample to the Primos company which sent a representative to the property with the result that 831 lb. recently shipped brought $559 less freight. In all 2,000 ft. of development work has been done on the property; one shaft having been sunk to a depth of 104 ft. and another to 176 ft.

Work on Prospects in the Globe District on the eastern slope and foot-hills of the Pinal Mountains southeast of Globe has aroused no little interest locally, as important discoveries of gold-copper ore have been made. On one of these a shaft has been sunk to a depth of 26 ft. in ore averaging $17 per ton in gold, in another some $100 gold ore has been found, but the vein, which is between diorite and schist, carries copper as the chief metal. In one of these properties, the Logan, 2,000 ft. of development work has been done and some high-grade copper ore carrying about $8 gold is to be taken out for shipment to the smelter. The low-grade is of commercial concentrating ore. Gold ore is being mined by lessees on the southwestern slope of the Dripping Springs range south of Hayden. The low-grade ore assays $16 per ton but some of the leasers have run across a little high-grade specimen ore that runs up to $8,000 or $10,000. The vein is exposed in the hill and highgrade is found at depth.

The Christmas Mine a few miles above Winkelman will become an important producer by the first of the year. Christmas is now the terminal of the Phœnix & Arizona Eastern R.R., connections with Globe being made by auto-stage three times weekly. A small tonnage of ore is now being shipped regularly to the smeltery at Hayden; most of it being produced by leasers who are gophering into the hill along the outcrop of the load and transporting the ore down to the railroad terminus by burro. The Christmas mine was acquired by the A. S. & R. Co. this summer and is being put in condition for regular production, when 250 to 300 men will be employed. The work for the last few months has comprised building an ore pocket at the railroad terminus and another with crushing machinery just east of the main shaft; a wire-rope aërial tram, 7,000 ft. long, connecting the mine pocket with that at the railroad. The track cables have just been strung and when in operation it is calculated that about 25 hp. will be developed in excess. Electric power will be brought in from Hayden. The ore is bornite, chalcocite, chalcopyrite and pyrite in a garnetiferous gangue; the deposit being in a contact of limestone with granitic-porphyry. The orebody is wide and persistent with prominent outcrops and is said to be well developed down to a depth of 800 ft. The work is being done under the supervision of S. H. Sherman, who has been connected with the property for several years. The property was one time owned by the Saddle Mountain Mining Co. in which New Haven people were interested and by the Gila Copper Sulphide Corporation.

HIBBING, MINN.—Nov. 27

Tax Dispute between the mining companies and village officials was amicably adjusted on Nov. 23 at a conference in the city hall. The mining companies are to pay their taxes in cash within three weeks, except that they may pay in one-half of the village water-works warrants which they now hold. In return, the village is to limit its expenditures to $24,500 per month, except as to payments on certain outstanding contracts, or emergency expenditures. All litigation between the village and mining companies is to be abandoned. The proposed $1,900,000 tax levy for 1916 is likewise to be abandoned.

METALINE, WASH.—Nov. 30

Activity in the District is slowing up on account of the season, but prospects are that there will be a considerable amount of work undertaken in the spring. At present the Metaline Oriole Co. has started work in the lower tunnel to drive to the ore which was cut off by a fault. The Milwaukee Ltd., is asking for bids for 100 ft. of tunnel work, which it expects will cut the main vein. The Lead and Zinc Co. is working 25 men. The mill has been enlarged and is now awaiting the arrival of new machinery. It expects to be running at full capacity by the end of the year. The Riverside property is surveying its ground for a patent.

ATLANTA, IDAHO—Nov. 23

Considerable Activity, considering the handicap, is noted in the Atlanta district. The Boise-Rochester, which took over all the old Bagdad-Chase property, including 40-stamp mill, power plant, tram line, etc., has acquired additional ground—Old Chunk and Webfoot claims. The mill is dropping 20 stamps; the remaining 20 will be operated as soon as sufficient ore is blocked out. T. C. Brown, inventor of the Pachuca tank, has charge of the mill and is erecting an experimental cyanide plant to handle the concentrates. If this proves successful, the plant will be altered next summer to an all-slime cyanide mill. The ores of this district have been difficult to treat, and many failures have been made. The ore averages about $10, of which about 60% is saved by amalgamation, 20% on the concentrators, and 20% goes into the tails. The camp is handicapped by being 80 mi. from the railroad, and wagon roads over the mountains are closed six to seven months a year; the freight rate is $40 per ton when the roads are good. The district is in a forest reserve, and the Government exacts payment of 1c. per ft. for timber, 1c. apiece for lagging, $2.50 per M for lumber, and 65c. per cord for wood, for all such material used. The veins of the district are all soft, and close timbering is required, so that these fees to the Government seem to be a hardship to the miner. The Overlook Mining Co., 16 mi. from Atlanta, is installing a 10-stamp mill, Bleichert tramway, etc. S. A. Work is superintendent. Twenty-five men are working there.

The Mining News

ALASKA

ALASKA MEXICAN (Treadwell)—During October crushed 19,075 tons. Total yield per ton of ore milled, $1.43.

ALASKA TREADWELL (Treadwell)—During October crushed 82,593 tons of ore. Estimated gross realizable value $153,415.

ALASKA GOLD BELT (Juneau)—Face of tunnel was in 2,300 ft. on Nov. 26. Main orebody is expected to be cut at 2,500 ft.

ALASKA UNITED (Treadwell)—Started up 30-stamp addition to R. B. mill, Oct. 24. During October R. B. mill crushed 22,848 tons of ore and 700-Ft. mill 23,170 tons. Yield per ton of ore milled, $1.84 and $1.30 respectively.

ARIZONA

Cochise County

MASCOT COPPER (Mascot)—Shipped 1,256 tons of ore to smelters in October. Company has ordered new consolidation Baldwin locomotive.

CARTWRIGHT MINES (Johnson)—Virginia-Arizona Copper and Smelting Co. organization of Douglas men, has acquired Cartwright group in Winchester district southwest of Johnson.

MILLER CAÑON (Hereford)—News of a gold strike Saturday, Nov. 27, precipitated somewhat of a rush for this district. Miller Cañon is situated in the Huachuca mountains, few miles south of Hereford, and was located as placer ground.

Gila County

ARIZONA COMMERCIAL (Globe)—Reported to have decided to erect $50,000 power plant and discontinue using Old Dominion power.

NEW KEYSTONE COPPER CO. (Miami)—Company has now been dissolved. Distribution of 93c. per share upon outstanding stock of the company of the par value of $1 per share has been declared in full and final distribution of assets of company.

Greenlee County

THE FEDERAL INVESTIGATORS in the Clifton-Morenci-Metcalf strike district, Messrs. Davies and Myers, have completed their work after taking many affidavits at the three camps.

Maricopa County

MAX DELTA (Phœnix)—Plans to build mill at mine, 9 mi. south of Phœnix. Former United States Senator Lee Mantle, of Butte, Mont., is president.

Mohave County

TOM REED MINE (Kingman)—Cleaned up $100,000 in October.

GOLCONDA (Kingman)—Is now working 265 men and producing $250,000 monthly.

GOLD ROAD BONANZA (Gold Road)—Work has been started on 2-compartment shaft, to be sunk 200 ft.

COPPERFIELD (Mineral Park)—Copperfield Porphyry Copper Co. incorporated to develop 120 acres around Ithaca Peak.

NELLIE MINING CO. (Kingman)—Contract has been let for 4½x8x500-ft. shaft. Automobile road to property is being built.

SILVER & BIG BETHEL (Kingman)—Situated on Golconda vein. Has been sold to C. B. Bell and associates of Douglas.

MAZONA MINING CO. (Oatman)—Will start sinking 500-ft. vertical shaft upon its group of nine claims, adjoining Tom Reed and Gold Cliff mines on west.

SHOOTING STAR (Chloride)—Kingman Zinc Mining Co. has taken over Fountaine, Cupel, Robinhood and Shooting Star mines in the Stockton Hill district of Cerbat.

OATMAN BIG LODE MINES CO. (Oatman)—Preparing to start development work upon a group of six claims which it has acquired from D. P. Mitchell and associates.

CARTER M. & M. (Kingman)—Proposed 500-ft. shaft now down 250 ft. A 4-ft. vein assaying $14 was discovered in winze 20 ft. from southeast drift on 150-ft. level.

GOLD ORE (Gold Road)—Drifting on 500 level is being pushed. Thirteen feet of $40 ore has been encountered in east drift and 9-ft. vein assaying $100 has been found in tunnel going west.

OATMAN SECRET GOLD MINING CO. (Oatman)—Composed of prominent Arizona men, has just been organized to take over Gold Coin group. Wagon road to property is being constructed and bunk and cook houses are being built. A 50-ft. shaft will be sunk immediately.

OATMAN SYNDICATE MINING CO. (Oatman)—J. Parke Channing, consulting engineer of the Adolph Lewisohn interests, of New York, and associates have organized the Oatman Syndicate Mining Co., which has taken over the Putney group of 12 claims belonging to H. G. Putney, in Oatman district. A 500-ft. vertical shaft will be sunk and other development work done.

UNION BASIN (Golconda)—Expects to finish construction of 200-ton flotation plant about middle of next month. Its new high-tension electric-transmission line being built from Kingman to the Golconda mine, 20 mi., will be finished about same time. Controlling interest in the company is owned by N. L. Amster, of Boston, Mass., and associates. Mine is now producing between $200,000 and $250,000 gross, monthly. Main shaft has reached 900-ft. depth and station is now being cut.

Pima County

STRATTON COPPER CO. (Tucson)—Plans to build new concentrator at its mines in Catalina Mountains. Will have daily capacity of 500 tons.

PIONEER SMELTING (Corwin)—By a ruling of the state supreme court upholding Pima County Superior Court, Messrs. Walker, Zipf and Dickson, trustees in bankruptcy of the Pioneer Smelting Co., recovered on note for $31,000 and foreclosure on some mining claims.

Yavapai County

PORTLAND ARIZONA (Copper Basin)—Preparations being made to install large compressor.

COPPER CHIEF (Jerome)—Hayden Development Co. is erecting 200-ton mill. Reported 500,000 tons ore blocked out.

HÜBNERITE has been found in Eureka district. Claims adjoin holdings of Lawler, Wood and Connor, who have already made shipments of this ore.

PEAU COPPER (Prescott)—A. L. Garford, automobile manufacturer, has bought controlling interest in this mine in the Cherry Creek district and has let contract for much exploration.

RANDOLPH-GEMMILL DEVELOPMENT (Crown King)—Reported to be successfully treating refractory ores of that district. Milling 100 tons daily of old Crown King dump on lease. Will enlarge plant to treat custom ore.

MERRILL METALLURGICAL CO. (Prescott)—Negotiations for sale of Congress gold mine by Development Co. of America to Merrill Metallurgical Co. of San Francisco practically closed. Extensive dump is to be treated.

UNITED VERDE EXTENSION (Jerome)—Producing 40 tons daily, of which 10 tons average about 45% copper. Eighty men employed. Hoist being installed to handle ore from 1,400-ft. level and work is progressing on new tramway to supplant burro transportation from mines to railroad.

BROOKSHIRE (Jerome)—Green Monster Mining Co. has been organized to take over Brookshire, Treadwell, Layman and Clark-Hopkins groups in Jerome district. Consolidation embraces 30 patented and 26 unpatented claims, lying between United Verde and United Verde Extension. Identified with new company are N. E. Bailey, superintendent of United Verde & Pacific; Leroy Anderson, attorney for United Verde, and Thomas Taylor.

CALIFORNIA

Contra Costa County

VALLEY PIPE LINE (Martinez)—New line completed, extending from oil fields at Coliola, Shell tank farm, a distance of 157 mi. to Martinez. Capacity of line, 25,000 bbl. per 24 hr. Expected that this line will supply demand of refinery. Shell company has installed 35 additional 55,000-bbl. tanks, to increase storage capacity at refinery.

Butte County

JOSEPHINE-BUMBLEBEE (Oroville)—Preparations being made for development and extraction of ore. Installation of new mill of 25 tons' capacity contemplated; machine drills will be installed.

Calaveras County

SUMMERVILLE (Angels Camp)—New shaft will be deepened to 800 ft. Overhauling 40-stamp mill.

SOMMERVILLE (Angels Camp)—New shaft near Forth crossing is down 130 ft. Property former producer. The 40-stamp mill is being overhauled. Old 800-ft. shaft has been abandoned.

Imperial County

NEW LIVERPOOL SALT CO.—Claim against California Development Co. is under option to Imperial Irrigation district, El Centro. Terms are $600,000 in bonds.

MODOC MINES (Highgrade)—N. E. Guyot, manager, is getting in winter supplies. Drift at 200 level has encountered vein which was disclosed on 100 level. Shaft will be deepened to 300 ft.

Inyo County

KEANE WONDER (via Rhyolite, Nev.)—Property has just come into possession of its new owners: Francis-Mohawk Mining and Leasing Co. of Goldfield, Nev.; F. L. Wildes, receiver of State Bank and Trust Co.; and E. F. Tatem, of Montana. Property was sold in November, 1914, to satisfy judgment. Equipment consists of 20-stamp mill, cyanide plant, and aërial tram mine to mill. Operations are to be resumed.

Mono County

PITTSBURG-LIBERTY (Masonic)—Mill operating full capacity on ore, chiefly from Golden Serita where good ore has been disclosed on 100 level. Some high-grade with milling ore. Development in Pittsburg-Liberty mine progressing satisfactorily. New York claim has been acquired by J. D. Martin and development started.

Nevada County

BLACK BEAR (Grass Valley)—New compressor and air pump of 300-gal. capacity being installed.

CONLIN (Grass Valley)—Alfred B. Swinerton, R. M. Hotaling and others, of San Francisco, have examined and are reported to have begun negotiations for purchase of property. Mine was formerly producer of high-grade ore.

COLUMBIA (Washington)—Ten-stamp mill crushing 50 tons of ore per day. Large amount of ore blocked out and reserve broken down. Compressed-air drills are used in drifts. Mine will operate all winter regardless of weather.

POLAR STAR (Grass Valley)—Ten men are employed and number will be increased as soon as living quarters are provided. Electric hoist and pump about ready for installation. Property adjoins North Star. Salt Lake men are operating. Oscar Coffine is superintendent.

EXCELSIOR (Forest Hill)—Second unit of three stamps has been added to mill and third is in course of construction in San Francisco. Reported that mill is crushing 100 tons of ore per day. New office building and five new residences have been built, giving camp a prosperous appearance.

OCEAN STAR (Washington)—Property which is owned by Englishmen will be reopened, with N. M. Melrose superintendent. Winter supplies have been ordered and development started. Recent financial difficulties said to have been adjusted to permit resumption of work. Shaft will be deepened and mill capacity increased.

Plumas County

ENGELS (Taylorsville)—Preliminary railroad survey on mine to Western Pacific R.R. about completed.

NEW YORK (Greenville)—Work in No. 3 crosscut will be renewed and extended until the vein is encountered.

STAUFER (Greenville)—Superintendent Elliott reports everything in readiness for winter work and probability of extensive development.

Sierra County

SOUTH FORK (Downieville)—Mason gravel claims bonded to Thomas Wilson of Manhattan, representing a Nevada company, who will soon begin active work.

MONARCH (Sierra City)—Richest and most important strike in 20 years in Sierra City district recently made here. Ore averages thousands of dollars per ton gold. This mine is on serpentine belt on which old and rich Sierra Buttes mine is located, and is being developed by R. G. Gillespie, of Pittsburgh, Penn. Extensive surface and power plant built during past year. Large restraining dam being built to hold tailings, and all preparations for continuous work on large scale at both mines during winter. D. McGonigal, superintendent.

Shasta County

REID (Redding)—New vein reported on 700 level. If ore proves to be medium grade, preparations will be made for extensive development, as orebody is said to be large.

ELDORADO (French Gulch)—James Connor, owner of this mine on Clear Creek near Tower house, is mining high-grade ore and treating it in two-stamp mill. Last cleanup returned $400 from 10 days' run.

HAY FORK VALLEY DREDGING GROUND reported at Weaverville to have been bonded to G. E. Hunter. There is large acreage in valley and it is believed that good proportion of it will prove valuable for dredging.

GLADSTONE (French Gulch)—Reported that ledge which was lost on 1,200 level has just been disclosed on 1,300 level. Number of men reduced in September, 75 being laid off and 32 retained to carry on drifting on 1,300 level. Gladstone is one of large producers of state and within past year or so has made important improvements including a steel headframe. J. A. Jilson, manager, and Edward L. Young, superintendent, were both confident that orebody would persist to and below 1,300 level.

GOLDEN JUBILEE (Carrville)—Mine taken over by California Extracting Co. of San Francisco. Purchase price said to be $50,000. Mine was located in 1896 and developed into good producer. Ores near surface were free-milling, but at depth refractory sulphides were encountered. Recently 40-ton cyanide plant was installed. Property was owned chiefly by Mcormick-Saeltzer Co. of Redding. Present operators contemplate installation of a tube mill and adoption of Vandercook process.

COLORADO

Clear Creek County

ONEIDA (Freeland)—Body of rich gray-copper ore has been opened in raise extended to height of 150 ft. at point about 1,000 ft. from portal of the Stag tunnel. Last 25 ft. of raise is in ore. Vein is 5 ft. wide and assays 0.52 oz. gold, 10 oz. silver and 4% lead.

UNITED FREELAND DEVELOPMENT AND TUNNEL CO. (Idaho Springs)—Property of this company, embracing over 100 patented lode mining claims and several millsites and tunnel sites, has been purchased by syndicate of Chicago and St. Louis capitalists, who have planned campaign of extensive development through McClelland tunnel. Portal of tunnel is located about 5 mi. west of Idaho Springs and one mile east of Dumont. Tunnel is now 7,150 ft. long. New company plans advance of 3,000 ft. to develop Freeland and Lamartine districts. Connection will be made with old Freeland shaft and workings will be drained. This connection will require 1,100 ft. of tunnel and 1,000 ft. of raising. It is probable that Lamartine, Gum Tree, Oneida, Lone Tree and Freeland Extension properties will all be benefited by new development Company contemplates construction of a modern milling plant at portal of tunnel, for treating its own ores and product of properties tributary to tunnel. L. W. Shaffer, of Idaho Springs, has been appointed general manager.

Lake County

DOWNTOWN PUMPING CO. (Leadville)—Has experienced provoking delays due to motor troubles, centrifugal pumping units having been idle at intervals that permitted heavy flow of water into old workings of Penrose and neighboring mines to gain appreciably on unwatering operations.

Ouray County

CAMP BIRD, LTD. (Ouray)—In October crushed 5,730 tons ore; estimated profit, £11,500.

IDAHO

Shoshone County

HECTOR (Wallace)—Long crosscut expected to cut vein 3 miles from portal has reached position vertically below outcrop, depth of 1,800 ft.

INTERSTATE-CALLAHAN (Wallace)—Judge Dietrich of Federal court has issued order discharging receiver appointed by Judge Woods of state court for this company.

BROWN & FINNELL (Pine Creek)—Operators have bonded Pine Creek antimony property to Burke McIntosh and associates, of Kellogg. New owners plan mill to treat entire mine output.

CLIMAX (Wallace)—Building has been erected for 10x10 compressor and 35-hp. motor, which will be installed at once, contract having been made with Washington Water Power Co. for current.

NATIONAL (Mullan)—National mill started Nov. 11. Only one shift is being worked now. National ore is low-grade copper, average probably not exceeding 2%, but carries considerable silver. Large amount of ore blocked out.

TAMARACK-CUSTER (Wallace)—Reports emanating from reliable sources, state that Tamarack-Custer is negotiating with Ray-Jefferson company to join in construction of mill to treat output of both properties, which lie near each other in Nine-Mile district of Coeur d'Alenes.

GETTYSBURG (Mullan)—Official statement from W. E. Cullen, secretary Independence Lead Mines Co., who is also secretary of the Stewart Mining Co., reports work concentrated on No. 4 tunnel of Gettysburg, from which raise will be made to No. 3, in which there is large body of lead ore. This is known as Gettysburg vein, extension of You Like. No. 4 tunnel also being extended to cut Morning vein.

MICHIGAN

Copper

COPPER PRODUCTION from the mines of the Michigan district ran close to 25,000,000 lb. for the month of November, and for December the product will be over 23,000,000 lb. refined, if the present basis of operation is maintained. Production for the Lake Superior district for the present year is estimated at more than 250,000,000 lb. The average price for the year will be above 16c.

AHMEEK (Kearsage)—Is producing larger tonnage of copper rock than ever before in its history and percentage of copper content is above average for Kearsarge formation, although not quite up to last year or year before for Ahmeek. Mill now is operating six heads and handling an average of 100,000 tons of copper rock each month, so that production is at rate of about 25,000,000 lb. per year.

CALUMET & HECLA (Hubbell)—Third of large furnaces for smelting plant at Hubbell now under construction. Work will be continued during winter. New furnace will have capacity of 150,000 lb. and will have electric equipment for loading and dumping. It is modeled after No. 20 and No. 21, each of which has capacity of 150,000 lb. The C. & H. smelting and refining plants now have payroll of 500 men, twice what it was year ago.

Iron

ODGERS (Crystal Falls)—Shaft sinking was started this week.

L. S. & I. RY. (Marquette)—Four new locomotives are to be ordered for ore hauling.

PIONEER IRON (Marquette)—Ten more retorts are to be added to the furnace plant. Ten are now being constructed.

CLEVELAND-CLIFFS IRON (Ishpeming)—At special meeting of shareholders, held Dec. 1, it was decided to increase capitalization of company from $5,000,000 to $10,000,000.

AMERICAN (Diorite)—Two electric pumps now taking water from big swamp that overlies part of orebody. Water level was lowered 20 ft. by sinking 6 large sandpipes and forcing water to surface by air.

MINNESOTA

Mesabi Range

BARNETT & RECORD (Two Harbors)—Has been awarded contract for dismantling No. 2 Dock of Iron Range R.R., which is to be superceded by $1,500,000 steel and concrete dock. Old No. 3 Dock will not be torn down until completion of the new dock.

ARTHUR MINING CO. (Hibbing)—Three large steam shovels have been ordered from the Bucyrus Co.; will weigh 315 tons each. Booms will be 75 ft. long; dipper capacity will be 7 yd. Will be possible to make cut 50 ft. deep with them. Three Osgood shovels have also been ordered. Eight new locomotives will be delivered before spring.

LEONARD NO. 2 (Chisholm)—Electric locomotives operating on stockpile are handling three cars each, all side-dump. Ordinarily but one car is used, but change is necessitated because of unusual length of the stockpile. Distance to be trammed is so great that hoisting would be delayed if but one car were used.

MONTANA

Beaverhead County

BANNACK GOLD (Bannack)—Reported that ore assaying 36.8 oz. in gold and 43.7 oz. in silver was encountered in No. 2 Thompson stope of Golden Leaf mine. It has been opened up at a point about 280 ft. from surface. Company has blocked out in neighborhood of 160,000 tons of milling ore. It has been decided to block out at least 200,000 tons before beginning construction of amalgamation and cyanide mill, which will probably be started Mar. 1.

Blaine County

LITTLE ROCKIES DISTRICT—Considerable mining excitement around Landusky, Whitcomb and Ruby Gulch; gold-bearing claims being worked on increasing scale. Mining at Zortman has been in progress for years. Eastern capitalists have taken options on claims, aggregating in value $150,000, and installation of big mining plant near Landusky may follow.

Deer Lodge County

WASHOE REDUCTION WORKS (Anaconda)—Construction work is making rapid strides. New roaster building is nearing completion and bricklayers are now busy on building and lining roasters. Large flue for roasters was started last week, also erection of 1,000-ton coal bin for pulverizing plant. Slime-flotation building is also nearing completion and concentrate tank-house is being retimbered.

Lewis & Clark County

SCRATCH GRAVEL MINING DISTRICT—Resumption of operations at Head properties in this district by John MacGinnis, H. L. Wilson and associates of Butte, and fact that they are taking good pay ore out of property, has started great amount of prospecting in adjoining claims and has created mild boom in district.

Silver Bow County

ANACONDA (Butte)—Work on old Alice mine at Walkerville, stopped for some time because of litigation, resumed.

EAST BUTTE (Butte)—Now producing at rate of 20,000,000 lb. of copper per annum at a cost of 10c. per lb. New flotation plant is practically ready for operation.

BUTTE-DULUTH (Butte)—Capt. A. B. Wolvin, who owns three-fifths of stock and some bonds of company, will soon announce arrangements made for taking care of most pressing claims and property, only one now idle in Butte, will be operated again.

DAVIS-DALY (Butte)—About 75 tons of ore per day being mined and shipped from Colorado mine, running about 7% in copper. It is probable that November profits will amount to $10,000. Planning to install new hoisting engine; also to cut out shoulder between 1,700 and 1,900 levels to make three-compartment shaft down to 2,500 level, which would enable company to increase output to 400 tons of ore per day.

NEVADA

Esmeralda County

JUMBO EXTENSION (Goldfield)—During quarter ended Sept. 30 shipped 8,354 dry tons, gross value $325,040, on which the smelting loss was $37,721, freight and treatment $73,274, sampling $5,406, and mine costs $47,348, leaving net realization of $161,289.

REORGANIZED KEWANAS (Goldfield)—On 840 level from main winze and about 300 ft. northerly from it, new winze has been started on vein near hanging wall to go to latite-shale contact and explore vein at that horizon.

GOLDFIELD CONSOLIDATED (Goldfield)—Production for October was 36,500 tons and net realization $98,375. Net operating costs were $4.40 per ton. Leasers produced 119 tons valued at $3,995. Ore transportation to mill over Consolidated line now being handled under contract by T. & G. railroad.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 27 was 9,951 tons, estimated value $265,078, compared with 10,093 tons for week previous. Producers were: Tonopah Belmont, 3,006 tons; Tonopah Mining, 2,900; Tonopah Extension, 1,850; Jim Butler, 1,100; West End, 647; North, Star, 52; Halifax, 49; miscellaneous leases, 347 tons.

HALIFAX-TONOPAH (Tonopah)—On 1,200-ft. level at point of recent ore discovery, work of cutting station and installing hoist at collar at 40-ft. winze completed and sinking resumed. Progress at Halifax is being watched with interest as it holds large possibilities in eastern extension of Tonopah's proven ore zone.

TONOPAH BONANZA (Tonopah)—Greenwater Copper Mines and Smelting Co. through purchase of 200,000 shares of treasury stock and other large interests has acquired control of this property from Herman Zadig, of San Francisco. John Magee has been appointed superintendent. Although no details have been given out, it is stated that shaft, which has present depth of about 1,040 ft., will be equipped to sink to 2,000-ft. mark. This marks entrance of another strong company into development of Tonopah's western section.

Storey County

ANDES (Virginia)—Saved 10 cars ore from stope above 175-ft. level.

SIERRA NEVADA (Virginia)—From stope in 2,500 level shipped 91 tons to the mill; average assay $14.22 per ton; southeast drift from west crosscut in low-grade ore.

CROWN POINT-BELCHER (Gold Hill)—Extracted 251 cars of ore from No. 1 stope on 1,600 level and shipped 575 tons of dump rock and 225 tons of mine rock to the mill; bar of bullion shipped.

UNION & SIERRA NEVADA (Virginia)—Joint east crosscut from 100-ft. point in raise above 2,500 level shows face of $50 ore. Saved from this work 28 cars of ore averaging $65.48 per ton.

MEXICAN (Virginia)—East crosscut 2,700 level in porphyry and quartz of low assay. Mexican mill crushed 168 tons of custom ore, average assay $25.63 per ton. Mill idle 4 days on account of delayed shipment of zinc dust.

OPHIR (Virginia)—In southwest drift 2,500 level, at 271-ft. point 4 ft. of low-grade quartz exposed in upper blast; porphyry and quartz also at 126-ft. point. Central tunnel north drift in milling quartz over 2 sets wide. Saved from stopes 362 cars of ore and milled 331 tons.

UNION (Virginia)—From north end No. 3 stope 2,500 level saved 14 cars averaging $10 per ton; from south end saved 21 tons averaging $33.42 per ton. Saved from raise No. 1 14 tons, averaging $21. Top of raise in $19 ore. Sill floor northeast drift shows $10 ore in face.

UTAH

Beaver County

FORTUNA GOLD QUEEN (Beaver City)—Being prepared for more extensive development; lumber for four buildings has been received; expected to have these ready before cold weather sets in. Considerable opencut work is being done. Ore from Davis lease has been tried out at Sheep Rock mill, and good saving made. Ore has been opened on another lease, and work is being done to cut extension of vein productive in Davis lease.

Juab County

UNCLE SAM (Eureka)—Tunnel being driven to prospect for continuation of recent Yankee strike. Leasers are mining some ore in old workings.

RIDGE & VALLEY (Eureka)—Lead-silver ore of good grade has been opened from 1,600 to 1,670-ft. level, and is being mined. Workings are being put in shape for increased production.

Salt Lake County

SOUTH HECLA (Alta)—Face of 500 level, which is being driven on Wedge fissure, is heavily mineralized, and carries bunches of ore in places. About 6 ft. a day progress is being made.

MONTANA BINGHAM (Bingham)—Conger vein has been cut in this company's tunnel. Bingham Conger Copper Co. claims that vein apexes on its ground and is working 20 men with view to proving this.

OHIO COPPER (Bingham)—General Exploration Co. is mining and milling 2,000 tons of ore a day. Minimum royalties amount to $6,250 a month, according to the terms of the lease, and have averaged around $15,000. Royalties are 10% on 16c. copper, 14% on 18c. copper, 16% on 19c. copper, etc. Lessees are reported to be making upwards of $20,000 a month.

SELLS (Alta)—Ore shipments are to be started soon from this property adjoining South Hecla, as soon as hauling conditions permit, roads at present being congested with shipments from latter property. Orebins and ore chute from top of dump to bins are completed. Hauling is now done by sleds to Tanner's Flat and from there by wagon to Wasatch over a poor road.

Summit County

PARK CITY ORE PRODUCTION for November amounted to 5,855 tons, estimated at $234,200. This is compared with 8,262 tons shipped in October from four principal producers; five shipping weeks entered into October, while only four were counted in November. The strike, with a 10-day tie-up, at the Coalition, heaviest producer in camp, cut down aggregate one-third from normal output. Producers were: Daly-Judge, 2,010 tons; Silver King Coalition, 1,220; Silver King Consolidated, 1,100; Daly West, 890; Ontario, 75; Daly, 60; others, 500.

DALY-WEST (Park City)—Work is to be resumed at No. 3 shaft and this section of mine is to be unwatered to 1,700-ft. level.

SILVER KING CONSOLIDATED (Park City)—Galena ore has been opened near east end of 1,700 level. Water-tank holding 23,000 gal. has been built on hill slope 186 ft. above collar of shaft for fire protection.

Tooele County

LION HILL CONSOLIDATED (Ophir)—Shipments begun in spring from St. Clair lease are stated to have amounted to $50,000. Siliceous silver ore carrying some lead and gold has been followed for 300 ft.

WISCONSIN

Zinc-Lead District

STONER (Linden)—Stoner Bros. has completed a 50-ton mill at Linden.

VINEGAR HILL ZINC (Platteville)—Company is building 200-ton mill on Blackstone tract at New Diggings.

K. M. & C. (Platteville)—Ray Keating and others are building 75-ton mill on Wilkinson property at Benton, surface equipment of which was destroyed by fire early in summer.

WISCONSIN ZINC (Platteville)—Contemplates building four mills, 200 tons each, on Longhorn, Birkbeck, C. A. Thompson and East End Champion. New Skinner roaster at Champion mine has been put in operation; plant is equipped with six Cleveland-Knowles separators and will handle 800 tons of green ore per week.

CANADA

Yukon Territory

NORTH WEST CORPORATION (Dawson)—Considerable additional stripping work done during current season. Excavating and washing plant installed to treat the gravel of Dominion Creek. A. N. C. Treadgold, managing director. This company is subsidiary of Granville Mining Co. of London and New York.

MEXICO

Pachuca

SANTA GERTRUDIS (Pachuca)—Ore crushed during October, 20,503 tons; estimated profit, £6,740.

SOUTH AMERICA

Chile

BRADEN COPPER (Rancagua)—During September mill treated 89,361 tons of 2.02% ore; produced 7,908 tons of 13.12% concentrates. Minerals Separation treated 87,110 tons; concentrates, 20.77%; copper produced, 1,611 tons.

ASIA

Chosen

ORIENTAL CONSOLIDATED (Unsan District)—Tonnage milled during October was 25,432 and bullion shipments amounted to $135,537. Cable advices are that November cleanup amounted to $144,800. Value of the ore milled was above average.

The Market Report

Metal Markets

NEW YORK—Dec. 8, 1915

All of the principal markets were softer last week, but the recession in prices was trifling in all cases with the exception of spelter, which became rather demoralized.

Copper, Tin, Lead and Zinc

Copper—Business was light, but there were moderate transactions from day to day both with domestic and foreign buyers. The producers generally asked 19¾c., r. t., and some of them reported business at that figure, while others reported that they had been unable to get it. From certain first hands copper was available at 19⅝c., r. t., and a round lot was reported sold at that price on Dec. 3. Sales for delivery in Europe were made at £97 on Dec. 2, and at £98@98½ on the following days. Computations of the New York cash equivalent of these prices were variable owing to the uncertainties of freight rates and exchange. During the last week contracts for carrying copper to Europe were made on the basis of $1 per 100 lb., which a few months ago would have been an incredible figure. Some sales of copper for export were made during the last week on the basis of f.o.b., New York, some of this business being done at 19¼@19½c. Copper prices during the week exhibited a considerable range, there being variations among sellers and also according to deliveries, prices being a little stiffer for near-by deliveries than for the later ones.

Copper Sheets, base price is 25c. per lb. for hot rolled and 26c. for cold rolled, with usual extras. Copper wire is 21@21½c. per lb., carload lots at mill.

Copper Exports from the United States for the week ended Nov. 20 are reported by the Department of Commerce at 19,551,362 lb. The principal items were 7,318,441 lb. to France, 5,977,122 lb. to Italy and 4,009,809 lb. of England. Copper imports for the week were: Metal, 6,348,058 lb.; in ore and matte, 518,133 lb.; total, 6,866,191 lb. The larger imports were from England, Peru, Canada and Chile.

Visible Stocks of Copper in Europe on Nov. 30 were: Great Britain, 13,572; France, 1,473; afloat from Chile, 2,400; afloat from Australia, 3,500; total, 20,945 long tons or 4,691,680 lb. This is a decrease of 623 tons from Nov. 15; and of 3,980 tons from the Oct. 31 report.

Tin—But very little business was done. Owing to the small demand and the larger arrivals the market declined.

Visible Stocks of Tin on Nov. 30 were: United States excluding Pacific ports, 10,062; London, 5,514; Holland, 875; total, 16,451 long tons, or 3,685,024 lb. This is an increase of 3,297 tons during November.

Lead—Early in the week premiums continued to be realized for special brands of lead, but later the market became easier and the metal was available in nearly all quarters at 5.25c., New York, at which price there were more sellers than buyers.

Spelter—On relatively small business the market experienced a severe decline, for which there was apparently no special reason other than the perception of the hollowness of the recent advance. The foreign demand which previously had been the backbone of the market having ceased, temporarily at least, the producers beat a retreat. In the latter part of the week prompt spelter was available from many quarters at 15c., January, at 14c., January-February-March, at 13c. The bulk of the business that was done by producers was for January-March delivery. Spelter for delivery in the second quarter of 1916 was offered at much lower figures, there being apparently a willingness of some sellers to contract at less than 11c. for such business.

Arrivals at Baltimore for the week included 7,471 tons zinc concentrates from Port Pirie, Australia.

Zinc Sheets are in good demand but have not advanced this week, and the base price today is $22 per 100 lb., f.o.b. Peru, Ill., less 8% discount

Exports and Imports of the principal metals, other than iron and steel, in the United States nine months ended Sept. 30, copper and tin in long tons, lead and zinc in short tons:

	Exports		Imports	
	1914	1915	1914	1915
Copper	298,505	221,305	116,941	105,121
Tin	543	515	34,055	39,540
Lead	50,211	92,240	17,556	40,561
Zinc	24,946	95,922	819	715
Ores:				
Zinc	8,499	713	14,931	93,291
Zinc ore, contents	140	609	5,664	36,222

Exports include reëxports of foreign material. Copper includes contents of ore and matte; lead, contents of ore and base bullion.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
Dec	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
2	4 7075	55½	@19 45	38¼	5.25	5 17½	14 50
			@19 55		@5.32½	@5.22½	@17.00
			19 40		5.25	5.15	13.50
3	4 7038	55	@19 55	38¼	@5.32½	@5 22½	@16.00
			19 35		5 25	5.15	13 00
4	4 7038	55	@19.55	38½	@5 32½	@5 22½	@15.00
			19.25			5 15	13.00
6	4.7038	56¼	@19 50	37¼	5.25	@5.20	@15 00
			19 45			5 15	12 50
7	4 7125	56¼	@19 55	37¼	5.25	@5.20	@15 00
			19 45			5.15	12 50
8	4.7125	55¾	@19 55	37¼	5.25	@5.20	@15.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash The difference between the price delivered and the New York cash equivalent is at present about 0 20c. on domestic business. The price of electrolytic cathodes is 0 05 to 0 10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands Quotations for spelter are for ordinary Prime Western brands. Only the St Louis price is herein quoted, St Louis being the basing market We quote the New York price at 17c per 100 lb. above the St Louis price

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb are: St. Louis-New York 17c.; St Louis-Chicago, 6.3c ; St Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
Dec	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos	£ per Ton	Cts. per Lb	£ per Ton	Cts per Lb
2	26⅛	79½	80	99	20.81	165¼	164½	28⅜	6 04	100	21 03
3	26 7/16	78¼	78¾	98½	20 71	168	167½	28¼	5 94	93	19.55
4	26 7/16	...	...	...							
6	27⅛	78	78½	98	20 50	166	165¼	28¼	5.94	89	18.71
7	26 9/16	77¼	77½	98	20 55	165½	165	27¾	5 87	87	18 33
8	26½	76½	77	98	20.55	166	165½	28¼	5.93	84	17.52

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent discount For convenience in comparison of London prices, in pounds sterling per 2240 lb , with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4 80 : £ 15 = 3.21c ; £20 = 4 29c.; £30 = 6 43c.; £40 = 8.57c.; £60 = 12 85c Variations, £1 = 0 21¾c.

Exports of **Metals and Minerals from Spain** eight months ended Aug. 31, as reported by "Revista Minera" in metric tons:

	Metals		Ores, etc.	
	1914	1915	1914	1915
Iron	12,441	95,176	4,881,927	2,931,030
Copper	15,729	11,706	74,975	26,304
Copper precipitate	7,282	8,010	..	..
Lead	110,665	95,899	1,560	641
Zinc	1,454	2,843	65,306	21,579
Quicksilver	1,275	703	..	..
Manganese	..	..	7,238	5,439
Pyrites	..	..	2,079,658	1,299,281
Salt	..	..	417,075	352,864

Imports of coal for the eight months were 1,446,319 tons, a decrease of 309,734 tons from 1914; imports of coke, 128,027 tons, a decrease of 140,188 tons.

Other Metals

Aluminum—The market remains about the same. Imported metal is scarcer, and the American producer has none to spare for early delivery except on contract. Quotations are 57@60c. per lb. for No. 1 ingots, New York, for a spot delivery.

Antimony—The market continues strong, although business has been on a moderate scale. Supplies are low and prices are very firm. Chinese and other ordinary brands are quoted at 39@40c. per lb. Cookson's is held as high as 55c., with very little to be had. Under present conditions it costs close to 40c., duty paid, to import Chinese. Antimony ore is also in small supply and has been sold at $2.55 per unit.

Nickel—There is no change to be reported. Ordinary forms are 45@50c. per lb., according to size and terms of order. Electrolytic is 3c. per lb. higher.

Quicksilver—This metal has advanced sharply and is very firmly held. Stocks are very low. The New York quotations are $120@125 per flask of 75 lb. Some dealers will not quote, having no stocks or only enough to supply regular customers. San Francisco reports by telegraph a firm market, very light stocks and sales as high as $115 per flask, with little or no prospect of a decline. On the other hand, London price is unchanged at £16 10s. per flask, with the same quotation from second hands.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted as 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium metal,** 75c. per lb., New York.—**Cobalt metal,** 97% pure, is sold at $1.75@2 per lb.—**Magnesium,** pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.

Gold, Silver and Platinum

NEW YORK—Dec. 8

Gold in the United States Dec. 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,427,167,399; in Treasury current balances, $221,663,793; in banks and circulation, $611,856,355; total, $2,260,687,547. This is an increase of $62,573,785 in November.

Gold sales from the United States Assay Office in New York in November were $3,679,450, being $226,686 more than in October, and $570,607 more than in November, 1914. For the 11 months ended Nov. 30, the total sales were $58,860,366 in 1914, and $31,572,157 in 1915; a decrease of $27,288,209 this year.

Platinum—There is no change in the market. Supplies are very scarce and dealers hesitate to make quotations, transactions being rather a question of negotiations. Quotations are approximately $70@74 per oz. for refined platinum and $71@78 per oz. for hard metal.

Iridium—This metal is also very scarce. No definite quotations can be given, sales being a matter of negotiation in each case.

Palladium—Some sales are reported at $45@50 per oz., according to size and terms of order.

Coined Silver in the United States Dec. 1 is estimated by the Treasury Department as follows: Standard dollars, $568,271,655; subsidiary coins, $188,695,357; total, $756,967,012. Of the standard dollars $489,093,355 are held in the Treasury against silver certificates outstanding.

Silver has had some reaction owing to the filling of the India orders in connection with Mint buying. The disposition of the English Mint is not to force the price up but to absorb the floating amounts of bullion at current rates

Exports of silver from London to the East Jan. 1 to Nov. 24, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£4,679,500	£3,495,000	D. £1,184,500
China	42,000	7,000	D. 35,000
Total	£4,721,500	£3,502,000	D. £1,219,500

Stocks in Bombay are reported on Nov. 24 as reduced to 5,700 bars

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Dec. 4

The base price paid this week for 60% zinc ore was $100 down to $94 at week end. The base price paid for 80% lead ore was $70 per ton.

SHIPMENTS WEEK ENDED DEC. 4

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,104,090	125,500	791,400
Year	195,231,750	5,643,500	27,325,710

Shipped during week to separating plants, 5,588,000 lb. zinc ore

JOPLIN, MO.—Dec. 4

Blende, high price, $107.35; base per ton 60% zinc, premium ore, $105; medium, $100@90; lower grades down to $85; calamine base per ton 40% zinc, $70@60; average selling price, all grades of zinc, $97.93 per ton. Lead, high price $72.90, base per ton 80% metal content, $70@71; average selling price, all grades of lead, $66.64 per ton.

SHIPMENTS WEEK ENDED DEC. 4

	Blende	Calamine	Lead	Values
Totals this week	11,825,620	1,063,950	2,236,520	$705,690
Totals this year	546,877,620	42,773,650	$5,146,700	25,202,770

Blende value, the week, $594,890; 49 weeks, $21,822,500.

Calamine value, the week, $36,280; 49 weeks, $1,098,150.

Lead value, the week, $74,520; 49 weeks, $2,282,120.

While this week's shipment is above an average one it is a drop of 2,700 tons from last week and shows the effect of the lower spelter market. During November the demand was exceptionally strong and practically all the reserve stock was shipped away, leaving only 1,700 tons at Granby where there was 4,000 tons a month ago. Miami is about cleaned up and none of the other camps have had more reserve than a two days' production at the end of the week for many months. Miners working on a sliding scale wage base will be paid during December on an average base price of zinc for November of $101.25, against $82 base of November wage scale. They were notified of this last Monday and nothing more was heard of the threatened strike.

Iron Trade Review

NEW YORK—Dec. 8

The iron and steel trades continue strong and active. The most notable change apparent is an increase in domestic orders and some falling off in steel for shells and other war munitions for export. The gain in domestic orders is largely in structural steel.

The control of the Cambria and the Pennsylvania steel companies seems to be still in doubt. Numerous rumors as to the condition of affairs and the projected combinations are current, but there is no certain information to be had.

The syndicate which is planning a combination of Eastern blast furnaces now has options on the Thomas, the Wharton, the Empire and the Crane iron companies. These companies together own 15 blast furnaces in Pennsylvania and New Jersey with iron-ore mines, coal mines and coke ovens. All are producing properties and would constitute an important block of merchant furnaces.

Exports from Baltimore for the week included 2,751,992 lb. steel bars, wire rods and skelp to Liverpool.

The Bethlehem Steel Co. is having plans prepared for the erection of three new blast furnaces at South Bethlehem. The Midvale Steel and Ordnance Co. is arranging to build an additional blast furnace at Coatesville, Penn., at the Worth Brothers plant.

PITTSBURGH—Dec. 7

The runaway market in steel products that was so apparent last month is being checked to an extent by the fact that there is little to run away. The steel mills are filled up solidly with business for months to come, while buyers with scarcely an exception have gotten their tonnages onto the mill books, the real question in the trade being one of arranging deliveries so as to discommode the smallest number of buyers, of course paying attention to the sequence in which specifications have been received. This sequence is not the governing element in all instances by any means as cases are cited of buyers desiring some of their later specifications to be filled before earlier specifications.

Finished-steel prices have become practically nominal in the majority of lines. While precise quotations are available as representing the market in general it is frequently impossible to buy at them. Thus bars, plates and shapes are 1.70c., with premiums for early delivery, and open contracts usually refused at any price. Sheets are strong at 2.50c. for black, while 2.25c. on blue annealed has become practically nominal. The leading interest quotes nominally 4.75c. on galvanized, but is practically filled up for three months. Wire mills are congested with business.

A situation has been reached in which the purely domestic demand for steel is beyond any previous record and the war demand, while important, is no longer the principal element in the market. Recent rumors that the Allies will buy less when present contracts for war steel expire do not seem to cause the least concern in the steel industry

Pig Iron—The boom in steel has reached pig iron, as prices are advancing sharply with a comparatively small turnover, all indications being that the trade is facing an actual scarcity. The supply of idle furnaces to come in and retard the advance seems now to be exhausted. Sales of bessemer pig iron reported in the local market include 3,500 tons at $18, an advance from $17.50, 1,100 tons at $18.50 and 1,000 tons, in two lots of 500 tons each, made this week at $19, apparently the minimum of the market today and representing an advance of $1.50 on a turnover of scarcely more than 5,000 tons, altogether an unprecedented performance for bessemer iron. It is stated that a firm bid of $20 for January delivery has been turned down. Foundry iron is in fairly large request and prices have been advancing sharply, by 50c. to $1 in the week. Basic shows no activity and the last important domestic sales, at $16, Valley, have no bearing on the present situation. There have been sales for export at around $18, Valley, but under peculiar conditions. We quote: Bessemer, $19@20; basic, $17@18; foundry and malleable, $17.50@18; gray forge, $17@17.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report average prices in November, computed from actual sales in 1,000-ton lots and over, at $16.615 for bessemer, an increase of 61.5c., and $15.518 for basic, an increase of 50.33 cents.

Ferromanganese—Better deliveries of English ferromanganese are in sight and the $100 contract price is a definite factor, domestic producers being therefore disposed to recede from their former quotation of $110. Prompt lots bring about $100 per ton.

Steel—Hardly anything is being done in the open market, steel being so scarce. A producer of openhearth steel has bought a round lot of bessemer billets at $29 for use in its finishing mills, giving it more openhearth steel to sell in unfinished form. Several similar transactions, by other mills, were reported last month. The market is quotable at $29 for bessemer billets and sheet bars and $30 for openhearth, at maker's mill, Pittsburgh or Youngstown, but the quotations are practically nominal. Forging billets are $48@50 and rods $38@40, Pittsburgh.

Foreign Trade in Iron and Steel in the United States 10 months ended Oct. 31 is valued by the Department of Commerce as below, the figures including machinery:

	1914	1915	Changes
Exports	$152,776,839	$251,112,482	I. $98,335,643
Imports	22,905,321	14,818,206	D. 8,087,115
Excess, exports	$129,871,518	$236,294,276	I. $106,422,758

The chief changes were in the later months. September exports were more than three times those of last year.

FERROALLOYS

Ferrosilicon, high grade, 50%, is $83@85 per ton at furnace, according to size of order; bessemer ferrosilicon, from $84 at furnace for 16%, down to $24 for 10%, for 1916 delivery. Spot is $1 higher.—**Ferrotitanium** is 8@12.5c. per lb., according to size of order.—**Ferrovanadium** $2.25@2.50 per lb. of contained vanadium.—**Spiegeleisen,** $28@30 per ton at furnace.—**Ferrotungsten** is very high and irregular. Sales have been reported as high as $6 per lb. of contained tungsten; while **Tungsten** metal has sold at $7 per lb. for 98% pure metal.

IRON ORE (By Telegraph)

Pittsburgh, Dec. 8—Lake Superior iron-ore prices for next season are announced today as follows: Old Range bessemer, $4.45; Mesabi bessemer, $4.20; Old Range nonbessemer, $3.70; Mesabi nonbessemer, $3.55; all f.o.b. Lake Erie ports. The advance over last season's schedule is approximately 75c., except that Old Range bessemer advances only 70c. Some of the producers favored an increase of $1. The new prices are 50c. below the schedules obtaining in 1907 and 1910, which were the highest since the 1900 season.

OTHER ORES

Tungsten Ore—The Primos Mining and Milling Co., one of the large purchasers of tungsten ores, has recently published a revised schedule of purchase prices for Colorado ores. Under prevailing market conditions, miners are doing remarkably well mining ore of as low grade as 2% which sells for $29 per ton or at the rate of $14.50 per unit, a figure double that paid 18 months ago for 60% material which is now worth $35 per unit or $2,100 per ton. Intermediate figures in value per ton are as follows: 3%, $46; 4%, $92; 5%, $115; 10%, $230; 15%, $345; 20%, $460 per ton.

COKE

Connellsville—The market for furnace coke is quiet, but there is an undertone of strength, there being few sellers at quoted prices of $2.15@2.25 for prompt furnace, and a definite scarcity may develop over the holidays, as is usually the case. There is no demand for contract furnace coke, quotable nominally at $2.35@2.50 for first half and $2.25@2.35 for the whole year. Foundry coke is firm and moderately active at $3@3.25 for prompt or contract, per net ton at ovens. The sharp advances occurring in pig iron are not necessarily favorable to the coke market, as they indicate a scarcity of pig iron due to there being few if any idle furnaces to be blown in, so that no increased consumption of coke is suggested by the pig-iron advance.

Coal and Coke Shipments, Pennsylvania R.R. lines east of Pittsburgh and Erie, 10 months ended Oct. 31, in short tons:

	1914	1915	Changes
Anthracite	9,067,445	8,687,790	D. 379,655
Bituminous	37,840,834	35,983,366	D. 1,857,468
Coke	8,277,868	9,604,424	I. 1,326,556
Totals	55,186,147	54,275,580	D. 910,567

October total tonnage was 6,615,053 tons, an increase of 875,511 tons over last year.

British Fuel Exports, 10 months ended Oct. 31, in long tons:

	1914	1915	Changes
Coal	52,060,846	36,944,758	D. 15,116,088
Coke	975,254	798,188	D. 177,066
Briquettes	1,487,943	1,087,660	D. 400,283
Steamer coal	16,037,409	11,745,472	D. 4,291,937
Total	70,561,452	50,576,078	D. 19,985,374

The steamer coal is fuel furnished to steamships in foreign trade. Imports are very small.

Chemicals

NEW YORK—Dec. 8

The general market seems to have a stronger undertone and business looks better for next year.

Arsenic—The market is still rather quiet with small sales. Quotations are $3.75@4 per 100 lb; but it is claimed that they can be shaded for a good order.

Copper Sulphate—Business has been chiefly in small lots. Prices have advanced sharply, the current quotations being $10 per 100 lb. for carload lots and $10.25 per 100 lb. for smaller orders.

Nitrate of Soda—The position is very strong, notwithstanding the increased production in Chile. This has been offset by the difficulty in getting ships, and the high ocean freights. The quotations are firmer, spot being especially strong. As high as $3.25 per 100 lb. is asked for spot, while $3 per 100 lb. is named for futures.

Shipments from Chile for the 10 months ended Oct. 31 are reported as below, in tons:

	1914	1915	Changes
United States	454,950	713,700	I. 258,750
Europe	1,072,400	775,300	D. 297,100
Totals	1,527,350	1,489,000	D. 38,350

Pyrites—Arrivals at Baltimore for the week included 2,514 tons of pyrites from Spain.

Imports and Exports of Chemicals in the United States nine months ended Sept. 30, in pounds:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	3,171,867	2,655,334	700	8,825
Bleach	29,185,862	6,779,926	12,654	120,126
Acetate of lime			41,514,968	17,586,573
Calcium carbide			20,401,723	28,869,280
Potash salts	25,065,751	13,960,537	481,655	983,178
Sodium cyanide	1,240,904	3,662,888		1,796,927
Soda salts, value	$468,664	$361,313	$10,061	$22,635

Exports include reëxports of foreign material. This statement does not include nitrate of soda nor crude potash salts used chiefly as fertilizers.

Assessments

Comp.	Delinq.	Sale	Amt.
Blue Bull Reorg., Nev.	Nov. 1	Dec. 6	0.01
Clear Grit, Ida.	Dec. 14	Jan. 5	0.0015
Coeur d'Alene Inv., Ida.	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah	Dec. 11	Jan. 3	0.02
Confidence, Nev.	Dec. 24	Jan. 14	0.10
Cons. Imperial, Nev.	Nov. 30	Dec. 21	0.01
Darby M. & M., Ida.	Nov. 16	Dec. 16	0.00125
Dry Canon Cons., Utah	Dec. 18	Jan. 17	0.001
Emerald Oil, Utah	Nov. 27	Dec. 16	0.06
Eureka M. & M., Ida.	Nov. 26	Dec. 27	0.001
Great Western, Nev.	Nov. 15	Dec. 7	0.001
Hancock Cons., Mich.	Jan. 3		1.00
Hector, Ida.	Nov. 18	Dec. 10	0.005
Idaho & Los Angeles, Ida.	Nov. 26	Dec. 27	0.005
Ivanhoe, Ida.	Nov. 8	Dec. 9	0.0025
Jack Waite, Ida.	Nov. 20	Dec. 20	0.01
Laclede, Ida.	Dec. 6	Dec. 27	0.003
Leonora M. & M., Utah	Nov. 27	Dec. 17	0.005
Lucky Swede, Ida.	Nov. 11	Dec. 11	0.002
Military M. & M., Ida. (post.)	....	Dec. 11	0.0065
Missoula Copper, Ida.	Nov. 15	Dec. 15	0.002
Montana Standard	Nov. 15	Dec. 15	0.005
National Copper, Ida.	Nov. 20	Dec. 18	0.01
National Lead, Ida.	Nov. 15	Dec. 15	0.001
Nevada-Douglas, Nev.	Nov. 30	Dec. 31	0.10
New Arcadian, Mich.	Dec. 1		0.50
New Baltic, Mich.	Jan. 15		0.50
O. K. Ex. M. & R., Utah	Nov. 20	Dec. 15	0.005
Oreano, Ida.	Dec. 18	Jan. 18	0.001
Oriental, Nev.	Nov. 6	Dec. 7	0.003
Original, Nev.	Nov. 6	Dec. 7	0.003
Phedora, Ida., (post.)		Dec. 11	0.0005
Phoenix, Mich.	Jan. 1	...	1.00
Rescue Eula, Nev.	Dec. 6	Jan. 10	0.01
Seg. Belcher & Midas, Nev.	Dec. 12	Jan. 6	0.02
Silver Cliff, Ida.	Nov. 8	Dec. 6	0.0025
Sonora M. & M., Ida.	Nov. 4	Dec. 17	0.003
Sunset Dev., Ida.	Dec. 8	Jan. 3	0.002
Sunshine, Ida. (post.)		Dec. 15	0.0006
Ton. Gipsy Queen, Nev.	Oct. 29	Dec. 6	0.01
Tonopah Midway, Nev.	Dec. 11	Jan. 11	0.01
Umatilla Ton., Nev.	Nov. 8	Dec. 13	0.005
West Toledo, Utah	Dec. 16	Jan. 3	0.01
Wolf Mountain, Utah	Nov. 12	Dec. 14	0.0025

Stock Quotations

Among sales at auction we note: 3,061 Great Sierra Consol. Silver Co., $3 lot; 112 Magistral Exploration Co., $8 lot; 600 Parrott City Gold Placer Mining and Water Power Co., $6 lot; 1,300 Navaho Gold Mining Co., $10 lot; 7,200 Goldfield Tomboy Mining Co., $11 lot; 250 British Guiana Consol. Co., Ltd., $15 lot; 170 Ohio Zinc Co., $11 lot; $11,300 Woodstock Iron and Steel bond certifs. of deposit, $100 lot.

COLO SPRINGS Dec. 7 Name of Comp.	Bid.	SALT LAKE Dec. 7 Name of Comp.	Bid.
Acacia	.02¼	Beck Tunnel	07½
Cripple Cr'k Con.	0095	Black Jack	‡.07
C. K. & N.	‡ 02	Colorado Mining	.09
Doctor Jack Pot.	09¾	Crown Point	01¼
Elkton Con.	31¼	Daly-Judge	7 75
El Paso	78	Emma Cop.	.19½
Findlay	03½	Gold Chain	54
Gold Dollar	‡ 02	Grand Central	‡ 50
Gold Sovereign	06¾	Iron Blossom	96
Golden Cycle	2 03	Lower Mammoth	06
Isabella	19	May Day	18
Jack Pot	‡ 06¾	Opohongo	‡ 00½
Jerry Johnson	05	Prince Con	.76
Lexington	‡ 005	Seven Troughs	01½
Mary McKinney	43	Silver King Coal'n	3 37½
Pharmacist	006	Silver King Con.	2 30
Portland	1 82	Sioux Con.	03½
Raven B. H.	‡ 03	Uncle Sam	08
Vindicator	‡1 74¾	Yankee	38½

TORONTO		Dec. 7	
Bailey	04¼	Dome Exten.	33
Chambers Ferland	25	Foley O'Brien	50
Coniagas	4 60	Hollinger	29 15
La Rose	70	Imperial	05
Peterson Lake	36	Jupiter	19
Right of Way	‡ 05¼	McIntyre	1 03
Seneca Superior	60	Pearl Lake	‡ 00½
T. & Hudson Bay	23 00	Porcu. Crown	90
Timiskaming	68	Preston E. D.	05¼
Trethewey	‡ 18	Vipond	77
Wettlaufer-Lor	08½	West Dome	17½

SAN FRANCISCO		Dec. 1	
Alta	08	Belmont	4 43¾
Andes	10	Jim Butler	1 09⅜
Best & Belcher	05	Lone Star	03
Caledonia	44	MacNamara	03
Challenge Con	16	Midway	.15
Chollar	‡ 02	Mont.-Tonopah	34
Confidence	15	North Star	17
Con. Virginia	23	Rescue Eula	08
Gould & Curry	04	West End Con.	83
Hale & Norcross	04	Atlanta	25
Jacket-Cr. Pt.	15	Blue Bell	03
Julia	‡ 02	Booth	40
Mexican	33	C. O. D. Con	03
Occidental	.75	Comb. Frac.	07
Ophir	29	D'field Daisy	04
Overman	08	Jumbo Extension	1 21¼
Potosi	‡ 02	Pitts.-Silver Peak	06
Savage	06	Round Mountain	41
Sierra Nevada	49	Sandstorm Kendall	08
Union Con.	63	Silver Pick	05
Utah Con	‡ 03	Central Eureka	06

N. Y. EXCH. Dec. 7 Name of Comp.	Clg.
Alaska Juneau	10½
Am.Sm.&Ref.,com.	99
Am. Sm. & Ref., pf.	110½
Am. Sm. Sec., pf. A	90
Am. Sm. Sec., pf. B.	85½
Anaconda	87¾
Batopilas Min	2⅜
Bethlehem Steel	468½
Bethlehem Steel, pf.	155
Chile Cop.	25½
Chino	54¼
Colo. Fuel & Iron	51½
Crucible Steel	74
Dome Mines	29¾
Federal M. & S., pf.	48
Great Nor., ore., ctf.	49¼
Greene Cananea	44½
Guggen. Exp.	78
Homestake	122¾
Inspiration Con.	45
International Nickel	193¾
Miami Copper	34¼
Nat'l Lead, com.	65½
National Lead, pf.	110½
Nev. Consol.	16¾
Ontario Min	7¼
Quicksilver	3¼
Ray Con.	25¾
Republic I&S, com.	53½
Republic I&S, pf.	110
Tennessee Copper	58
Utah Copper	80
U. S. Steel, com.	86¾
U. S. Steel, pf.	116

N. Y. CURB Dec. 7	
Alta Con	.10
Beaver Con.	.48
Big Four	.05
Braden Copper	16
Buffalo Mines	1.10
Can Cop Corpn.	2⅜
Cashboy	.07
Cerro de Pasco	37
Con. Ariz. Sm.	1½
Con. Coppermines	1¼
Con. Nev.-Utah	5/16
Dia. Black B.	.04
Florence	.37
Goldfield Con.	1 3/16
Goldfield Merger	.17
Howe Sound	4½
Kennecott Cop.	53
Kerr Lake	4½
Magma	15
McKinley-Dar-Sa.	.73
Mines of Am.	3 7/16
Mother Lode	.32½
Nevada Hills	‡.20
New Utah Bingham	3⅜
Nipissing Mines	7⅝
Oro	06
Ray Hercules	3¼
St. Joseph Lead	14
South Utah	.25
Stand'd Oil of N.J.	507
Standard S. L.	2½
Stewart	⅝
Success	.61
Tonopah	7⅜
Tonopah Ex.	4 1/16
Tonopah Merger	.55
Tribullion	⅜
Yukon Gold	3

LONDON Nov. 22	
Alaska Tre'dwell	£6 17s 6d
Burma Corp.	1 11 3
Cam & Motor	0 13 9
Camp Bird	0 7 9
El Oro	0 10 0
Esperanza	0 11 0
Mexico Mines	4 6 3
Nechi, pfd.	0 12 3
Oroville	0 14 0
Santa Gert'dis	0 10 6
Tomboy	1 4 0
Tough Oakes	0 11 3

BOSTON EXCH Dec. 7 Name of Comp.	Clg.
Adventure	1½
Ahmeek	394
Alaska Gold M.	23¼
Algomah	1½
Allouez	56
Am. Zinc	68¾
Ariz. Com., ctfs.	7¾
Bonanza	.35
Butte-Ballaklava	3 3/16
Butte & Superior	71½
Calumet & Ariz.	69
Calumet & Hecla	548
Centennial	16
Copper Range	57
Daly West	3
East Butte	15¼
Franklin	9¼
Granby	80
Hancock	16
Hedley	28½
Helvetia	25
Indiana	5
Island Cr'k, com.	48½
Island Cr'k, pfd.	89½
Isle Royale	27½
Keweenaw	2¼
Lake	15½
La Salle	5¾
Mason Valley	1½
Mass	12¼
Mayflower	3¼
Michigan	2
Mohawk	86½
New Arcadian	9¼
North Butte	31¼
North Lake	1⅜
Ojibway	1½
Old Colony	2¾
Old Dominion	58
Osceola	84¼
Quincy	85
Santa Fe	3½
Shannon	8
Shattuck-Ariz.	35
Superior	25½
Superior & Bost.	2⅜
Tamarack	48
Trinity	9⅜
Tuolumne	.30
U. S. Smelting	46¾
U. S. Smelt'g, pf.	48¾
Utah Apex	3¼
Utah Con.	11½
Victoria	2½
Winona	3⅜
Wolverine	58
Wyandot	1⅜

BOSTON CURB Dec. 7	
Bingham Mines	8
Boston Ely	.38
Butte & Lon'n Dev	.35
Calaveras	2
Calumet-Corbin	.15
Chief Con.	1 1/16
Cortez	.40
Crown Reserve	.63
Davis-Daly	1¼
Eagle & Blue Bell	1 7/16
First Nat. Cop.	5⅜
Houghton Copper	2½
Iron Cap Cop., pf.	7
Majestic	1¼
Mexican Metals	.36
Nevada-Douglas	.80
New Baltic	3¼
New Cornelia	9⅜
Ohio Copper	.24
Oneco	1
Raven Copper	.10
Rex Cons.	25
Smokey Dev.	15
So. Lake	5½
Tonopah Victor	35
United Verde Ext	4 15/16
Utah Metal	10½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	49.385	28.083	23.199	23.125
November	58.995	49.082	51.714	27.263	22.703	25.094
December	57.760	49.375		26.720	22.900	....
Year	59.791	54.811		27.576	25.314	...

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

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Electrolytic 1914	London Electrolytic 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	17.686	‡	72.601	‡	88.000
November	11.739	18.627	53.227	77.744	*	93.273
December	12.801	...	56.841		*	......
Year	......	....	......	....	......	.....

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33.080	‡	151.554
November	33.304	39.224	139.391	167.670
December	33.601	.....	147.102	....
Av. year	34.301	......	....	......

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.046
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3.384	4.499	‡	23.994
November	3.683	5.155	3.585	5.078	18.500	26.278
December	3.800	......	3.662	....	19.097	......
Year	3.862	......	3.737	......	....	.....

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	12.800	4.750	12.596	‡	66.536
November	5.112	15.962	4.962	15.792	25.016	88.409
December	5.592	......	5.430	......	27.369	......
Year	5.213	.....	5.061	.....	....	....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59	18.26	13.43	17.30	13.83	17.20
December	14.70	...	13.45		13.83	...
Year	$14.88	.	$13.78	.	$14.01	....

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Sluicing Methods at Fairbanks

By Hubert I. Ellis*

SYNOPSIS—Gravel is sluiced as fast as mined in summer. Construction of sluice and dump boxes varies with conditions, although the principles hold throughout. Pole riffles are usually employed, although occasionally the iron-bound Hungarian type is in service. Methods of cleaning-up are described.

Except for small-scale operations at the heads of the creeks and at other places where water is scarce during dry weather, gravel mined during summer at Fairbanks, Alaska, is sluiced as fast as hoisted. The bucket is dumped on an inclined platform, or apron, which discharges into the mud box, or dump box. Here the lumps of sticky clay are broken up and the large rocks removed. Following the dump box, which is larger and of more substantial construction than the sluice boxes, comes the main sluice, consisting of five or more 12-ft. riffled boxes and additional false-bottom boxes to distribute the tailings. Dump box and sluice are placed on light timber trestles at sufficient elevation to give plenty of grade to the boxes and to provide room for the disposal of tailings.

*Kellogg, Idaho.

Fig. 1 shows the relation of the apron to the dump box and also the construction of a typical dump box. The box is usually equipped with block riffles and is given a grade of 3 to 12 in. in 12 ft., 10½ in. being a common figure. This grade is about the same as that of the sluice boxes and is often insufficient for the dump box in which the current, owing to the greater width of the sheet of water and the constant interference from dumping and forking, is considerably less. To obviate this difficulty the intake from the flume is commonly placed at a relatively higher position in the box than the outlet.

The apron, which may or may not be covered with sheet iron, is made of light poles or plank. When poles are used without an iron cover, considerable fine dirt sifts through and gold is thus lost.

MAKING A CLEANUP AFTER SLUICING PART OF THE WINTER DUMP

Sluice boxes are made in sizes ranging from 10 in. wide at the small end to 14 in., the 12-in. size probably being most used. Details of construction of such a box are shown in Fig. 2. The ordinary telescope box, owing to ease of setting and changing, is most widely used, but some operators prefer the box illustrated in Fig. 3, which is built after the order of the ordinary flume box, on the ground that it does not clog so easily. This seems largely a matter only of individual taste.

The flimsy construction of these boxes is a marvel to one accustomed to the heavy material used for the sluices in large hydraulic mines. One-inch lumber, planed on one side so that its effective thickness is not more than ⅞ in., with 2x4-in. braces, makes a box that can be handled with ease and that will take care of all the gravel that can be passed through it in one season—usually less than 15,000 cu.yd. Next year is another matter in the view of the average operator, for he may have made his stake, he may have failed so heavily as to lose his plant, he may have sold out or he may have moved to another creek or even to another district. In any event the boxes are sure to require resetting, and the expense of constructing four or five new ones to save the bulk of the gold is comparatively slight. (The materials for a box cost about $2.50.) The native timber of the Tanana makes a poor grade of lumber, and sluice boxes, while idle, will warp and crack in such manner as greatly to decrease their effectiveness. Consequently it is considered good practice to equip only the best of these old boxes with riffles, using the others as false-bottom boxes for distributing the tailings. These false bottoms are also of one-inch material and serve to protect the bottoms from

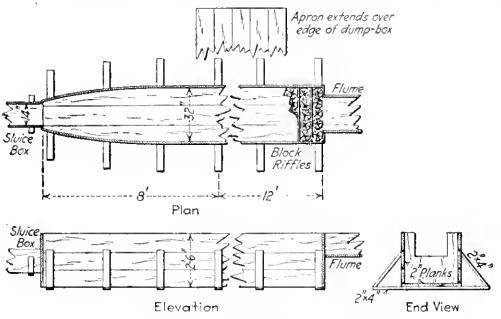


FIG. 1. DETAIL OF DUMP- OR MUD-BOX

excessive wear, especially at the drop where a box receives the discharge from the one above.

Sluice boxes, when used for any length of time, accumulate important quantities of gold in cracks, joints, splinters and abraded portions and knot-holes. To recover this they are burned after being discarded. Some have yielded more than an ounce of gold dust. Before laying aside for the winter, if it is thought that they carry considerable gold, they are frequently dried thoroughly over the boiler and pounded on canvas to recover as much as possible without destroying their utility.

Grades and Riffles Depend on Various Factors

The grade at which the boxes must be set depends on the amount of water available, the coarseness and quantity of the gravel, the type of box and riffle, and on the fall that can be used and still leave room for disposal of tailings. With pole riffles and telescope boxes the average is about 10 or 10½ in. per box-length of 12 ft.—although in reality it is more than this, since the effective length of box, owing to overlapping, is less than 12 ft. Theoretically, the thinnest layer of water that will carry away the material is best for saving gold, and a wide sluice with comparatively low velocity is advisable. In practice it is found that a comparatively high grade is necessary to save fine gold and that less water is then required, which is an important point in many parts of the Fairbanks district. For these reasons narrow boxes with steep grades are employed.

Many kinds of riffles have been tried at Dawson and Nome, but the Fairbanks operators have been too well satisfied with the ordinary pole riffle to seek earnestly for a substitute. These (see Fig. 4) are made of peeled spruce poles 2 or 3 in. in diameter, in 6-ft. lengths or slightly less, with head pieces of proper length to fit tightly into the boxes. They are held in place by nails driven into the head blocks through the sides of the boxes; the nails are allowed to protrude enough so that they can easily be withdrawn with a clawhammer when it is wished to remove the riffles. The poles wear out quickly, which might be prevented by protecting them with iron strips, but they are so inexpensive and quickly made that this is not considered necessary.

An iron-shod cross-riffle, known locally as the Hungarian, is very efficient as a gold saver, and it is not unusual to equip one or two boxes with it, the others

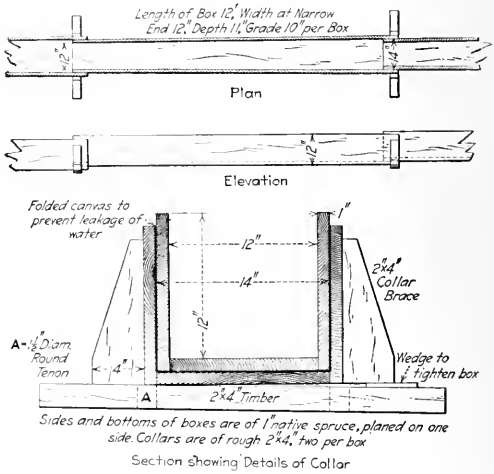


FIG. 2. TELESCOPE TYPE OF SLUICE BOX

having pole riffles. Some operators prefer the Hungarian for all boxes, but it is more expensive and has the disadvantage of clogging more easily than the pole riffle.

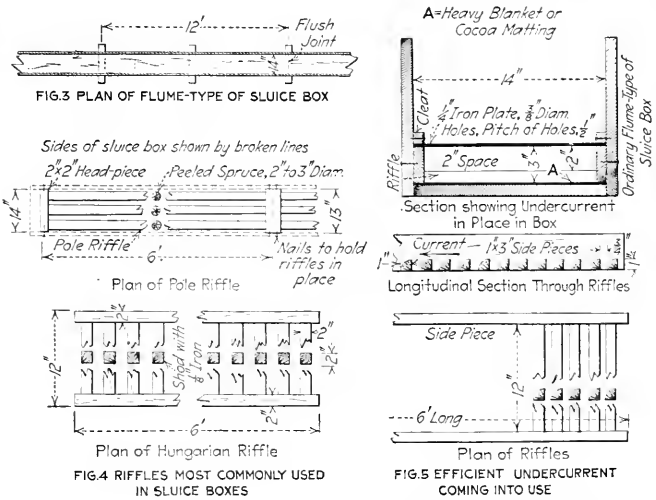
Refinements in the matter of gold-saving devices have attracted little attention at Fairbanks. Transverse undercurrents of the usual type, in connection with punched-iron screens, coco matting and amalgamated plates, have been tried with moderate success, but they have not in many cases returned the cost of installing, which may be partly owing to lack of intelligent attention. One serious objection to their use is that they remove large quantities of water from the sluice, causing the coarse tailings to pile up at the end of the boxes.

A new type of undercurrent designed to overcome this difficulty is shown in Fig. 5. It was tried out with excellent results during the summer of 1914 by E. M. Keys, of Chatanika. In four months gold to the value of $2,600 was saved, as against a few hundred for all season using the old-style undercurrent. It is essential, however, that

boxes equipped with it be cleaned up every two days, since its efficiency decreases greatly thereafter. Two boxes of the flush-joint type shown in Fig. 3 are fitted with this riffle, and one is cleaned up each day. In doing this it is a simple matter to remove the plate and riffles and rinse off the blanket and coco matting in a tub of water. This is done, of course, at a time which will not interfere with sluicing operations. The same riffle, installed on claim No. 7 Below Discovery, Cleary Creek, where, owing partly to the fine character of the gold previous attempts at mining had resulted in failure, recovered 20% of the entire cleanup. This gold, which had been lost before, made it possible to operate at a profit.

It has generally been held by Fairbanks operators, in view of the failure of the ordinary type of undercurrent and amalgamated plates materially to increase the saving, that very little fine gold occurs in the deposits of the district. The experience of Mr. Keys proves the falsity of this contention and indicates that there is much room for improvement in methods of gold recovery.

A string of boxes is rarely called on to handle more than 150 cu.yd. of material in 10 hr. and it handles this easily if a reasonable amount of water is available. The gravel dumped on the apron rolls or slides into the dump box, where the dump-box man stands in hip boots, armed with a broad sluice fork of eight or more strong tines. The fresh gravel is worked over by means of the fork until it gradually washes away, the large rocks being thrown over the side of the box. It was formerly considered the best practice to have the shovelers throw all large rocks behind them underground, but it is becoming customary to send all these that are not too large to the dump box, since this allows them to be washed clean and avoids delay on the part of the shovelers. At some mines the rock piles become so large that it is necessary to place a car and track at the elevation of the dump box to wheel the rocks away. Considerable skill and conscientiousness are required on the part of the dump-box man (who must work during summer with his feet in ice-cold water and his head in the blazing sun) especially when water gets low and gravel comes faster than usual, for there is often a tendency to use the fork as a shovel and remove much fine material with the coarse rocks, thus losing considerable gold. The dump-box man also, if he has time, takes care of the sluice boxes and the tailings discharge, swinging the tail boxes from side to side and adding new ones as they are needed.



FIGS. 3 TO 5. RIFFLE TYPES AND UNDERCURRENT ARRANGEMENT

The Problem of Water and Means of Handling It

The semi-aridity of the climate of the Yukon basin and the low gradient of the streams combine to make the water question a serious one. Gravity water for sluicing is obtained at Fairbanks wherever it is possible to do so without prohibitive expense, but the comparatively small scale of the operations, coupled with the large number of individual operators and their proneness to move from claim to claim and from creek to creek, has prevented the development of an efficient ditch system. The only ditch of any importance is the Cleveland, which takes water from the Chatanika River and delivers it to the mines at the mouth of Cleary Creek at such elevation that pumping is not required. The price charged is about $1 per sluice-head per hour. There are many smaller ditches that lead the water from each creek up on the benches, where it may or may not require pumping, but these do not go beyond the watershed of the individual creeks to obtain their supply. The amount of water required varies with size of boxes, grade, character and quantity of gravel, etc. The amount that will keep a given set of boxes running freely under whatever conditions they happen to be working is termed a "sluice-head," irrespective of the actual second-feet flowing.

Where water cannot be obtained by gravity, resort must be had to pumping, and where it is very scarce it must be impounded and used over and over, the portion that escapes by seepage and otherwise serving to replenish the supply of the next lower operator. In returning the water the boxes are usually so arranged as to discharge upstream and ponds are made by fencing with low dams made of brush or moss weighted with gravel, mud or sand; they are characterized by a considerable horizontal area and small depth.

On account of the dirt and grit in the water centrifugal pumps are used exclusively for raising it to the boxes. These are usually of the Worthington or Snow makes, 6- to 8-in. discharge pipe, driven by belt from 20- or 25-hp. horizontal engines. The lift varies from 20 to 35 ft. With wood costing $12 or more a cord the cost of pumping assumes formidable proportions, and this is one place where cheaper power will be of inestimable benefit. An effort will be made to introduce oil engines for pumping, and it is probable that this will result in an important saving to the district.

Method of Cleaning Up the Boxes

The cleanup, which is usually made weekly or at 10-day intervals, is simple, although details vary more or less at different mines. The riffles are first removed by withdraw-

ing the nails holding them to the boxes and are washed free from all adhering gold and gravel. As a general thing, except perhaps once a month or at the end of the season's work, only the upper boxes are cleaned up, since these and the dump box catch by far the greater proportion of the gold. If it is not desired to take the time and labor necessary for a careful cleanup, the gold may be concentrated without moving, but it is more often shoveled into pails or pans and carried to the upper boxes. A box that is smooth and comparatively free from knotholes, cracks and seams, near the lower end of those to be cleaned, is then chosen, and a block of wood 2 or 3 in. high is fitted tightly into this to serve as a dam to catch the black sand and other concentrates.

Water is next turned on in just sufficient quantity to move the material slowly down the boxes and is carefully regulated to prevent too rapid movement, since the gravel and gold, on passing from a rough box into one with a smooth bottom, are likely to be flushed down too quickly, in which case they may over-ride the dam and make it necessary to carry everything back to the upper boxes. Two or three men, with wooden paddles about 3 ft. long and 3 in. wide, work over the concentrates as they wash down, placing the paddles on the bottom and pushing up against the current through the concentrates. Care is taken to keep far enough down, moving from place to place, to avoid disturbing the gold, which collects at the upper end and becomes cleaner and cleaner as the whole gradually works down the boxes. All rocks of any size are thrown out by hand. The water is turned off while the gold, containing considerable black sand and other impurities, is several feet above the wooden block inserted as a dam. A large flat rock is placed against one side of the box, and the enriched concentrate is brushed over against this side. A little water is then turned on, and the gold is cleaned by brushing the water against the concentrate with a stiff whisk-broom, something after the order of the *planilla*. The black sand is gradually washed away, the gold remaining behind in a comparatively clean condition. (See Fig. 6.) The cleanup may be expedited by dividing the concentrates into two or more parts to be worked over by two or more men. In any event one man usually goes over the upper boxes with a whisk broom and carefully brushes down all gold that has remained behind. This is not done if only a rough cleanup is desired, and if little time is available the concentrates as stopped by the dam, gold and all, may be removed at once from the box and cleaned by panning or otherwise.

In cleaning the gold in the boxes, some of it escapes and washes down with the back sand to the dam. Some of this is fairly coarse, but much of it is fine and flaky and can be removed from the black sand only with considerable difficulty. The blank sand is shoveled out and stored in barrels or boxes, or it may be put back into the sluice. It is sold to professional black-sand cleaners or is cleaned by the operator himself at the end of the season. It is sometimes treated with a dilute solution of potassium cyanide to clean any rusty gold that may be present and then ground in a home-made cleanup barrel with mercury. The amalgam is recovered by means of a funnel and bowl, as shown in Fig. 7.

The impure gold dust removed from the boxes is freed of iron and magnetite by means of a small horseshoe magnet. It is then usually screened into two or more sizes. The coarse pieces are picked over by hand and all foreign material is discarded, while the fine part is cleaned by blowing in the well-known rectangular trays. This operation, though apparently simple, is one requiring skill and experience. The dust is flipped into the air by a peculiar underhand rotary-jerking motion, the heavy gold being thrown back toward the operator while the lighter impurities and some gold work out toward the front of the scoop. The operator blows lightly with his breath to assist in the separation, and in this manner all light impurities are gradually removed. It is a tedious operation and one requiring great pains, so it is not surprising that many miners send their dust to the bank in a very impure condition. One operator, when chided for this by the assayer, pointed to a huge tailing pile, saying that in removing all that from the gold he thought he had done his share. Impure gold may be cleaned by the bank assayer in the presence of the depositor, in which case the "blowings" are returned, or the impurities may be fluxed off in melting into bars for shipment.

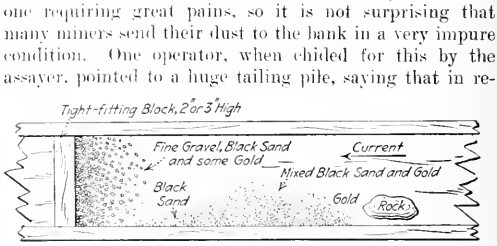


FIG 6 REMOVING BLACK SAND FROM CLEANUP

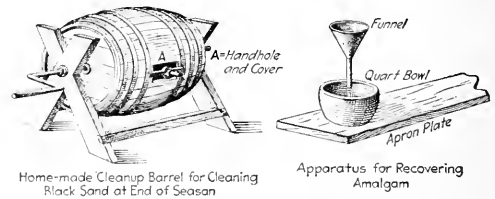


FIG 7 APPARATUS FOR CLEANING BLACK SAND

FIGS. 6 AND 7. METHOD AND APPARATUS FOR CLEANING UP

Briefly, the operator sells his gold dust to one of the two banks at Fairbanks, receiving a cash advance within safe limits if it is desired, and final payment on completion of the assay. The bank charges for handling are 2½% of the value of the gold; that is, the depositor receives 97½% of the value his gold will have when made up into coin by the Government, all charges being paid by the bank out of its 2½%.

Discovery of Platinum in Spain

According to a detailed account published in *Revista Minera Metalúrgica y de Ingeniería*, Madrid, Nov. 1, 1915, the presence of platinum has been definitely determined in some parts of the Ronda Mountains, in the province of Malaga, Spain.

In the course of a petrographic study of the rocks of the district by Domingo de Orueta, it was noticed that some of the rock bears a close resemblance to the platinum-bearing strata of the Urals, in Russia. The matter was followed up by careful sampling, during which platinum was actually found. The ground was then explored by boring, and the borings were washed. By this means pellets of platinum were found, together with the characteristic black sands, magnetite, chromite, etc.

Mining and Military Engineers Past and Present

The emergencies of the present European war have been of such constant occurrence and have been met with such brilliant fortitude, especially by the Royal Engineers, that they have been given a glowing tribute by Sir John French in a dispatch dated Oct. 15, in which he calls special attention to the splendid work carried out by those "companies officered largely by *mining engineers*[1] and manned by professional miners."

I have on previous occasions called your Lordship's attention to the admirable work of the corps of the Royal Engineers This work covers a very wide field, demanding a high standard of technical knowledge and skill, as well as unflagging energy.

The necessity for skilled labor at the front has been so continuous that Royal Engineer units have frequently been forced to forego those periods of rest which at times it has been possible to grant to other troops; but, in spite of this, they have responded loyally to every call on their services. Notwithstanding the heavy casualties sustained by all ranks, the esprit de corps of the Royal Engineers is such that the new material is at once animated by the same ideals, and the same devotion to duty is maintained.

I desire to call your Lordship's attention to the splendid work carried out by the Tunneling Companies. These companies, officered largely by mining engineers and manned by professional miners, have devoted themselves whole-heartedly to the dangerous work of offensive and defensive mining, a task ever accompanied by great and unseen dangers. It is impossible within the limits of a dispatch to give any just idea of the work of these units, but it will be found, when their history comes to be written, that it will present a story of danger, of heroism and of difficulties surmounted worthy of the best traditions of the Royal Engineers, under whose general direction their work is carried out.

It did not take the present war to bring the necessity of engineering knowledge in warfare to the attention of the commanding generals. Our own Engineer Corps, about which so much is now being heard in connection with its augmentation in time of trouble by a reserve of civilian engineers, came into being as an arm of the service in 1846.

The conspicuous services performed in the Mexican War by engineers, which Maj. Wildurr Willing, in "Professional Memoirs," says "must ever be a source of inspiration and profitable study to their successors in that branch," are interestingly summarized in the "International Military Digest."

The need for engineer troops was first emphasized when Taylor's pursuit of the Mexicans on Texas soil was halted by the lack of pontoon equipage with which to cross the Rio Grande. Authorized on May 15, 1846, the first engineer company was organized under Capt. A. J. Swift and reached the Rio Grande on its way to the front with Wool's army in October. The river, 800 ft. wide at this point, was crossed by means of a flying bridge. Means for other difficult crossings had to be improvised during this march. In the advance on Victoria the next month, the "pick and shovel brigade" rendered the road practicable for the train.

During Scott's operation at Vera Cruz, the engineer company was employed in opening up new roads, destroying the underground aqueduct that supplied the city, locating and constructing (assisted by details from the line) the batteries and siege works, and later in mapping this captured city. Colonel Totten was Scott's chief engineer during this time. When the column started for Mexico City, the company marched at the rear; after Cerro Gordo and the resumption of the advance from Puebla, it had moved up to the forefront, and with the best of transportation. Among its important duties were the improvement of the roads, by which Scott turned the city to the south; participation in the attack at Padierna and the surprise of Valencia's army; the construction of batteries that bombarded Chapultepec; and an active rôle in following up that victory and entering the city. The company officers at this time were Lieuts. G. W. Smith and G. B. McClellan.

All told, there were 14 engineer officers in the war, of whom were in the Topographical Engineers. Especially conspicuous were the services of the individual officers on staff duty. Both Taylor and Scott used these officers constantly in reconnoitering the enemy's position; nearly every plan of campaign was based upon their reports, and the attacking columns were often guided by these same officers. Thus Mansfield at Monterey, Lee and Johnston at Cerro Gordo, Beauregard and Tower before Mexico City, and a dozen others made notable performances. It was a striking tribute to the engineers that from their number were chosen five of the council of 12 that decided which point of the city fortifications was to be attacked.

In a recent lecture Prof. R. M. Johnston, Harvard's great military scientist, discussing old and new theories of battle, stated that geometry was first called in to the general's aid in the eighteenth century and it soon became his sovereign master. The eighteenth century thus first brought the engineer into prominence, and he was constantly consulted, at that time, on all questions of time, distance and formation. He was not, however, given any prestige, but was kept as the cook in the kitchen, to make the broth which the pompously arrayed butler would serve. The wars of the Revolution gave the engineers a somewhat better chance, and in 1791 came the founding of the Ecole Polytechnique. The development of artillery was the chief factor that made for the change of old theories at this time, and it was the artillery that produced Napoleon.

[1] The italics are ours.—Editor.

Sulphuric-Acid Supplies in France and England

The requirements of the French munition factories for sulphuric acid have become so important that it has been questioned, says *Le Phosphate*, whether the whole of the French output should not be reserved for the state instead of the 20% as at present. Happily it has been remembered in time that the needs of agriculture are as important as others from the point of view of the war, and it has been finally decided to reserve the quantities necessary for the manufacture of superphosphate.

Our contemporary estimates that this will give from 300,000 to 400,000 tons of superphosphate—little enough in comparison with the amount used before the war, but now perhaps sufficient in view of the shortage of labor in the country districts.

In addition to the foregoing translation, the *Chemical Trade Journal* prints the following: Everywhere it is complained that the color difficulty grows greater, says the *Dyer and Calico Printer*, and the government consumption of sulphuric acid is freely given as the cause of the shortness of the supply of British-made colors. Dyers feel the shortage more acutely than anybody else, but the consequences are felt, of course, by everybody needing colored yarn or goods, so that there is a continual buzz of dissatisfaction. It may be hoped impartially that the arrangements for promoting the production of sulphuric acid are upon a scale commensurate with the new arrangements that are being made for its consumption. Very soon sulphuric acid will be wanted in quantities largely exceeding a consumption that is already tremendous, and a surplus beyond the needs of the explosives trade is indispensable if there are to be dyes in any abundance.

New Coal Fields Are Reported near Manchuli on the Chinese Eastern R.R. in Manchuria. Their extent is now being investigated.

Ashio's Copper-Smelting Works at Honzan, Japan

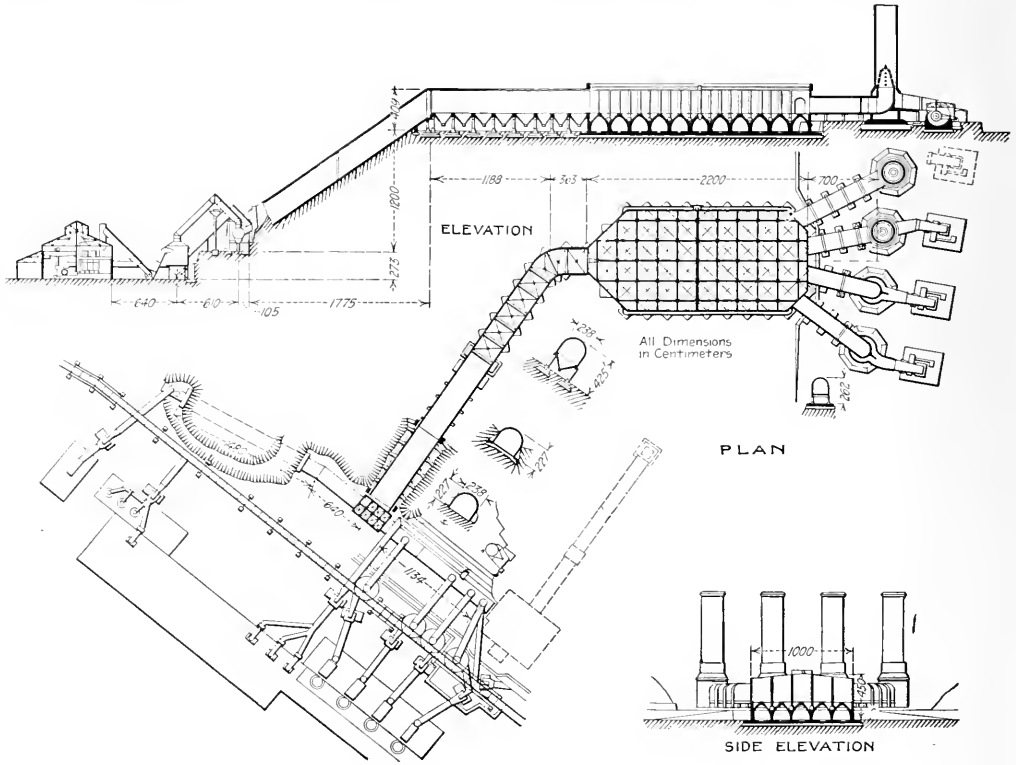
SYNOPSIS—The products of the Ashio Copper Mines are smelted at Honzan, about 100 mi. north of Tokyo. The coarse first-grade ores are charged directly to the blast furnaces; the concentrates and fines are first briquetted or sintered in pots. Acid-lined barrel-type converters are used. A new dust-settling system was completed in September.

The Ashio Copper Mines, of Japan, formally opened on Sept. 27, 1915, its new dust-settling system at the Honzan smelting works, near Ashio, in Tochigi Ken, on the island of Hondo. The Ashio company has in this district a concession of about 4,000 acres. The three principal mines are Honzan, Kotaki and Tsudo, which are situated about three miles apart. Each has its own ore-dressing plant, but the smelting for all the Ashio mines is done at Honzan. The blister copper is refined at the Nikko Copper Works, about 20 mi. northeast of Ashio.

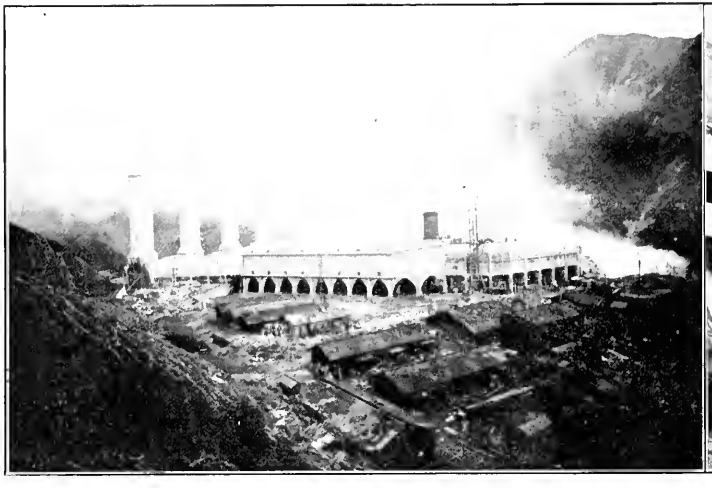
Furukawa & Co., which owns the aforementioned properties, is the most important mining company in Japan. It was established over 40 years ago by the late Ichibei Furukawa and controls seven groups of copper mines, two silver mines, one gold mine, one lead mine and several collieries, the company's concessions embracing 54,000 acres. To summarize briefly, it has 9 offices, 2 copper works (Nikko and Amagasaki), 20 mines, an annual production of 15,000 tons of copper, 200,000 tons of copper ore and 550,000 tons of coal, besides lead bullion, silver ore, zinc ore, etc. It employs about 22,000 men, who are supervised by 1,600 officials.

Chief Copper Mineral Is Chalcopyrite

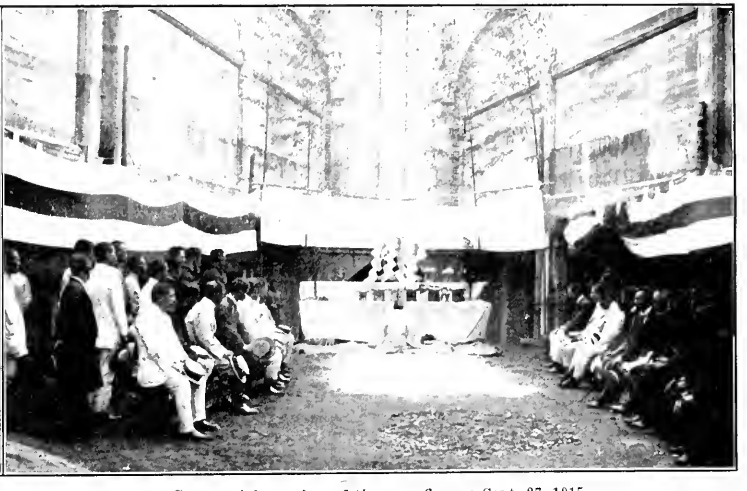
The ore deposits of the Ashio group of mines consist for the most part of veins transversing Tertiary liparite (rhyolite) and, to some extent, the Paleozoic sediments of the district. The principal Paleozoic rocks are slate, quartzite and limestone. The liparite is a volcanic neck erupted through the Paleozoic and is more than two miles in diameter. The chief constituents of the veins are chalcopyrite and pyrite, with frequently arsenopyrite, blende, galena and pyrrhotite. Occasionally, bornite, chalcocite, cuprite, malachite, pisanite, azurite and native copper are all found in the oxidized zone. Rarely, native bismuth, bismuthinite, wolframite,



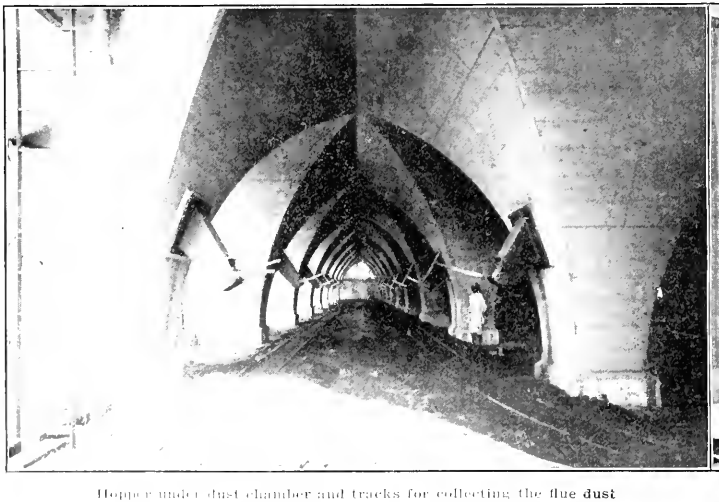
PLAN AND ELEVATION OF HONZAN SMELTING WORKS OF THE ASHIO COPPER MINES



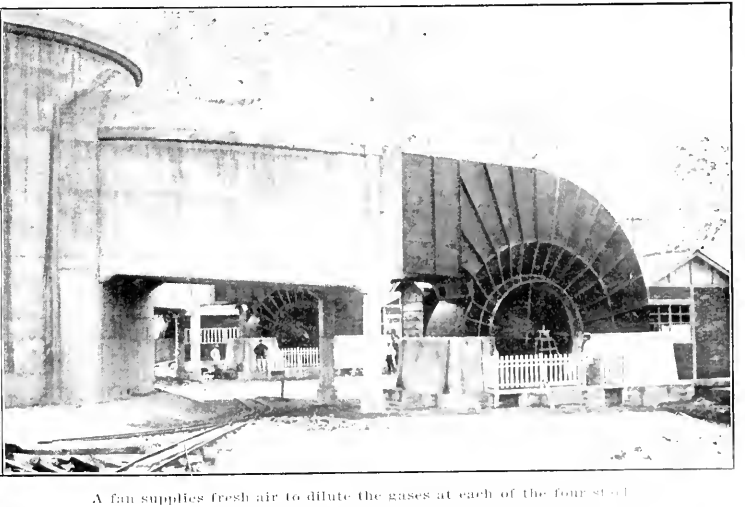
General view of Ashio's new dust-collecting system



Ceremonial opening of the new flue on Sept. 27, 1915



Hopper under dust chamber and tracks for collecting the flue dust



A fan supplies fresh air to dilute the gases at each of the four stacks

ASHIO COPPER MINES' NEW FLUE SYSTEM FORMALLY OPENED SEPT. 27, 1915, AT THE HONZAN SMELTING WORKS, IN TOCHIGI KEN, JAPAN

fluorite, vivianite, ludlamite and apatite are found. As gangue, chlorite, quartz and clay are common, with calcite occurring occasionally.

Overhand stoping is generally adopted at the Ashio mines; underhand stoping and *Nukibori* (special working for richer part of vein) are rarely used. Both hand and machine drilling are done. Among the machine drills are: Water Leyner, Ingersoll-Sergeant, Sullivan, Flottmann, Little Wonder and others. The ores in the mines are usually classified into two kinds—first-grade and second-grade. The former is rich ore sorted underground and usually averages 12% copper. About 214 tons of first-grade and 1,263 tons of second-grade ore comprise the daily output from the three mines, according to a booklet published this year by the Furukawa company, from which many of the data in this article were obtained.

Blast Furnaces and Acid-Lined Converters

Smelting is done in four blast furnaces, the matte being converted in three stands of acid-lined barrel-type converters. The ores received at the smelting works are

EXPANSION JOINT IN ASHIO DUST CHAMBER

classified into five kinds. These include lump ore, fines, concentrates, slimes and cement copper. The output from the concentrating plants amounts to about 300 tons daily, with an average copper content of about 11%. Cement copper is obtained from two sources, the mine water and the waters draining from the old dumps. The copper is precipitated on scrap iron, the daily production amounting to about 2.3 tons averaging 66% Cu. The smelting plant treats annually about 100,000 tons, with an output of over 11,000 tons of copper.

The lump ore is charged to the blast furnaces in the raw state, and the fines are either sintered or briquetted. Most of the fines are sintered in pots, of which there are 8, placed in two rows and used alternately. The pots are conical, hold about 11 tons of ore and have false bottoms through which the blast enters. After sintering, the mass is cooled and crushed into suitable sizes for charging to the blast furnace. Three briquetting machines are at work, with an output of 40 tons of briquettes in 24 hr.

The blast furnaces are of the rectangular water-jacketed type, each 42x160 in. at tuyeres. The height from the center of the tuyeres to the feed floor is 8 ft. 6 in. Each furnace has twenty-four 4½-in. tuyeres. The forehearths are 12 ft. in diameter inside and 4 ft. in height, and are lined with magnesite brick. The blast for the furnaces is supplied at 2-lb. pressure by a Roots No. 8 blower and turbo-blowers. Each furnace smelts about 90 tons per 24 hr., and the grade of the matte averages 40%. The composition of the slag is: Silica, 39%; iron, 25%; lime, 19%; alumina, 9%; copper, 0.2%.

The matte is converted in hydraulic-tilting shells, of which six are provided for the three blowing stands. The shells are 72 in. in diameter and 100 in. in length. Blast is supplied at 10-lb. pressure by two horizontal blowing engines driven by electricity, and also a vertical engine driven by water power. The lining material is decomposed liparite found in the vicinity. The converters produce about 65,000 lb. of blister copper per day, which is cast into 70-lb. bars or anode plates. The analysis of the blister copper is: Cu, 99.077%; Au, 0.0003 oz.; Ag, 0.1065 oz.; As, 0.029%; Bi, 0.006%; Fe, 0.052%; S, 0.028%; Se and Te, 0.038%.

New Flue System Finished This Year

The smoke from the smelting plant is passed into a Cyclone dust catcher by means of fans. Having precipitated most of the suspended dust therein, the fume enters the common flue and proceeds to the fume-precipitating chamber, where it is condensed and precipitated by the Rösing wire system. The gases escape through the chimneys after being diluted with fresh air forced in by the fans. The provision of four stacks is noteworthy, and the general arrangement of the flue system may be noted from the accompanying engravings, showing the flue system in plan and elevation, as well as presenting several interesting exterior views. It will be observed that the new flue system involved a large amount of concrete construction, which, judging by the general view, has been well executed. Another interesting illustration is that of the ceremony celebrating the opening of the flue on Sept. 27. Another view shows the fans that supply extraneous air at the base of the stacks for diluting the flue gases. The gases as discharged into the air contain about 3% by volume of SO_2. Care is also taken to prevent damage by the waste products of the precipitating and dressing plants. The tail water from the precipitating tanks and the slimy water from the ore-dressing plants are treated with milk of lime after they have passed through the settling pond.

Power for the Ashio copper operations is supplied from the Hosoo hydro-electric power plant, built in 1905, about 12 mi. from Ashio. This plant develops 2,500 hp., but it is being enlarged to 10,000 hp. for the purpose of supplying both the Ashio Copper Mines and the Nikko Refining Works. Besides the main power plant

there are several auxiliary electric- and two water-power plants, near Ashio. The consumption of power in the various departments of the Ashio Copper Mines is as follows: Mining, 2,550 hp.; ore dressing, 800 hp.; smelting, 2,200 hp.; miscellaneous, 600 hp.; total, 5,150 hp. The Ashio district has rail communication with Tokyo, about 100 mi. to the south, by means of the Ashio Ry. and the Imperial Government Ry.

Flotation at Globe-Miami, Ariz.

SPECIAL CORRESPONDENCE

The Globe-Miami district of Arizona is now, and has been for some time, the scene of many important and interesting developments in flotation. The principal mills are operating either on a commercial scale or experimentally, and some profitable commercial results are being obtained. At the Inspiration mill the ore is dumped into a large steel bin. For each of the 18 sections of the mill there is a gate and chute at the bottom of the bin, and underneath the chute a Stephens-Adamson conveyor-type feeder that drops the ore upon an inclined conveyor belt, carrying it up to the feed box. Here half goes to the first and half to the second 8x6-ft. Marcy ball mill of each section. Two 225-hp. motors operate the ball mills in each section. These mills are set end to end, with two Dorr duplex classifiers between them, one pointed toward the first ball mill and the other toward the second.

From the feeding box the ore enters the first Marcy mill, the flotation oil and mill water being added at the mill feed box. The ground pulp emerging flows around the mill and through one of the Dorr classifiers, where the oversize is pushed up to the feed box of the second Marcy mill, thus completing half the closed circuit. Each Marcy mill in each section receives the coarse from the classifier of the other Marcy mill, together with a fresh supply of ore from the feed box, and the flotation oil and mill water.

The flotation oil is contained in a headless steel drum and is drawn out by a miniature bucket elevator, the bucket being carried upon two continuous chains and running over a toothed head wheel driven by a pawl. The mechanism is similar to some of the usual types of zinc-dust feeders.

The thickness of the undersize from the Dorr classifiers is controlled by a float operating the valves, controlling, through electrically operated mechanism, the flow of water into the slimes compartment. Seven sections of the mill are now complete, and the ball mills of nine sections are ready to work. In the seven sections in operation there are three different systems of treatment below the Dorr classifiers.

DIFFERENCE IN SECTIONS AT INSPIRATION

In sections 1 and 2 the undersize from the Dorr classifiers runs to a set of 12 Callow flotation machines, the concentrates then going to a set of four Callow cells for cleaning. The clean concentrates run by launder through the concentrate-collecting system, while the tailings are returned by a centrifugal pump to the first Callow cells for retreatment.

The tailings in the first group of Callow cells run to a drag classifier of the Esperanza type. The slimes overflow and are combined with flotation oil in a collecting box beneath the classifiers. The sands run into two hydraulic sizers, each of which has six pockets, and in each pocket there is a pair of Deister baffle-cone classifiers. Fine slimes run into a compartment at the end of the sizers and then to the collecting box under the drag classifiers. Material in this collecting box is elevated by two centrifugal pumps, each carrying half the stream, to a separate group of 12 Callow cells that make clean tailings and concentrates, which go to the same four cleaning cells that clean the concentrates from the first group.

The products from the two pairs of Deister cones making the coarser classification products go together to one Deister double-deck simplex sand table. Each of the other pairs of cones feeds one double-deck table, so that six sizes are made for table treatment; requiring eleven tables per section. The tables make clean concentrates, middlings and tailings, but the middlings now flow off into the tailings launder. A middlings treatment will be undertaken later when the work of completing the mill will permit.

In sections 3 and 4 the flow differs in that the pulp from the Dorr classifiers goes to two sets of flotation machines of eight cells each, while the pumps and collecting boxes return to only one 8-cell machine; otherwise the flow is the same as in sections 1 and 2.

SECTIONS WITHOUT CALLOW MACHINES

In sections 5, 6 and 7 no Callow machines are used, but Inspiration cells, devised at the property, are at work. The pulp from the Dorr classifiers goes to two machines of 16 cells each, the concentrates from which go to a similar set of two 6-cell machines and make a clean and finished concentrate, the tailings being returned by centrifugal pumps to the feed box of the first group of 16-cell machines. More flotation oil is added at the tailings compartment of the cleaner cells. The tailings from the 16-cell machines flow to a drag classifier, which delivers the coarse material to the Deister sizers, and treatment of the products from there on is the same as has already been outlined. The slimes overflow from the drag classifier, together with the slimes from the slimes compartment of the hydraulic sizers, runs to waste from the collecting box, instead of being pumped back for further treatment, as is the case in sections 1, 2, 3 and 4.

The main tailings launder leads to three 60x10-ft. Dorr thickeners, the overflow going to a large sump from which it is pumped back to the new water-storage tanks. The thickened underflow goes to the tailings. The present set of three thickeners is not of sufficient capacity to handle all the tailings, and seven more are to be added—three 100x10 ft., three 80x10 ft., and one 60x10 ft.

HANDLING THE FLOTATION CONCENTRATES

All concentrates launders converge to a group of 60x10-ft. Dorr thickeners, the overflow from which goes to the same sump as the overflow from the tailings thickeners. The thickened underflow is raised by four bucket elevators to 12x12-ft. Oliver filters, the cake being scraped over a steam-heated plate and the dewatered concentrates dropping to a conveyor belt. They are then elevated to a steel concentrate-storage tank under which the concentrate cars can be started and the concentrates drawn into them for haulage to the smeltery.

The Inspiration flotation machine is built up of 16 compartments, each about 30 in. long by 42 in. wide, the

partitions between cells being so arranged that the underflow of the first cell flows successively through all the others, in this respect somewhat resembling the flow through the Minerals Separation machines, but the flow is by gravity, or displacement, there being no agitators to lift the pulp. The cells of the 6-cell cleaner machine are smaller than in the 16-cell rougher. The air pipes are above the machines, and a branch from the air main runs vertically downward into each cell, instead of entering from below, as in the Callow cell.

The Globe-Miami district affords some interesting comparisons now in milling practice, in the procedure followed at the Miami, Inspiration and Old Dominion mills. In the Old Dominion the ore differs from that treated in the Miami and Inspiration mills. A rougher, or bull jig, makes clean concentrates on a mixed feed, the concentrates being about ¼-in. size. The other jigs, together with a rougher or bull jig, recover the larger part of the concentrates produced. A Minerals Separation machine of 16 compartments treats slimes, and some Callow cells have been installed for experiment. Flotation here produces a sort of end product—that is, only a small portion of the entire mill concentrate. Hardinge mills for regrinding and Symons disk crushers in the coarse-crushing department are used, the only rolls being those recrushing the bull-jig tailings.

At the Miami mill, rolls are used both in the coarse-crushing department and in the mill proper, working on the feed from the mill ore bins and the coarse product from them going to the Hardinge mills. Callow flotation cells are used for the final treatment of slime, elevators raising the material, while the flotation oil is added at the launder running to the elevators. A Pachuca agitator was used for emulsifying the oil, but has been found unnecessary. The slimes from one section are treated in a group of Callow cells, the concentrates from two sections being cleaned in a group of four similar cells.

At the Old Dominion mill the 12 head cells of the Minerals Separation machine make a finished concentrate, the last four cells' overflow product being returned by the elevators to the head end of the machine.

At the Inspiration mill the flotation cells treat all the pulp and float some copper-sulphide grains even up to 40-mesh size, and the larger part of the concentrates are made by flotation. The tables recover a lower grade and work on material that has passed through the first, at least, of the flotation cells. The flow of pulp is direct, there being no regrinding once the material leaves the Dorr classifiers. There are no elevators in the mill except those lifting concentrates, and rolls are eliminated entirely. The arrangement of a mill treating 14,000 tons daily is remarkably compact. The plant probably covers less floor space per ton of capacity than any other mill.

The Principal Ore of Antimony is the sulphide, stibnite, which contains, when pure, 71.4% antimony, according to the Mackay School of Mines "Bulletin." Stibnite is a lead-gray metallic mineral with a high luster, commonly occurring in aggregates of columnar or bladed crystals and radiating groups, and more rarely in massive granular form. It may be distinguished from galena, which it resembles in color and hardness, by the fact that galena always has a cubical cleavage. Moreover, when stibnite is melted before the blowpipe, it fuses easily, gives off copious white fumes and produces a brittle button, whereas galena gives off scanty fumes and a malleable button. In this respect it resembles arsenopyrite, but the latter mineral not only gives off heavy white fumes, but also a strong garlic odor.

Operations at Old Dominion

GLOBE CORRESPONDENCE

At the Old Dominion smeltery at Globe, Ariz., a third blast furnace has been blown in to smelt the increased tonnage of ore now coming to the plant. The greater part of the tonnage now comes from the Old Dominion and United Globe mines and as concentrates from the mill. The Arizona Commercial is supplying ore regularly, and there is a growing tonnage coming in from custom and leasing operations. The flue dust and flotation concentrates are being briquetted prior to smelting, while table and vanner concentrates are mixed with plaster and molded into briquettes. The Old Dominion blast furnaces are running on a charge containing a high proportion of fines.

At the Old Dominion mill 700 tons of ore is being treated daily, the main recovery being effected by jigs. The jig tailings are reground in Hardinge mills, classified and treated on tables or vanners. Slimes are treated in a 16-cell Minerals Separation machine and in some recently installed Callow flotation cells. Coal tar is to be used in the flotation machines in the place of the higher-priced pine oil and creosol. A coal-tar storage tank is now being erected at the side of the mill.

A total of about 1,000 tons per day is now being hoisted from the mine, most of it coming from the east and west sides of the 12th, 14th and 16th levels. The ore is dumped into storage pockets in the station floors and is drawn automatically into the skips and hoisted to surface. What waste is not used for filling underground is also raised in skips; very little is now raised in cars. The 18th level has been unwatered, and the Aldrich pumps on that level are running again. This level has just been recovered after the flooding of the lower levels last March. The pumps on the 18th level are motor-driven, and the armatures had to be rewound after having been under water for six months. These pumps raise 1,200 gal. per min. from the 18th to the 16th level, where the main steam-driven mine pumps are situated. A total of 6,000,000 gal. daily is now being raised, but after the flooding last March more than 12,000,000 gal. was pumped daily. Sinking from the 12th to the 16th level of the Kingdon shaft is to be started soon, and development work is under way to explore undeveloped parts of the lower levels.

California Oil in October

SPECIAL CORRESPONDENCE

Petroleum production in California in October was 7,675,146 bbl.; shipments amounted to 8,599,681 bbl. Total stock on hand Nov. 1 was 57,879,376 bbl., showing a decrease in October of 924,535 bbl. The intentional curtailment of production in the present year, owing to the European war's retarding the marketing industry, has reduced the stocks on hand from 58,259,119 bbl. on Jan. 1, 1915. The average daily production in October was 3,251 bbl. more than the average daily production in September. For the same two months in 1914, the increase in October over September was 34,256 bbl. The shut-in production remains about the same as in September—18,000 bbl., of which 12,000 bbl. are in Coalinga field. New wells completed in October netted 4,220 bbl. of new production daily.

Drill Steel and Its Treatment

By E. M. Weston*

SYNOPSIS—Of the steels tested those gave poorer results that were lower in carbon and higher in sulphur and manganese. Alloy steels did not give as good results as ordinary steels. The larger the steel the lower should be the carbon contents. Steels were found to improve after being sharpened several times, probably owing to the effect of hammering.

During 1910-11 the Mines Trial Committee carried out a number of interesting investigations. Though some short references have appeared, no summary of these investigations and the conclusions reached has ever been published. They are of interest to mining engineers in all parts of the world. The first investigation was directed to discover by analysis and practical trials what was the best steel for bars of various sizes and the best method of heat-treatment to give them. Following is a list of the terms used in the report and their meaning:

Alloy Steels—By these is meant steel containing chromium, vanadium or tungsten and perhaps aluminum.

Carbon Steels—These are ordinary steels with manganese and a little aluminum.

Cutting Off—This refers to remaking bits flaked or burnt. It generally takes 40% longer time to sharpen such a bit.

Scaling—This occurs in the forge and is due to excess of air, which caused oxidation of the steel while heating.

Chipping—This term refers to the breaking off of flat scales not more than $\frac{3}{16}$ in. thick when the bit is drilling. Not more than 10% of properly sharpened bits should chip, showing that the right hardness has been obtained. Chipping does not greatly influence the drilling speed.

Flaking or Splintering—This is the breaking off of large irregular pieces and is due to very hard ground or to an excess of silicon, sulphur, carbon, manganese or some alloy. It may also be caused by faulty heat treatment.

Fire Cracking—This is due to bad steel, especially that containing excess of sulphur, or, in the case of high-carbon steel, to rapid or irregular heating.

Water Cracking—This is the cracking of heated steel when plunged in water and is due to very high carbon contents or notably to excess of phosphorus or to irregular heating.

Soundness of Steel—This refers to its freedom from occluded gases, slag and fissures.

Tempering—When heated steel is hardened by plunging it into cold water, it is often too hard and brittle. This defect is diminished and the steel made tougher at the expense of hardness by reheating it to some temperature about 200° to 300° C. for a short time. This operation is generally necessary in the case of high-carbon steels, but with ordinary steel of lower carbon contents it can be dispensed with by raising the temperature of the water in which the steel is quenched.

Recalescent, or Critical, Points of Steel—On heating a piece of rock-drill steel slowly and observing its rate of rise of temperature with a pyrometer, a halt will be observed to occur between 700° and 750° C., denoted by the sign A_c. On slowly cooling, a similar halt is observed, usually 30° C., below A_c; this is denoted by A_r. The halt at A_c is due to the heat being expended in producing microscopic structural changes, the steel being converted into martensite. This structure is retained if the steel is suddenly cooled and the steel is hardened. In ordinary mine work this process is known as tempering.

If the steel be slowly cooled it becomes soft, or annealed, owing to the change of the martensite into pearlite and ferrite when the steel contains less than 0.9% C. or into pearlite and cementite when carbon is over 0.9%. Ferrite is very soft, pure iron. Cementite is hard, brittle carbide of iron. Pearlite is a mixture of the two. The points A_c and A_r are called the recalescent or critical points of steel.

Methods of Conducting the Tests

The steels tested were 1½-in. cruciform, 1-in. and ⅞-in. octagon, and were used in $2^{3}/_{4}$-in. sloping drills. They were given the necessary heat treatment, and the bits were carefully measured, inspected and weighed before and after being used. The distance drilled was noted and sometimes the drilling rate of speed. Various marks were allotted for merit, and the question of price was considered. Chemical analyses were made of the various steels, and a fair idea of the class of steel most suitable for work in the hard quartzites of the Rand, and inferentially in hard ground elsewhere, was obtained.

First, with regard to loss of reaming efficiency with ⅞-in. octagon drill steel, a comparison of the steel giving the best and worst results showed:

For the Best		For the Worst	
Carbon	0.770%	Carbon	0.650%
Silicon	0.110%	Silicon	0.100%
Sulphur	0.010%	Sulphur	0.020%
Phosphorus	0.029%	Phosphorus	0.026%
Manganese	0.290%	Manganese	0.380%

This showed lower carbon contents and greater sulphur and manganese in the poorer steels.

With regard to loss of weight through wear, the results showed:

For the Best		For the Worst	
Carbon	0.800%	Carbon	0.640%
Silicon	0.070%	Silicon	0.180%
Sulphur	0.012%	Sulphur	0.020%
Phosphorus	0.028%	Phosphorus	0.032%
Manganese	0.270%	Manganese	0.430%

This shows a similar result and the bad effect of phosphorus.

The general results of the tests were as follows:

A. Although some of the alloy steels have shown excellent drilling results and are not costly in steel consumption, not one of them is equal to the rest of the ordinary carbon steels. With alloy steels, a uniform composition is harder to obtain than with carbon steels. The former have more tendency to overheat and are more difficult to weld.

B. Best 1½-in. cruciform steel: Steel having carbon contents above 0.75% was rejected, owing to the difficulty of welding it. It was also found that as a general rule the larger the size of steel the lower should the carbon contents be, as the difficulty of equal or regular heating and quenching increases with the size of the steel. The best

*Union Club of South Africa, Johannesburg, South Africa.

steels of this size had a composition: Carbon, 0.66%; silicon, 0.09%; sulphur and phosphorus, 0.036%; manganese, 0.28%.

C. Of the 1-in. octagon steel the best had a composition of: Carbon, 0.69%; silicon, 0.09%; sulphur and phosphorus, 0.036%; manganese, 0.30%. Of the 7/8-in. octagon steel the best had a composition of: Carbon, 0.72%; silicon, 0.09%; sulphur and phosphorus, 0.035%; manganese, 0.27%.

Bits made from sections larger than 1½-in. cruciform are much larger, and in rapid working they tend to overheat if the interior is properly treated, thereby decarbonizing; quenching is also difficult. These steels should contain from 0.60% to 0.65% C. In all these steels the maker should be allowed to use aluminum as a purifier if not more than 0.10% is left in the finished steel. The best steels were Swedish bessemer, crucible, openhearth (mostly) and electric crucible. Steels were found to improve after being sharpened several times, probably owing to the effect of hammering on the grain of the steel.

Particulars of the Heat-Treatment

Usually, on the Rand, all drills except those of hollow steel are heated but once for a long distance from the bit. They are rapidly sharpened, they are not gaged and are quenched without reheating. This method tends to overheating, to the decarbonization of the steel and to irregularities in the gage. The steels of the compositions already quoted can be quenched off the anvil without tempering. The temperature of the quenching bath should be between 18° and 26° C. Drills should be properly cleaned and should be slowly heated. Hand steel requires 5 min., medium steel 8 min. and large steel 12 min. This heating should preferably be done in an oil furnace, as overheating is very liable to occur with coal fires, especially when watched by natives. The drills should be heated to a bright orange-red heat (about 1,050° C.) for 1½ in. for hand steel, 2 in. for medium sizes, 3 in. for large steel, and be thoroughly and regularly heated through the mass of the steel. The heated drill should be forged until it cools to a dull-red color, about 600° C. With hand sharpening, this should take from 45 to 60 sec. The bit should be at once reheated to a bright-red color, about 950° C. It should then be finally sharpened and carefully gaged until a cherry-red color, about 750° C. This should take another 45 sec. Bits of 1½ in. cruciform steel, or larger, are quenched by standing them on a knife-edge ½ in. to ⅝ in. below the surface of the water. Smaller bits are plunged vertically, moved about for a few seconds and left standing on a false bottom. With more rapid machine sharpening, except with hollow steel, one heat should be sufficient, as gaging is automatically done.

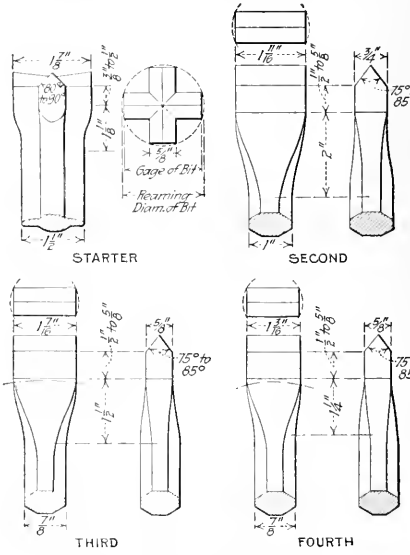
Quenching tanks should be supplied with cold water at the bottom at three places and should have a false bottom, as well as frame and knife-edge below water level. They should be fitted with an indicating thermo-telegraph thermometer, so that the necessary temperatures can be maintained. Usually the bath is allowed to be too cold in the morning and to get far too hot later in the day. If steel is quenched at above 800° C., the grain gets coarser, the tensile stress and the elongation both become less. The higher the carbon contents of the steel, the higher should be the temperature of the water for quenching. If, however, it requires a higher water temperature than 35° C., the carbon content is too high for rock drills unless tempering is employed. Shanks of drills may be tempered by leaving them for a minute in a molten-lead tank 1 in. deep, covered with ashes; if somewhat harder shanks are required, a little tin may be added to the lead.

The loss of weight per inch drilled with the very best steel was 0.4 gram, and good steel averaged about 0.6 gram, costing about 0.015 penny. The total cost of solid steel and its sharpening is 6% of stoping costs of 4s. to 6s. per ton. With hollow steel it is about twice as much. The best steel could be bought in Johannesburg at from 4d. to 4½d. per lb. The loss of steel per inch drilled was found to be the same with all three sizes of steel experimented with.

Design of Drill Bits Adopted

The style of drill bits adopted has been already illustrated in the *Journal*, but it deserves further notice.

It was stated that chisel bits were found by experiment to be the fastest drillers and this was claimed to be due to the facts that they occupy only 50 to 63% of the hole



BITS USED IN STEEL TESTS BY MINE'S TRIAL COMMITTEE

and that they allow the escape of mud better. This reason is open to question. The four square reaming edges, of the depth shown in the sketch, were adopted. I have seen such a design of bit recommended for hammer drills, but it is opposed to all accepted theories of the correct formation of the wings of piston-drill bits. One might suppose that it would prejudice the rotation of the drill in the hole, but the fact remains that the experimenter got most excellent results in hard ground from this design, and I commend it to the attention of mining engineers elsewhere. The next point of interest was that the experimenter showed that by using gaged steel, more carefully sharpened, and drilling larger holes, it was possible to reduce the drills used per fathom broken from 35.8 to 26.6. Gaging may take 25 to 30% more time and add to the cost of sharpening, but it pays for itself. The

reaming diameter of the holes drilled was greater than the nominal gage. The experimenter says of these square reaming edges: They should be hardened for ¾ of their length. (1) They help by reaming out the hole to keep it from decreasing in diameter too rapidly. (2) They prevent "wobbling" of the drill in the hole and thus preserve its cutting edge and reduce wear and tear on machine. (3) The drill passes slips or heads better.

The thickness of the bit should be kept about ⅝ in., otherwise the reaming diameter is increased too much. There was a great difference in gage used; $\frac{3}{16}$ in., ¼ in., and ¼ in., as shown by the following table:

	Starter	Second	Third	Fourth
Inches drilled	13.4	22.1	23.4	21.5
Drill rates, in. per min.	1.58	1.77	1.97	2.14
Gaged bit	$1^{13}/_{16}$ in.	1¾ in.	1⅝ in.	1⅜ in.
Reaming diameter	1.95 in.	1.79 in.	1.54 in.	1.34 in.
Loss of reaming diameter	0.09	0.18	0.17	0.15

The experimenter remarks that it would be possible to reduce the gage. This is evident. Owing to vibration of the drill in the hole, the hole bored is always 0.05 larger than the bit, so that all the difference necessary between different steels would have been about 1/6 in., or 0.17 in. This would have meant an increase of drilling speed equivalent to starting the hole at about 1⅝ in. instead of 1⅞, probably 10 to 15%. This is a matter that received far too little attention, owing to the mistake of using the same steel to drill dry holes as to drill wet holes.

Another series of experiments showed the benefit of gaging steel. The ordinary run of mine steel was found when new to differ from 0.09 in. to as much as 0.17 in. from the proper gage, while the gaged steel hand-sharpened was found to differ only between 0.01 and 0.03 in. from standard.

These experiments undoubtedly were most valuable and pointed out the way to a great increase in efficiency in stoping on the Rand. Yet, except in the case of perhaps one or two mines, the results have received no attention whatever. Machine drills are, when sharpened by hand, as badly sharpened as ever, though the quality of the supply of drill steel itself has been standardized very well.

Canadian Mining and Exploration Co. Liquidates

The Canadian Mining and Exploration Co., a $5,000,000 concern organized in 1912 by a number of wealthy men in New York and Canada to investigate and exploit mining properties, is to be dissolved and the capital returned to the subscribers. Half of the $5,000,000 was paid in.

The directors investigated about 1,500 mining propositions without finding one that was considered worthy of development. In the meantime the capital paid in has been carried in interest and dividend-paying securities. These investments, which cost $2,231,000, are now valued at about $2,185,000, but the income received will enable the company to repay subscribers in full, with perhaps 5% interest on the money. All of the assets have been liquidated.

Ontario Mineral Output

In issuing its statistics on the mineral output of the Province of Ontario for the first nine months of 1915, the Ontario Bureau of Mines makes the following comment:

The Sudbury mines are being worked to their maximum capacity, and the production of nickel for the nine months nearly equals the largest previous output for a full year. Over 75% of the output is made by the Canadian Copper Co., but the operations of the Mond Nickel Co. are now more extensive than formerly and its output has correspondingly increased. The yield of copper is also much greater than in the corresponding period of 1914 and nearly equals the total output of that year. It was all contained in the Sudbury mattes. Metallic nickel and cobalt are now produced from the silver ores of cobalt by the smelters at Deloro and Thorold. The metallic-nickel output equaled 98,216 lb. and the cobalt output 24,962 lb., for the nine months. The trade in cobalt and nickel oxides has been heavily affected by the war, and the quantities shipped were much below those of the corresponding period of 1914. Efforts are being made to put the molybdenite industry on a commercial basis.

Hydraulicking at Surigao, P. I.

The most important hydraulic-mining operation in the Philippines was started in 1914 by the Cansuran Placer Co. in the Province of Surigao on the eastern coast of the Island of Mindanao. The company began hydraulicking toward the end of 1914 at a point from 10 to 12 km. south of the town of Surigao on property leased from the Cansuran Mining Co. According to the report[1] of Wallace E. Pratt, chief of the Division of Mines, American prospectors were quickly attracted to this region following American occupation, and C. A. Briggs, E. O. Parker and R. W. McCullough obtained possession, through location and through the purchase of a Spanish grant, of the placer properties on Cansuran Creek and of lode deposits, which through the organization of the Cansuran Mining Co. they have retained.

R. Y. Hanlon, upon whose report the placers were leased by the Cansuran Placer Co., made a series of 181 tests by sinking shafts through the gravel to bedrock and panning regular vertical sections from surface to bedrock. He delimited in this manner several blocks, near each other although not contiguous, with an aggregate area of 131 hectares. Over this area he obtained an average value of 57 centavos per cubic meter, the average depth to bedrock being 3.5 m. All this ground is at such an elevation that water for hydraulicking purposes can be brought to it under a head ranging from 40 to 100 m.

Hydraulicking is now in progress on the ground tested by Mr. Hanlon. Water is obtained from Tuganaan River and is conveyed a distance of about 1.8 km. by ditch, flume and pipe line. According to the engineer's estimates, 1,000 miner's inches (0.70 cu.m. per sec.) of water is available. The flume is 1.2 m. wide, has a fall of 1.7%, and is built of native wood. At present the water is stored in a reservoir which is about 46 m. above the monitors. Another large reservoir is under construction which will afford a head of about 100 m.; water can also be drawn from the flume directly into the pipe line under a head of about 100 m. The main pipe line is 0.61 m. (24 in.) in diameter, the branches to the monitor being reduced appropriately. Two 6-in. monitors and one 7-in. monitor are in place, although there is insufficient water now to operate all of them continuously. The sluices are 73 m. long, 1.5 m.

[1] "The Mineral Resources of the Philippine Islands for the Year 1914." Division of Mines, Bureau of Science, Manila, P. I.

wide and are riffled with hardwood blocks 0.3 m. (12 in.) square, set with a space of 2.5 cm. (1 in.) between cross tiers. There is at present a length of about 100 m. of bedrock sluice ahead of the sluice boxes.

The company has installed a small air compressor and uses three hammer drills for breaking up the larger boulders. A logging engine and movable cableway serve to remove rocks too large to go through the sluices. A small Pelton-Doble wheel on a separate pressure line furnishes power for lights, refrigerating plant and a small sawmill with which the timber cleared ahead of the giants is sawed into marketable lumber.

The last year was exceptionally dry in Surigao, and the streams unusually low. Consequently water for hydraulicking was insufficient in quantity. An area of about two hectares was washed, but the cleanup had not been made at the time of this report.

How To Splice Wire Rope*

It is often the case where the wire rope is used that in case of a breakdown no man can be found on the job who can splice the severed ends, and naturally there is much time lost in securing some outside man to do the work. Splicing a rope is generally regarded as a mysterious process, whereas almost anyone can learn in a few hours how to do it. The accompanying illustrations show how a substantial wire-rope splice may be effected.

A hammer and a cold chisel for cutting off ends of strands, a steel fid or marlinspike for separating strands, two clamps for untwisting the rope, a sharp pocket knife for cutting the hemp core and a wooden mallet are all the tools needed. When starting to splice, proceed in this order:

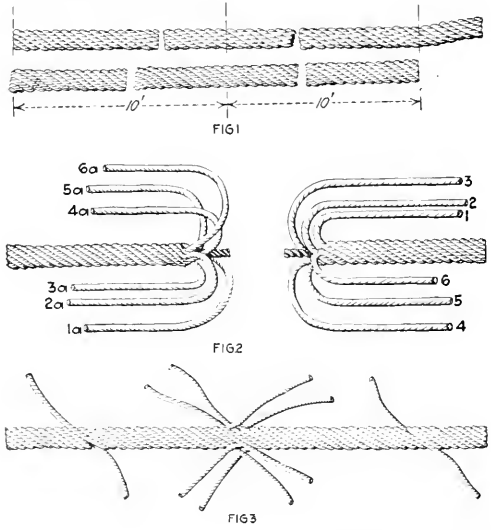
First, lay the rope on the ground, with ends overlapping 20 ft., 10 ft. each way from the center, as shown in Fig. 1.

Second, unlay the strands of both ends of the rope for a distance of 10 ft., as shown in Fig. 2. Cut off the hemp cores close up on both sides and bring the strands together so that the opposite strands will interlock regularly with each other.

Third, unlay strand 1*a* and follow up with strand 1 of the other end, laying it tightly in the open groove made by unwinding 1*a*; make the twist of the strand agree exactly with the twist of the open groove. Proceed with this until all but 6 in. of strand 1 is laid in or until 1*a* has become 20 ft. long, then cut off 1*a*, leaving an end about 6 in. long.

Fourth, unlay strand 4 of the opposite end and follow with strand 4*a*, laying it in the open groove as before, treating this as in the first case (see Fig. 3). Pursue the same course with 2*a* and 2, stopping 4 ft. short of the first set. Next do this with 5 and 5*a*, stopping as before, then with 3*a* and 3, and last with 6 and 6*a*. The strands are now all laid in with the ends 4 ft. apart, as shown in Fig. 4.

Fifth and last, the ends must be secured without enlarging the diameter of the rope. Take the two rope clamps, as shown in Fig. 6, and fasten them to the rope, as shown in Fig. 5. Twist them in opposite directions, thus opening the lay of the rope, as in Fig. 5. Next with a knife cut out the hemp core about 6 in. on each side. Straighten the ends and slip them into the place occupied by the core; then twist the clamps back, closing up the rope, and take out the slight inequality with the wooden mallet and a block of wood. Next shift the clamps and repeat the operation at the other five places, and the splice is made.



FIGS. 1 TO 6. THE SUCCESSIVE STEPS IN ROPE SPLICING AND THE CLAMPS EMPLOYED

*By C. J. Fuetter, Logan, W. Va., in "Coal Age," Nov. 20, 1915.

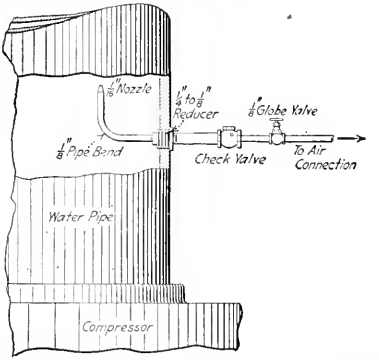
Salt Production of the United States in 1914 amounted to 34,804,683 bbl. of 280 lb. each, according to the Geological Survey. As a byproduct of the salt industry, there was 576,991 lb. of bromine made, and 19,403 tons of calcium chloride marketed in 1914. Michigan is the largest producer among the states, with 11,670,976 bbl. New York is second.

Details of Practical Mining

Circulating Cooling Water with Compressor Air

By Charles Labbe*

In the installation of a compressor in Nevada there was no running water available for cooling purposes. I therefore erected a thermo-siphon from a tank and used the same water at all times. However, as the water had to be hot to circulate well, it did not work efficiently. To remedy this I drilled a ¼-in. hole in the outlet pipe on top of the compressor and inserted a ¼- to ⅛-in. reducing bushing. A ⅛-in. pipe was swaged down so as to go freely through the opening, and a ⅛-in. thread was cut on the shoulder of this pipe, which was screwed into the bushing. The pipe was bent upward so as to permit the



ARRANGEMENT FOR CIRCULATING COOLING WATER

nozzle to deliver compressed air into the center of the water pipe. Connection was then made with the compressed-air line, the amount of air being regulated by a globe valve. A ⅛-in. check valve was also placed between the globe valve and the water pipe, so that no water would get in the air line if the compressor were shut down and the operator failed to close the globe valve.

Instead of pumping the water for cooling the compressor, just enough air is allowed to enter the water pipe to make the water circulate well, and I think it is cheaper than circulating the water mechanically and just as reliable. The hole in the nozzle being about $\frac{1}{16}$ in. and the air coming out with less than 5-lb. pressure, I regard this as an economical way of circulating the compressor-cooling water for a small installation. It also has the great advantage of simplicity.

*Nelson, Nev.

How to Designate Chains

Chains are designated by the diameter of the rod from which the links are made, as ½-in., 1-in., etc.; also by the form of the link, as close-link, in which one link is just large enough to inclose the two adjacent ones; open-link, in which the link is larger than in close-link; bar-chain, which consists of open links with a bar across the middle of each; twisted-link, in which each link is twisted through a certain angle, usually 90°; and straight- or flat-link, which is not so twisted.

Use of Cordeau-Bickford in Deep-Blast Firing

By L. B. Reifsneider*

The iron ore in the opencut workings of the Spanish-American Iron Co. at Daiquiri, Cuba, is cut into irregular blocks of varying dimensions by barren dikes. As it is desirable to work out the ore with as little sorting as possible, the spacing and depth of drill holes are largely governed by these dikes. The cut faces are from 25 to 50 ft. in height, but on account of the rock dikes, holes can rarely be drilled over 35 ft. in depth, about 28 ft. being the average.

The first trial of the Cordeau[1] was made in a series of eight flat lifting holes, varying in depth from 8 to 14 ft. in hard tough rock at the foot of a bench. The material is being handled by a steam shovel. The holes were charged as for ordinary battery firing and were connected in series. A 50-ft. lead of Cordeau was used and fired with a time fuse and a No. 8 blasting cap. The holes were charged with 40 and 60% Du Pont semi-gelatin. The results of the blast were excellent, but the finely broken condition of the rock indicated that, although the holes were not overcharged, at least 25% less explosive could have been used with satisfactory results had ordinary electric fuses been used as a detonating agent instead of the Cordeau.

A 30-ft. hole with very heavy burden was loaded in the same material a few days later. The toe had been well undercut by a previous blast, but would ordinarily have been charged with 250 lb. of R.R. powder. Remembering the experience with the former blast, in using Cordeau, it was decided to cut the charge 20%, or to 200

*Superintendent, Spanish-American Iron Co., Daiquiri, Oriente, Cuba.

[1]Cordeau-Bickford is a comparatively new detonating safety fuse. It consists of a flexible lead tube filled with tri-nitrotoluene as the detonating agent and is about the diameter of ordinary single-tape fuse. It is manufactured by the Ensign-Bickford Co., which has secured the patent rights from foreign manufacturers. Besides the economic advantages, the factor of safety in its use will recommend it to anyone using high explosives. The tri-nitrotoluene (usually abbreviated to t.n.t.), while in itself a powerful explosive, is insensitive to any ordinary shock; we have had a 10-ton locomotive run over a small test piece without exploding the Cordeau. It does not explode by friction and one can hardly ignite it with a match. Upon being exploded with a blasting cap its action is very rapid and powerful, the speed being estimated at about 17,000 ft. per sec. Wrapped and unwrapped Cordeau are manufactured. The unwrapped fuse is suitable for holes 50 ft. or less in depth, but for deeper holes the wrapped kind is recommended as the cotton sizing gives additional tensile strength. The weight of the lead tubing makes the unwrapped kind likely to tear when used in greater than 50-ft. lengths. The Cordeau is packed in convenient form, being wrapped on hardwood spools in such lengths as are most economical and convenient for the purchaser. In using the unwrapped Cordeau, care in handling is needed to prevent kinking and splitting the lead tube, but no more precautions are required than would be used in handling or loading with electric fuses. The Ensign-Bickford Co., Simsbury, Conn., publishes an interesting pamphlet on the use and properties of Cordeau.

lb. After blasting it was found that the holes were again overcharged, as the material had nearly all broken to hand-loading size and had been displaced so that a large portion of it fell on and obstructed the shovel loading track.

A combination of four lifters with a deep drill hole above was next tried. As the lifters were in very tough rock, they were loaded with 60% semi-gelatin, it being desired to get a shattering effect. The 30-ft. hole was in blocky material, and R.R. powder was used. The charge ordinarily used would have been 250 lb. of dynamite and 300 lb. of powder; this was reduced to 200 lb. of dynamite and 200 lb. of powder, and the results of the blast were excellent.

A number of holes had been drilled in ore in the toe of a cut face. As the holes were closely spaced it was desirable to fire them simultaneously. Cordeau was used and the charge cut from 200 lb. of 40% semi-gelatin to 125 lb. The blast was very effective, and the material was shattered so as to require very little blockholing afterward. Had 60% dynamite been available the economy would have been still more marked.

Cordeau was used in a five-hole deep blast in a cut floor. A charge of 250 lb. of black powder was calculated for each hole, as the burden was very heavy but badly broken-up ore, and the holes averaged 35 ft. in depth. Owing to caving, one of the middle holes in the heaviest burden admitted only 150 lb. of powder and another, 200. On firing, the holes which had admitted the whole charge broke well to bottom, but the other two were not strong enough to turn over their burden and the ore settled back in place very much cracked and shattered and but little more blasting was required to bring it down. Had blasting been with a battery and electric fuses, 300 lb. of powder per hole would have been the allowance, and under the conditions as they developed, the results would have been very unsatisfactory.

From these experiments the conclusion was reached that from 15 to 25% less explosive may be used in holes where Cordeau is used as a detonator.

The instantaneous explosion of the entire charge is obtained by using Cordeau, as it is the first thing put into the hole in starting to load and reaches to the bottom of the charge. As no blasting cap is necessary the danger of the tamping bar striking a cap in placing the explosive is obviated. The effect of the Cordeau is especially advantageous in using powder and gives the latter an effect similar to low-grade (15% to 25%) dynamite or Judson powder.

There is practically no danger of a missed hole going undetected in using Cordeau, as when the holes are exploded the Cordeau is entirely destroyed and a projecting piece of the Cordeau is very noticeable and means that the hole has not exploded. It can be connected up and fired with the ordinary cap and fuse at any time.

Its use is recommended for all deep holes and series blasting where electric firing methods can be used. The economy in its use in shallow holes is less marked, as its higher cost when used in blockholes, etc., more than offsets the saving that can be made in light charges.

As local prices for explosives are not applicable in the United States, no figures are given, but our records show actual average saving in explosives used, exclusive of the labor of charging, of 17.5% and in one case of 24%, as applied to deep blasts.

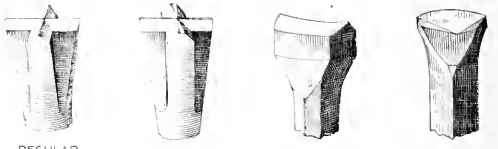
Some Comparative Tests of Piston-Drill Bits*

An investigation was made to compare the relative cutting speed and efficiency of some of the different types of rock-drill bits used in piston machines, including the regular cross bit, the low-center cross bit, a so-called flat cross bit, the Z-bit of the southeast Missouri type and the Joplin bull bit.

The drill steel used was 1¼-in. cruciform and 1-in. octagon Jessop drill steel, costing 14½c. per lb.—a better grade of steel than is commonly used in mining operations. These bits, except for one test, where they were forged by hand, were made and sharpened on a drill sharpener. Flat cross bits were made by filing the regular bit to the required shape. Dollies were made for forging these flat bits, but it was found difficult to form them on the sharpener, as it required the pounding down of too much metal in the center to bring out the flat edges.

A set of steel consisted of two "starters" about 27 in. long, a "second" 11 in. long and a "third" 60 in. long. "Starters" were made with a 2¼-in. gage, "seconds" with a 2-in. and "thirds" with a 1¾-in. gage.

The original purpose of the test was to compare the regular cross bit with a so-called flat bit made by flat-



TYPES OF BITS USED IN TEST

tening out the edges of the regular bit into the shape shown in the sketch. Earlier results seem to indicate that the flat bit possessed several advantages over the irregular, in that it appeared to cut faster, had greater endurance, lost gage less rapidly and, when used in rock of varying hardness, showed less tendency to run out of line.

Consideration of the results from starters was disregarded, as so many conditions enter in to make these results unreliable. A summary of results of these tests permits the following deductions to be drawn: Comparing the two "seconds," the regular bit seems to cut slightly faster, 3 in. per min. as compared to 2.93 in. for the flat. The flat "thirds" average 3.6 in. per min. as compared to 3.23 for the regular. From these results and from previous ones it is evident that a flattened bit will cut at least as fast as the regular sharp-edged bit. Comparing the average cutting speeds of the first two holes with the average of the entire run, it is seen that this holds true from the very start and does not take place as the bit wears down.

The reason for making a bit of the flat shape in the beginning was because of the observation that the irregular bit became flattened on the edges, with corners rounded and centers high, after being used in one or two holes. It was thought, therefore, that by putting more metal at the outside, the corners would hold up

*Abstract of paper by Prof. C. L. Forbes and L. M. Cummings, in "Bulletin of Bureau of Mines and Metallurgy," University of Missouri, August, 1915.

better, and such was found to be the case. It was especially noticeable that the center did not wear high in the better flat bit and the rounded corners were much sharper than with the regular bit.

From these tests the theory of chipping or penetration as applied to rock drilling appears not to hold, at least under the conditions in this work. Screen analysis of cuttings were made, in order to find the difference in coarseness with different bits. The results, however, were not satisfactory, as so many conditions entered to influence the fineness of cutting.

These tests were discontinued without running the drill steels to their limit, and in most cases it would have been possible to drill at least 10 ft. with every steel, except with the "starters." Under usual mining conditions in rock as hard as the granite used in these tests, steels would not be used more than twice, and in most cases not more than once. It would seem that economy could be attained by using the steel longer, as a difference in cutting speeds between the sharp and dull bits is almost negligible, while the slight advantage gained by using sharp steel is more than offset by the increased expense of sharpening the steel and transporting it to and from the working face. It is not meant that miners should be made to use dull steel or poor steel, but it is believed that one set of properly tempered steel could be used efficiently in at least five holes in rock similar to the granite used, and that no greater drilling speed would be obtained by using a new set of steel in each hole.

The loss of gage in drilling the first hole in these tests was usually $\frac{1}{4}$ in., and was as much as the total loss in drilling the four succeeding holes. A 2-in. bit, for example, would be reduced to $1\frac{3}{4}$ in. after drilling one hole, but it would lose only $\frac{1}{4}$ in. in drilling four more holes.

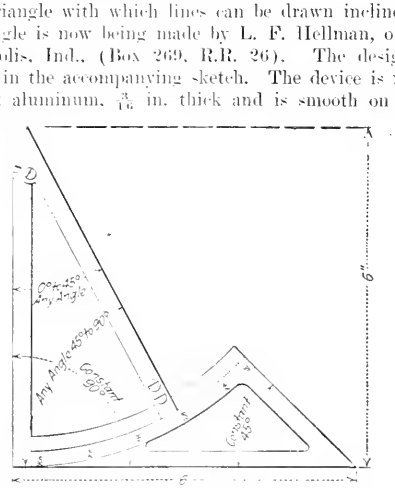
Summing up the comparison of flat and regular cross bits with piston drills in granite, the following deductions may be made: (1) A flat bit with cutting edges about $\frac{3}{32}$ in. wide will cut as fast from the beginning as the regular sharp-edged cross bit, proving conclusively that the so-called chipping action that is supposed to take place in rock drilling is practically negligible. It is difficult to conceive of a flat surface breaking away rock in any manner except by impact or crushing, and the fact that a new sharp flat bit cuts as fast as the new regular sharp-edged bit is conclusive proof that little or no chipping takes place under the condition of these experiments. (2) The flat bit is more difficult to forge in the sharpener than the regular bit, but by hand, if proper dollies are provided, it may be forged just as easily. The low-center cross bit, some tests of which were made, seems to be quite similar to the flat bit, and it is thought that the advantage of the low-center bit is due to its wearing down to practically the shape of the flat bit, and that instead of forging a flat bit, it might be just as well as to forge a low-center bit, which is more easily made. (3) The relative speed of flat bits, as compared to regulars, is greater with the smaller gages, often as much as 25%.

Relative to the comparison of regular, Z- and bull-bits, the following deductions were made: (1) The low-center cross bit is superior in cutting speed and endurance to the regular cross bit. (2) The Z-bit cuts faster than any of the other bits under the conditions in these tests. (3) The bull-bit has the one advantage of losing gage less rapidly than the others, but its cutting speed is much less.

These conclusions apply only to the use of bits for piston drills in granite. The cutting action of hammer-drill bits may be considerably different.

Universal-Angle Drafting Triangle

A triangle with which lines can be drawn inclined at any angle is now being made by L. F. Hellman, of Indianapolis, Ind., (Box 269, R.R. 26). The design is shown in the accompanying sketch. The device is made of cast aluminum, $\frac{3}{16}$ in. thick and is smooth on both



HELLMAN'S UNIVERSAL TRIANGLE

sides. The base and one side are rigid, but a part of the hypotenuse swings about a friction point. The arc is graduated to half-degrees, but quarter-degrees can be estimated. Triangles graduated for slope and pitch are also supplied. Only the 6-in. size is made, and this sells for $2.

Draining Ground Prior to Shaft Sinking

In ordinary shaft sinking the water encountered is pumped out as the deepening of the shaft progresses. On a lease of the Mary Calf land in northeastern Oklahoma two large shafts that were being sunk were made dry during sinking operations by the use of extraneous air lifts.

Drill holes lined with 5-in. casing and reaching to a depth of 170 ft., to which depth the shafts will go to reach the bottom of the ore formation, are put down by the use of churn drills. After the holes are drilled and cased, a $\frac{3}{4}$-in. air line is placed in each casing, forming an air lift, and when the pressure of air is turned on a heavy volume of water is lifted. From three holes at one shaft the combined water forced out by the air pressure was 800 gal. per min., which was sufficient to keep the shaft well drained and dry.

Cleaning of Manways

Timbers in all manways in daily use should be cleaned of all loose rock lodged upon them at least once in every 24 hours. Manways in daily use should be kept clear of obstructions.

Details of Milling and Smelting

Use of Cement Instead of Lead for Pipe Joints

The use of portland cement for making the joints of cast-iron water mains has become common in southern California cities. The practice appears to have originated in the water department of Longbeach, Calif., about ten years ago, and the success there obtained has caused a number of other cities to adopt the same plan, says *Engineering News*, Nov. 25, 1915. The superintendent of the Longbeach water-works, Clark Shaw, declares that the cement joint is not merely cheaper than the ordinary lead joint, but is tighter and more permanent.

The method of making the joint is as follows: After the pipes are connected, a ring of dry jute is inserted in the bottom of the bell and the bell filled with neat-cement paste. It is essential that this paste be mixed with only enough water to moisten it, but not enough to make it soft. After the bell is filled with the paste it is packed with a long calking tool, like that used for calking a lead joint. If the paste is of the right consistency it should pack under the tool until it is almost as hard as lead.

After the first calking, the joint is refilled with paste, which is again packed solid with the calking iron; this is repeated a third time. The joint is then neatly rounded off with a collar of 1 : 1 cement and sand. The cement is allowed to set for 48 hr. before water pressure is turned on the pipe. In case of necessity, however, water may be turned into the pipe within 24 hr. The only lead joints now used in Longbeach are in pipe that has to be put in service as soon as it is laid. The pipe used has the standard hub and spigot. A line of pipe 6,400 ft. long was recently laid with cement joints, and not a single leak was found when it was tested.

When it is necessary to take up pipe laid with the cement joint, a section of the cement on top, about 60° wide, is chipped out to the bottom of the bell, and the joint is then readily broken. This work is much more easily done than unjointing pipe having lead joints.

An important advantage of the cement-jointed pipe is that the conductivity of the line for electric currents is much reduced, as there is cement insulation at every joint. Liability of damage to the line by electrolysis is greatly reduced, although if one joint or only a few were made with cement there might be corrosion at these points.

A comparison of costs of the material required for a 4-in. pipe joint shows that with lead at 5½c. per lb. the material for a lead joint cost 29c. and the material for a cement joint, 3½c. At the present high prices of lead the difference is much greater, and on larger sizes of pipe the large saving possible makes the change one which is well worth the attention of water-works engineers. There is also much less expense for labor in the cement joint than for the lead joint, and the work is simpler. This should be a valuable idea in isolated districts such as mining camps.

Commenting editorially on the foregoing the *News* further says:

Why should the cement joint be absolutely water-tight against an internal pressure of 100 lb. per sq.in. or more, while the cement joint for sewer pipes in practically universal use be exceedingly apt to leak under the ordinary pressure of ground water?

The answer to this question is probably to be sought in the manner in which the cement joint for water mains is made up—with a cement paste containing barely enough water to moisten it, packed into the pipe bell with a calking tool and hammered home as if it were lead.

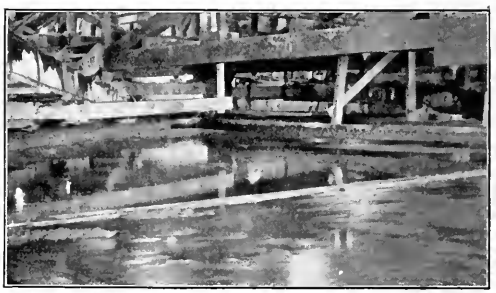
It is common knowledge that the strength of a cement briquette is greatly affected by the packing of the cement in the briquette mold; but we recall no tests made to determine how strong a briquette could be produced by compressing a very dry paste under repeated hammer blows. The long experience with the cement water-pipe joint now available indicates that such cement is not only very strong, but about as impermeable as metal.

*

Foam Sweep for Thickeners

By D. W. Minier*

The device here described for preventing foam accumulation on the surface of Dorr thickeners seems to be well known to some and not to others. It is said to have originated in Tonopah practice and is here described as used in an Arizona mill. It works well with continuous



FOAM SWEEP ON A THICKENER

counter-current decantation where an air lift is used for the transfer of the overflow solution of one thickener to the next in series.

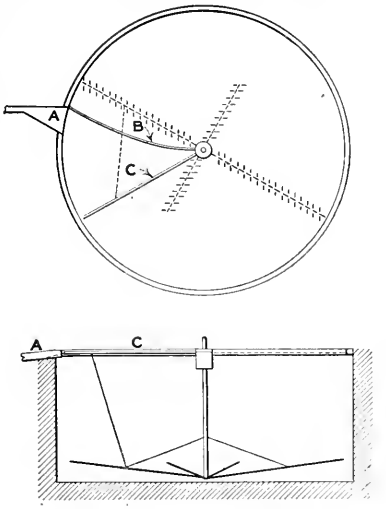
The idea is simply that of a fixed curved baffle extending from the periphery to the mixing cylinder at the center of the thickener, and a rotating float that pushes the foam ahead of it and, in passing under the curved baffle, forms a gradually closing V that forces the foam to an outlet launder bridging through the annular launder.

The curved baffle is of 1x3-in. stuff, and its flexion is held by a wire chord. It is suspended from the bottom member of the overhead truss by 2x4-in. pieces and fastened by lagscrews through slots in the 2x4-in. pieces, so that its elevation can be adjusted. There is a strip of belting fastened along its lower edge to form a flexible contact with the rotating float.

*Mining engineer, Pearce, Ariz.

The rotating float is of 4x4-in. seasoned redwood, painted with P. & B. paint. At the center of the tank it is fastened loosely to the mixing cylinder or shaft by an iron hoop, and rotation is effected by a rod fastened through the float and hooked over the tension rod of one of the rabble arms.

The overflow foam launder is 3 ft. wide and 4 in. deep and bridges over and through the overflow launder, its floor being 2 in. higher than the solution outflow holes in the annular launder. The level of solution in the thickeners should be maintained just slightly above the floor line of the foam-outflow launder, so that a thin sheet of solution



SHOWING THE FOAM SWEEP

is flowing out. A spray pipe above this launder helps to break up the foam and assist its flow. The solution level in the thickener can be regulated by plugging some of the holes in the annular launder, but is better done by means of sheet-iron gates across the launder, sliding in grooves on each side of solution-discharge outlet.

The sweep can of course be used only where there is a suitable place to send the foam and a small amount of the solution. In the plant mentioned, the thickener preceding the agitators is so equipped and the foam is sent to the first agitator of the series.

As the thickeners following the agitators are run on the counter-current system with air-lifts for transfer of solution, the foam from the first thickener is sent to the air-lift well for overflow solution of the second thickener and is thus returned with the diluent to the thickener of its origin. The air lift is effective in breaking up the foam.

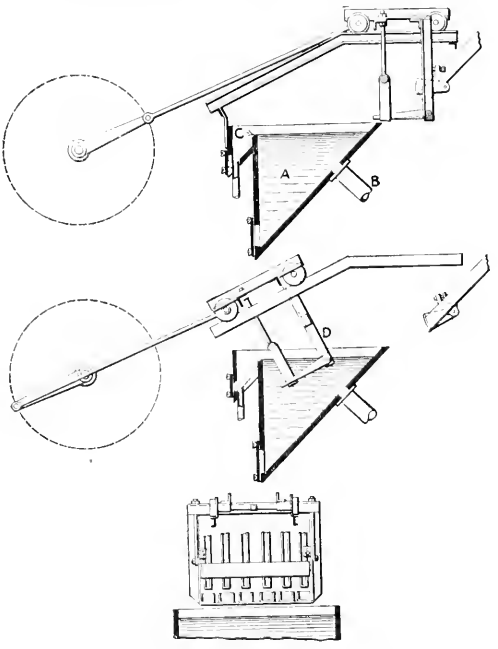
Electromagnetic Treatment of Monazite Sand

In Technical Paper 110 of the Bureau of Mines, by Karl L. Kithil, are given the following suggestions on the electromagnetic separation of monazite sand:

In concentrating monazite sand by the electromagnetic process, it is essential that great care be taken throughout the entire operation that the strength of the current is the same at all times, as the slightest variation will cause imperfect separation. An impure product and much loss of monazite will result unless the precaution is observed, as the monazite will be taken up by the wrong pole. If the strength of current be too great some of the monazite will be mixed with the valueless ilmenite or garnet, or if the amperage be too low, ilmenite or garnet will be carried over to the next following poles and will then become mixed with the monazite, and at the same time too many of the finer sizes of monazite will escape in the tailings. The distance between pole magnets must be carefully adjusted and the amperage of each magnet regulated by rheostats.

Stone's Flotation Apparatus

George C. Stone, of New York, has patented (U. S. Pat. 1,156,041, assigned to the New Jersey Zinc Co.) a flotation apparatus providing for the introduction of ore into the flotation liquid intermittently, preferably in relatively small individual charges and with a negligible amount of agitation of the liquid. For this purpose a carrier is provided for immersing the ore in the flotation liquid, as shown in the accompanying illustration. *A* is the flotation liquid, *B* the supply pipe there-



FLOTATION APPARATUS WITH IMMERSING FEEDER

for, *C* the barrier over which the mineral particles are floated, and *D* is the carrier for immersing the charge in the flotation liquid.

The carrier consists of a series of individual trough-like pans, movable in unison, entering and leaving the flotation liquid in a substantially rectilinear path and at an acute angle to the surface. When the ore carrier moves upward and out of the flotation liquid, it may be brought into coaction with a suitable source of ore supply and receive a new charge preparatory to the downward movement into the flotation liquid.

The Assayer and Chemist

Analysis of Commercial Selenium

By H. D. Greenwood*

Within the last two years a demand has been created for selenium and its soda salt, the glass industry using it to make ruby glass and the dyestuff industry to replace the sulphur derivatives. The following method for the analysis of commercial selenium has been in use in this laboratory for the last five years, and its accuracy has been demonstrated by checked assays with chemists here and abroad. It is so simple, quick and accurate that it has been placed among the routine methods. No originality is claimed.

Selenium Determination

Weigh out ½-gram (0.5000-gram) portions of the finely ground sample (100-mesh) into a 150-c.c. beaker. Add 10 c.c. H_2O, then add slowly 15 c.c. conc. HNO_3 and cover with a watch glass. Evaporate to dryness on the water bath, take up with 10 c.c. HCl (1:1) and 20 c.c. H_2O. Filter off the insoluble into a 400-c.c. beaker, and to the filtrate add sufficient conc. HCl to make a solution of 70% conc. HCl.

The selenium is precipitated at room temperature by a slow current of SO_2 at the rate of two small bubbles a second. Care must be taken to keep the solution at room temperature (60-70° F.) by placing the beaker in a vessel of running tap water.

When all the selenium has been precipitated and the solution smells strongly of SO_2, remove and allow to settle for one-half hour. Decant the supernatant liquor onto a tared gooch and wash the precipitated selenium in the beaker three times with conc. HCl and once with cold water, decanting each time.

To the precipitate still in the beaker add 25 c.c. cold water, and from a wash bottle with ordinary stream, hot water with vigorous stirring until the selenium turns black and granular. This is readily filtered off, washed with hot water and dried at 110-115° C. to constant weight. Weigh as metallic selenium.

Tellurium Precipitation

The filtrate from the selenium is diluted to four times the bulk with hot H_2O; 25 c.c. NH_4OH and 3 grams of powdered tartaric acid added, saturate the liquid with SO_2 (takes about two minutes) and bring to a boil. Allow to stand for two hours or longer on a hot plate. The granular precipitate is filtered on a tared gooch, washed with hot water, dried at 115° C., to constant weight and weighed as metallic tellurium.

The foregoing method, when strictly followed out, gives accurate results, but the beginner is apt to deviate from the method and lead to the following inaccuracies: If the temperature of the solution when precipitating Se is above 70° F., the Se balls up occluding impurities which can never be washed out; if below 60° F., incomplete precipitation occurs. If the precipitated Se is not made granular as stated, it cakes in drying and holds moisture even at 110° C. He also errs in not testing wash waters and filtrates, and finally in not having beakers and precipitating tubes entirely free from grease; the latter in this laboratory are always flame-burned before using.

*Chief chemist, U. S. Metals Refining Co., Chrome, N. J.

Recovery of Molybdenum from Laboratory Waste

In a recent paper in the *Analyst*, J. A. Prescott suggests a method for the recovery of ammonium molybdate used in phosphate determinations. The method is based upon the fact that if ammonium molybdate is boiled with an excess of acid, molybdic acid is precipitated. All residues, including acid liquors from which the yellow phosphomolybdate precipitate has been removed or alkaline or neutral liquors obtained by dissolving the yellow precipitate in alkali or ammonia and ignited residues, are thrown into a large evaporating dish, which is kept heated in order to concentrate the liquors.

As the liquors are concentrated, molybdic acid is precipitated, and eventually, as there is a preponderance of acid residues, a strong, acid, sirupy liquid is obtained, from which crystals of ammonium sulphate or ammonium nitrate separate on cooling. A certain proportion of phosphomolybdate separates out with the molybdic acid. The whole is filtered, and the yellow molybdic acid is washed with cold water and dissolved in excess of ammonia. To the ammonia solution, magnesia mixture in carefully added until no more phosphate precipitates. The solution is filtered, concentrated to a small bulk (keeping ammonia present in excess) and allowed to crystallize.

The mother liquors are worked up for further quantities of molybdate, and if necessary, the crystals obtained are recrystallized. When a blue color, due to the presence of lower oxides of molybdenum, is produced through allowing the waste liquors to evaporate to dryness and overheating, it may be removed by the addition of hydrogen peroxide.

Filtering Aluminum Hydroxide

A description of certain details of manipulation are given by H. W. Daudt, in the *Journal of Industrial and Engineering Chemistry*, October, 1915, by which he says it is possible to filter and wash aluminum-hydroxide precipitates readily.

The solution of the aluminum salts containing only a small excess of acid is heated until steam is given off copiously, while stirred constantly. Freshly distilled ammonia is carefully added until its odor can be detected in the steam. The solution with suspended precipitates is then boiled for approximately three-quarters of a minute—not more than a minute. The solution is immediately transferred to a prepared filter paper, no attempt

being made to decant from the supernatant liquid. The precipitate remaining on the sides of the beaker is transferred as rapidly as possible by means of boiling hot water and then washed with hot water or with an ammonium-chloride solution of definite concentration.

He has carefully checked the statement of Hillebrand, that complete removal of ammonium chloride from aluminum hydroxide before ignition is unnecessary. Consequently it is possible to use ammonium-chloride solution for wash water without sacrifice of accuracy by volatilization of aluminum or ferric chloride; while it is of advantage to have small quantities of ammonium chloride present, because the hydroxide precipitates tend to become colloidal when electrolytes are altogether absent in the wash solution.

What Is a Normal Solution?

What is a normal solution? The definition is not reassuring: "A normal solution is one in which a liter of solution contains a quantity of the substance, expressed in grams, equal to its molecular weight, divided by its hydrogen equivalent." Fortunately, this definition is not so bad as it looks, says *Power*, Sept. 28, 1915.

For instance, a normal solution of hydrochloric acid ($H + Cl = 1 + 35.4 = 36.4$ molecular weight) would contain 36.4 grams of hydrochloric acid per liter. But normal sulphuric-acid solution ($H_2 + S + O_4 = 2 + 32 + 64 = 98$ molecular weight) would contain 49 grams per liter, since its hydrogen equivalent is two. Normal sodium chloride ($Na + Cl = 23 + 35.4 = 58.4$) would contain 58.4 grams of salt per liter, but normal sodium-carbonate solution ($Na_2CO_3 \cdot 10\ H_2O = 23 \times 2 + 12 + 16 \times 3 + 10 \times 1 \times 2 + 10 \times 16 = 286$) would contain 143 grams per liter, since the two sodium atoms have a hydrogen equivalent of two.

This last compound shows that in making up normal solutions the water of crystallization must be considered. Although we usually write sodium carbonate as Na_2CO_3 in chemical equations, it is done only for convenience, and when normal solutions are prepared it is necessary to recognize that the salt as ordinarily prepared is not Na_2CO_3 of 106 molecular weight, but $Na_2CO_3 \cdot 10\ H_2O$ of 286 molecular weight.

The normal solutions are sometimes inconvenient to prepare. For instance, a normal solution of hydrochloric acid or of ammonia would be so strong as to lose HCl or NH_3 by evaporation, while normal solutions of some salts would often be impossible because saturation is reached below the normal point. For this reason tenth-normal solutions are often used $\left(\text{usually written } \frac{N}{10}\right)$ which are one-tenth the concentration of the normal solution.

AMOUNT OF SUBSTANCE IN NORMAL SOLUTIONS

Substance	Chemical Formula	Molecular Weight	Hydrogen Equivalent	Amount in Grams Per Liter
Sodium carbonate	$Na_2CO_3\ 10\ H_2O$	286 16	2	143 03
Sodium carbonate	Na_2CO_3 (fused)	106 00	2	53 00
Sodium bicarbonate	$HNaCO_3$	84 01	1	84 01
Potassium carbonate	K_2CO_3	138 20	2	69 10
Sodium chloride (salt)	NaCl	58 46	1	58 46
Ammonia	NH_3	17 03	1	17 03
Sulphuric acid	H_2SO_4	98 09	2	49 05
Hydrochloric acid	HCl	36 47	1	36 47
Caustic soda	NaOH	40 01	1	40 01
Caustic potash	KOH	56 11	1	56 11
Calcium chloride	$CaCl_2$	110 99	2	55 49
Calcium hydroxide	$Ca(OH)_2$	74 02	2	37 01

With the foregoing explanation in mind, the calculation of normal solutions becomes an easy matter. From the formula of the substance (including water of crystallization) and the table of atomic weights in any chemistry, calculate the molecular weight of the substance, divide by its hydrogen equivalent and the result is the number of grams of the substance which (assuming it is chemically pure) would give a normal solution when dissolved in a liter of water.

The accompanying table gives the amount required in a normal solution of a number of substances in common industrial use. The molecular weights are calculated by the accurate values given in the International atomic-weight table, 1914.

Toughening Filter Paper

A paper in the *Chemical News*, by Dr. Clayton Beadle, on the toughening of filter papers, describes a useful and simple method of strengthening a filter paper to such an extent that it will withstand the pressure produced by a powerful filter pump.

The paper is folded and fitted into a dry funnel in the ordinary way, and then a few drops of nitric acid of sp.gr. 1.42 are allowed to fall in the apex of the paper cone. The funnel is canted and quickly rotated so as to saturate the free unsupported apex of the cone with the acid, and is then immediately rinsed out under a tap, being filled and emptied from the top repeatedly, and finally rinsed out with distilled water if the presence of tap water is undesirable.

This treatment does not slow the filtering action of the paper; on the contrary, it tends to accelerate it, though treating the paper similarly all over slows the filtering very considerably—four or five times. The method is credited to E. J. Bevan, about 30 years ago, but few people seem to know of it.

The Determination of Lead in Blast Furnace Slags

By James O. Johnstone*

Weigh 2 grams of the finely pulverized chilled slag into a 400-c.c. beaker. Add 150 c.c. boiling water and 25 c.c. dilute sulphuric acid (1:1) and stir until all the slag is decomposed; some sulphides and carbon will remain undissolved. Then add an excess of potassium permanganate (about 2 grams) and boil for 3 min. Remove from the hot plate and add 5 grams tartaric acid and continue boiling till all the manganese dioxide is in solution. Filter off the lead sulphate, wash well, transfer paper and precipitate back into the beaker, digest with ammonium acetate, and titrate with ammonium molybdate. Time required: 20 min.

To Bore Holes in Rubber Corks

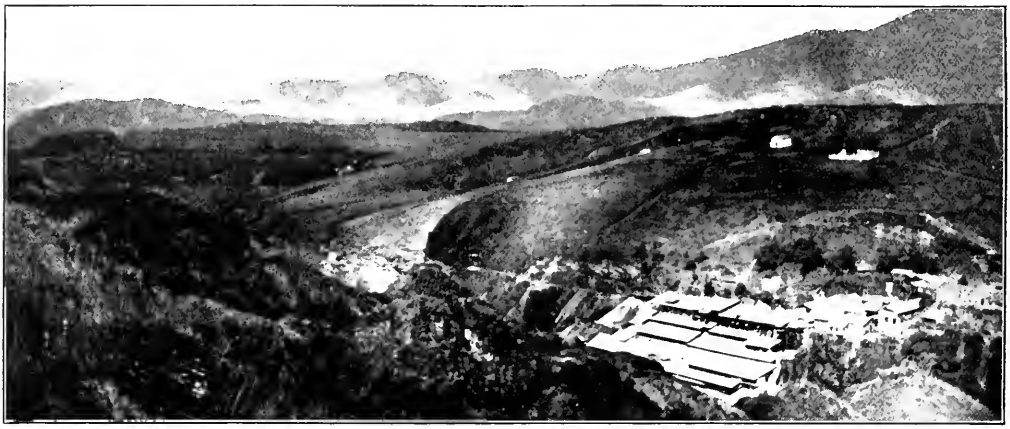
By Arthur S. Levy†

I have just come across the note on boring holes in rubber corks on page 440 of the *Journal* of Sept. 11. The way described is good, but a much kinkier kink is to use methylated spirits (any form of alcohol will do) to wet the cork-borer, only a few drops being required. The borer bites much better.

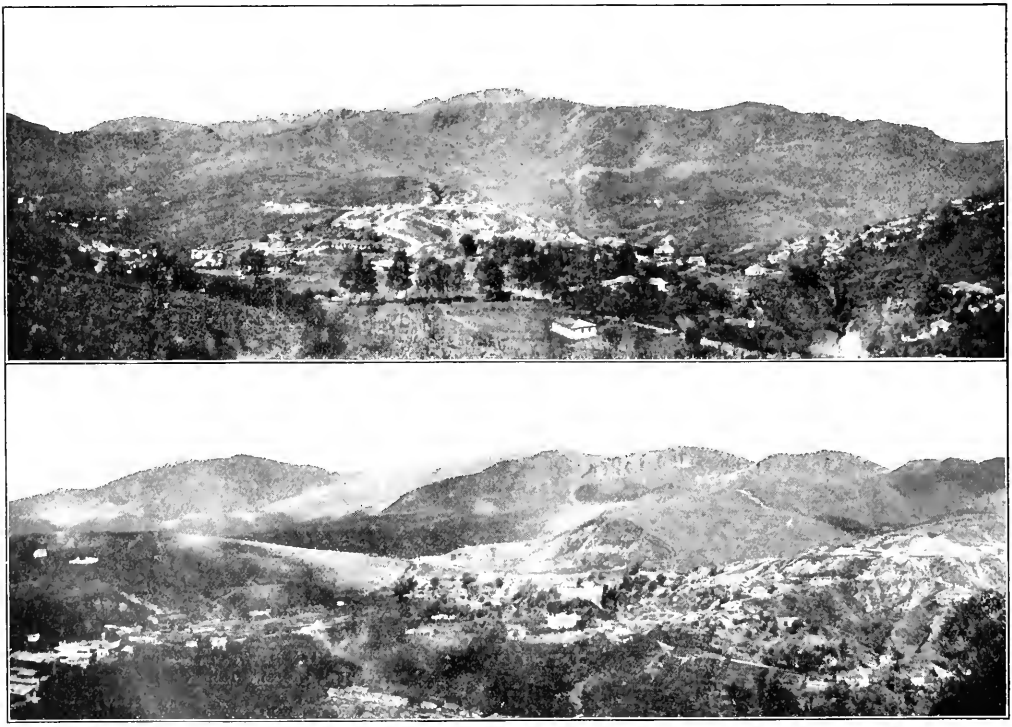
*Chemist, International Lead Refining Co., East Chicago, Ind.

†School of Mines, Columbia University, New York.

Photographs from the Field

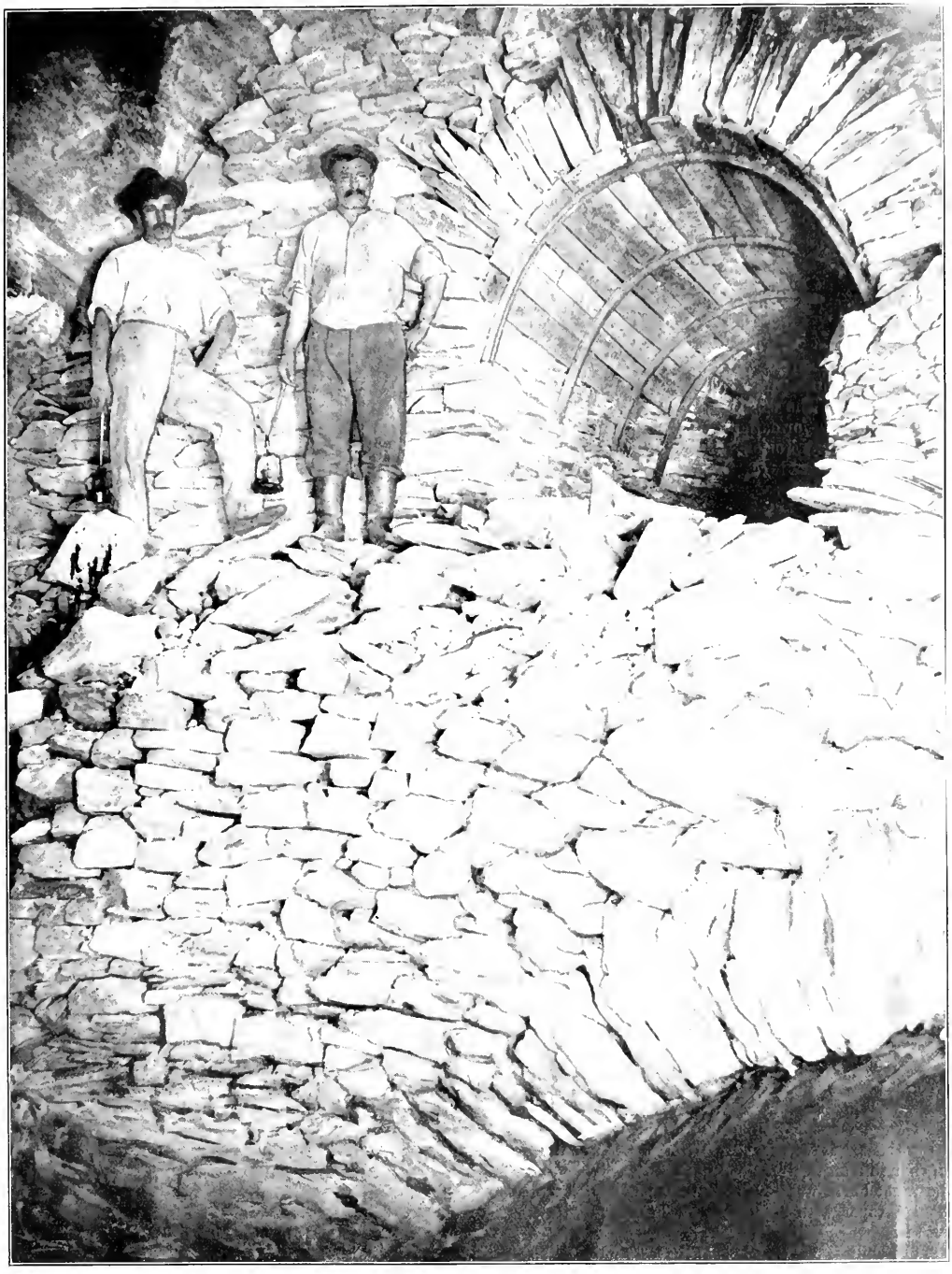


PANORAMA OF PASSAGEM, BRAZIL, SHOWING THE OURO PRETO MILL



PANORAMA OF PASSAGEM, BRAZIL, THE SEAT OF THE OURO PRETO MINES

The central peak in the upper photo is Mt. Itacolumi, whence comes the name of the mineral Itacolumyte, a variety of flexible sandstone



HAND FILLING OF STOPES AT THE PASSAGEM MINES OF THE OURO PRETO COMPANY, BRAZIL

Correspondence and Discussion

Fineness of Ore Crushing for Assaying

If Mr. Dewey's request for practical data relating to the decomposition of $NaHCO_3$ (*Eng. and Min. Journ.*, Nov. 20, 1915, p. 851) means an analysis of evolved gases at various temperatures up to the melting point of an assay charge, I must confess that such information is not available. But the following—call it fact or theory, as you please—should serve to substantiate the correctness of my contentions.

Sodium bicarbonate ($NaHCO_3$) decomposes slightly at ordinary temperatures. It will decompose completely below 200° C. The constituents of a charge do not react till the slag-formation temperature is reached; in other words, below fusion—usually above 500° C.

Sodium bicarbonate cannot be melted; it dissociates. The dissociation of sodium bicarbonate takes up heat, and we can no more expect fusion before the $NaHCO_3$ is converted to Na_2CO_3 than we can hope for the roasting of wet concentrates before the water is expelled.

The observable differences in fusing charges containing equivalent amounts of Na_2O as $NaHCO_3$ and Na_2CO_3 are: The bicarbonate charge dusts more—the CO_2 of Na_2CO_3 is not appreciably given off till displaced or fusion begins and the charge is no longer dry—fusion takes 5 to 20% longer, depending on charge and temperature, and the point of maximum reactions is reached earlier with the normal carbonate charge. This is simply in accord with the known properties of the two salts. To argue that fusion takes place around the sides of the crucible before the center of charge has reached a temperature sufficient to decompose $NaHCO_3$, while possibly true in certain cases, is begging the issue. Progressive assayers are substituting Na_2CO_3 for $NaHCO_3$ without any detriment to their results.

E. J. Hall.

New York, Dec. 7, 1915.

On Zinc Poisoning

The editorial note as to "Zinc Poisoning" in the *Journal* of Aug. 14, was read by me with much interest. The malaise known as "spelter shakes" is familiar to anyone connected with the melting of brass, but quite unknown in zinc-retort plants. When I was in Iola I never had any, although I was active around the spelter furnaces and inhaled considerable oxide of zinc from furnaces working on ores high in iron. In my work at Hartford on electric zinc smelting, I had "the chills" many times, but only so far as I remember when working on changing an electrode or under other conditions where the vapor burnt was rich metallic vapor as distinguished from a vapor with a quantity of indifferent gas mixed with it.

"The chills," or "the shakes," have peculiar characteristics. Usually they come on quite suddenly from 10 to 16 hr. after exposure. Soreness in the limbs, then a feeling of chilliness, pronounced restlessness and finally copious perspiration with deep breathing are manifest. I finally made it a practice to get up out of bed when I felt first a chill, heat some water and drink it after going through some calisthenics. This seemed to increase the sweating. Next morning I felt particularly fine.

Milk, if taken before or after exposure to the fumes, seemed to help. At least all my force got into the habit of taking milk when running the furnace.

There is no doubt that some form of flocculent albumen is an antidote for any mineral poison, and zinc under some conditions should be regarded as one in a mild form. However, possibly the hypothesis offered by the engineers of the New Jersey Zinc Co. that traces of copper in the zinc would give "spelter shakes" may be the true explanation. At all events, it is a fact that under certain circumstances zinc will poison people slightly, although in any event the period of intense physiological activity induced is enough to clear the system of poison completely. The general health of brass melters is known to be good, and Percy, in his "General Metallurgy" testifies to the fact that an old workman, who had lived and breathed zinc oxide for fifty-odd years, remained happy, cheerful and well.

Woolsey McA. Johnson.

Hartford, Conn., Nov. 17, 1915.

Society Employment Bureau

Referring to the last paragraph of the letter of Ernest McCullough in the *Journal* of Nov. 20, page 851, the following is quoted:

> . . . out of the hands of employment agencies, which bleed unfortunate technical men that have no other means of securing positions.

The few employment agencies that handle technical mining men are run along lines that make any such slur as the foregoing entirely uncalled for. The business of bringing the employer and the technical man together is as clean and legitimate and serves as much of a need, perhaps, as the trade journal, which depends for its business life on the bringing together of the machinery manufacturer and the mine manager through the medium of advertising.

Mines Technical Agency,
N. H. Beaton, Manager.

Los Angeles, Nov. 26, 1915.

Peculiar Magnetic Phenomenon

The "Peculiar Magnetic Phenomenon" described by Mr. Chase in the *Journal* of Dec. 4 may possibly be due to the track rails having once been handled with an electromagnet and becoming permanently magnetized.

In steel mills, nowadays, a great deal of the material is lifted and loaded by means of powerful electromagnets suspended from overhead cranes. I have heard of carloads of material that could be unloaded at destination only with great difficulty, because so many of the pieces were magnetized that all tended to cling together.

George W. Riter.

Salt Lake City, Utah, Dec. 7, 1915.

NEW PUBLICATIONS

ROAD CONSTRUCTION AND MAINTENANCE. 6x9, pp. 127, illus.; paper. E. I. du Pont de Nemours Powder Co., Wilmington, Del.

DIE ACHATE. By Raphael Ed. Liesegang. 6x9¼, pp. 118, illus., paper; 5 80 marks. Theodor Steinkopff, Dresden and Leipzig, Germany.

THE DEVONIAN OF SOUTHWESTERN ONTARIO. By Clinton R. Stauffer. Pp. 341, illus. Memoir 34, Canada Department of Mines, Geological Survey, Ottawa.

COMMISSION OF CONSERVATION, PROCEEDINGS OF THE SIXTH ANNUAL MEETING HELD AT OTTAWA, JAN. 19 AND 20, 1915. 6½x9½, pp. 333, illus. Commission of Conservation, Ottawa, Canada.

THE GEOLOGY AND MINERAL RESOURCES OF THE BULLER-MOKIHINUI SUBDIVISION, WESTPORT DIVISION. By Percy Gates Morgan and John Arthur Bartrum. 8½x11, pp. 220, illus. Bull. 17 (New Series). New Zealand Department of Mines, Geological Survey Branch, Wellington.

NEW ZEALAND; MINES STATEMENT. By Hon. W. D. S. MacDonald, Minister of Mines. Statistics, Reports Relating to Metalliferous Mines and Stone Quarries, State Aid to Mining, Roads on Goldfields, Prospecting Drills, Water-Races, Schools of Mines, Inspection of Mines, Examinations for Certificates, Geological Survey, State Coal Mines, etc., for the Year 1914. 8x12½, pp. 118, illus. New Zealand Department of Mines, Wellington.

MINERAL PRODUCTION OF CALIFORNIA FOR 1914, With Mining Law Appendix. Pp. 184, illus. Bull. 70, California State Mining Bureau, San Francisco.

This bulletin, which is published for free distribution, gives the usual statistics of mineral production and notes of mining developments. The total value of the minerals produced was $93,314,760. This is somewhat less than the figure originally given by the bureau, which is accounted for by the fact that it estimated the gold, silver and platinum production, in order not to delay the issuance of the bulletin. The revised figures of the United States Geological Survey were received before the bulletin was printed, and the corrections are given in a supplement to the chapter on metals.

There were 42 mineral substances produced, and of the 58 counties in the state, 56 of them produced mineral of some kind. Petroleum, of which 102,881,907 bbl. were produced, was highest in value in 1914, as it has been for several years. Gold was next in value, with 999,113 oz., valued at $20,653,496. The copper output was 30,491,135 lb., valued at $4,055,375. There was a decrease of more than $5,000,000 in the total value of all minerals produced in 1914, as compared with 1913. Petroleum, however, increased 387,375 bbl., but decreased in total value $1,090905, owing to a reduction in price in five of the seven fields. In the production of metals there was a total decrease in 1914 from the previous year, of $1,087,986, covering nine different metals. Of these metals only three—gold, iron and lead—showed an increase. In the past fifteen months there has been an increase in copper production and also in quicksilver, due of course to the war in Europe. There has also been some increase in zinc production in the past year. No production of antimony has been recorded since 1901, when there was an output of 50 tons. There has been a large amount of prospecting and development in the past twelve months, and it is expected that 1915 will show a record of renewed production. There has been an increased demand for magnesite, and production in 1914 exceeded that of 1913 by 1,806 tons; it was valued at $10 per ton, as compared with $7 per ton last year. The production of chrome showed a small increase, but for some unaccountable reason the total value decreased from $12,700 in 1913 to $9,434 in 1914.

PRACTICAL MINING ON THE RAND. By E. M. Weston. 5x7½; pp. 55; illus. Published by the author at Johannesburg, South Africa.

There have been many books published for the mining engineer or mining operator, but few, if any, published specifically for the shift bosses and the miners themselves—certainly none more interesting than the little booklet by E. M. Weston, entitled "Practical Mining on the Rand." In the preface Mr. Weston says: "Some little time ago I set out to lecture to miners on their work. I soon found that if I wished to retain their interest and to really help them, I would have to leave out very much that is usually included in a course of mining lectures and would have to bring in many things that are to be found in no book today." The booklet contains his lectures to his miners very much as he gave them. They are practical talks on practical matters to practical men.

The first lecture deals with "Handling Rock Drills Underground" and takes up in detail the method of rigging up the drill, the points to be avoided and the points to be taken advantage of in order to get the greatest results with the greatest ease to the miner. It deals with the causes of drills sticking in the holes; it takes up in detail the operations of running a drill, from the standpoint of the drill itself, as well as the round which is being drilled; it goes into considerable detail about the operations involved in changing steels, etc.

Another chapter, entitled "Explosives and Their Use," defines for the miner the various brands and kinds of dynamite and explains their differences and their uses. The question of fuse and tamping is also discussed at length. The layout of holes to break the ground to best advantage is discussed, and diagrams are shown of the different schemes of drilling.

Under the heading, "Developments," he goes into this question of layout of holes and drilling of rounds in very much greater detail and summarizes in the most understandable way the principles that must be considered in order to get the best results in drilling and breaking the breast of a drift.

Under the title, "Stoping," is a very interesting chapter on the setting up of the drill, drilling and the breaking of a round in stopes, and under the heading, "Hand Hammer Work," the subject of hand drilling is gone into at some length.

The pamphlet comprises 55 pages and can be read with profit not only by the shift bosses and miners for whom it was intended, but by the mine superintendent and the engineer.

NEW PATENTS

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

ALUMINA—Method for Producing Pure Alumina from Clay and Other Alumina-Bearing Materials. Max Buchner, Heidelberg, Germany. (U. S. No. 1,162,130; Nov. 30, 1915.)

BAG-SHAKING APPARATUS. Albert D. Bryant, Palmerton, Penn., assignor to New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,163,318; Dec. 7, 1915.)

CONCENTRATION—Chat Separator for Concentrating Jigs. Alvin P. Standefer, Miami, Okla. (U. S. No. 1,162,112; Nov. 30, 1915.)

CONCENTRATOR. Albert J. Matter, Portland, Ore. (U. S. No. 1,161,945; Nov. 30, 1915.)

CONCENTRATOR. John F. Isbell, Los Angeles, Calif., assignor to Orren Allen, Denver, Colo. (U. S. No. 1,163,344; Dec. 7, 1915.)

CRUSHER ROLL. Bruce W. Traylor, Allentown, Penn., assignor to Traylor Engineering and Manufacturing Co., Allentown, Penn. (U. S. No. 1,162,892; Dec. 7, 1915.)

CRUSHING—Apparatus for Disintegrating Ore and Other Material. Harry W. Hardinge, New York, N. Y., assignor to Hardinge Conical Mill Co., New York, N. Y. (U. S. No. 1,161,859; Nov. 30, 1915.)

DRILL—Rock Drill. Warren Wood, Paterson, N. J. (U. S. No. 1,162,964; Dec. 7, 1915.)

DRILL—Rock Drill. Vincent John O'Brien, Denver, Colo. (U. S. No. 1,162,249; Nov. 30, 1915.)

FLUE DUST—Process of Agglomerating Flue Dust or Other Finely Divided Material. Carl Giesecke, Brunswick, Germany. (U. S. No. 1,162,600; Nov. 30, 1915.)

FURNACE—Metallurgical Furnace. Franz Meyer, Uerdingen, Germany, assignor to Dwight & Lloyd Metallurgical Co., New York, N. Y. (U. S. No. 1,162,634; Nov. 30, 1915.)

FURNACE—Metallurgical Furnace. Utley Wedge, Ardmore, Penn. (U. S. Nos. 1,162,532 and 1,162,533; Nov. 30, 1915.)

HOISTING—Safety Stop Mechanism. Alexander J. Nicht, Chicago, Ill., assignor, by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. 1,163,029; Dec. 7, 1915.)

LAMP—Miner's Lamp. Augie L. Hansen, Chicago, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. No. 1,162,915; Dec. 7, 1915.)

LEACHING—Process for Extracting Valuable Copper Constituents from Cupriferous Ores and Their Gangues. Eugene Erdös, Kolozsvár, Austria-Hungary, assignor to Azurit Co., Ltd., for Chemical Industry Kolozsvár, Kolozsvár, Austria-Hungary. (U. S. No. 1,162,044; Nov. 30, 1915.)

ORE-PULP—Apparatus for Treating Ore Pulp. Bernard MacDonald, South Pasadena, Calif. (U. S. No. 1,163,097; Dec. 7, 1915.)

POTASSIUM AND SODIUM SALTS FROM KELP-ASHES. Process for the Manufacture of. Carl Klingbiel, Biebrich, Germany. (U. S. No. 1,162,617; Nov. 30, 1915.)

SLAG—Art of Converting Molten Slag into a Highly-Porous Mass. Carl H. Schol, Allendorf, Germany. (U. S. No. 1,163,605; Dec. 7, 1915.)

SMELTING—Apparatus for Continuous Smelting of Sulphide Ores. Gustaf Haglund and Anton Grönningsæter, Christiansand, Norway. (U. S. No. 1,163,234; Dec. 7, 1915.)

TUNNELING MACHINE. Samuel Hoar, Virginia, Minn. (U. S. No. 1,162,607; Nov. 30, 1915.)

WELDING—Method of Welding. Edwin E. Slick, Johnstown, Penn., assignor of one-half to Luther L. Knox, Avalon, Penn. (U. S. No. 1,161,419; Nov. 23, 1915.)

ZINC—Removing Cadmium from Zinc Ore. Gilbert Rigg, Palmerton, Penn., assignor to The New Jersey Zinc Co., New York, N. Y. (U. S. Nos. 1,161,885 and 1,161,886; Nov. 30, 1915.)

Mineral Export Tax in Peru

The mineral export tax, passed by the last Peruvian congress, became effective on Nov. 14, 1915. The export tax as finally fixed is a compromise between the first proposals of the government and those of the Sociedad Nacional de Minería. The exemption from taxation of zinc ores and zinc products, and apparently of lead in bars, is noteworthy. Through the courtesy of the *West Coast Leader*, a translation of the principal features of the new export-tax law (No. 2,187) is presented herewith:

Article 1—Mineral products and those derived from their treatment shall be subject to the payment of duties in the form and proportion determined by this law.

GOLD

Art. 2—A. Metallic gold in any form, shall pay a coinage fee of Lp. 3 per kg. of fine gold, and if exported, Lp. 10 per kg. [Lp., libra peruana, equivalent to the British pound sterling when exchange is at a parity.]

B. Gold contained in bars of other metals, in matte and other metallurgical products, shall pay an export tax of Lp. 2 per kg. of fine gold.

SILVER

Art. 3—Metallic silver, in whatever form, shall pay for each kilogram of fine silver exported, a tax of 1 shilling, starting with the quotation of 23½d. per standard ounce troy, 925 fine, increasing 2½d. per kg. for each 1d. rise in the price of silver.

Sulphates of silver from lixiviation processes shall pay an export tax of 3d. per kg. of gross weight, starting from 23½d. per standard ounce troy increasing 1d. per kg. for each penny increase in the price of silver.

COPPER

Art. 4—Metallic copper, pure or impure, in any form, shall pay an export duty from the moment that the quotation of standard copper in London is Lp. 60 per ton, as follows: on quotation of Lp. 60 to Lp. 65 a tax of 15 shillings per ton of 1,016 kg., gross weight exported; and the duty shall increase by 2 shillings per ton for each pound-sterling increase in the quotation.

If the bars contain gold and silver, on the former there shall be paid the duty indicated in Clause B of Art. 2, provided that the assay is 10 grams or more per ton; and on the silver, when in excess of 2 kg. per ton, the following scale per kilogram of fine silver contained: 6d. when the quotation for silver is between 23½d. and 24½d.; 1 shilling when between 24½d. and 25½d.; 2 shillings when silver is quoted over 25½d.

Smelting products the copper contents of which may be in excess of 80% and less than 90% shall pay as export tax, on the fine-copper contents, the duty established for copper bars.

Cement copper and smelting products the contents of which in copper may be in excess of 60% and less than 80% shall pay, as export tax, 50% of the duty established in this article for copper bars, on each metric ton of gross weight.

Smelting products containing less than 90% copper, but over 80% copper, shall not be considered bars, but shall pay on the fine-copper contents the duty established for copper bars.

Mattes the contents of which in copper do not exceed 60% shall pay as duty, per metric ton gross weight, 40% of the duty established in this article for copper bars.

The gold and silver contained in smelting products the contents in copper of which may be in excess of 80% and less than 90% in cement and mattes shall pay an export duty as follows: Gold, the duty fixed in Clause B of Art. 2 of this law, provided that the assay is 10 grams or more per ton; and silver, 1 shilling for each kilogram of fine silver, provided the material contains 2 kg. per ton.

LEAD

Art. 5—Argentiferous-lead bars shall pay only on the silver contents at the rate of 1 shilling per kilogram of fine silver, and provided the bars contain 2 kg. per ton.

ORES

Art. 6—All other minerals, metalliferous or otherwise, shall pay an export duty of 2½d. per 100 kg., gross weight, and mechanical or chemical concentrates of any class, metalliferous or not, shall pay 5d. per 100 kg.

Coal, sulphur, ores of iron, manganese, and zinc are hereby exempted from the effects of this article, as well as their concentrates. The latter, if containing other metals subject to tax, shall pay the duty.

Ores of rare metals, such as tungsten, molybdenum and vanadium and their concentrates, shall pay Lp. 1 per ton, whatever may be their price in the market.

Borates exported from "salinas," Arequipa, shall pay an export tax of 2 shillings per ton.

PETROLEUM

Art. 7—Crude petroleum and the residues and products of its distillation shall pay an export tax of 1 shilling per metric ton, gross weight.

Exporters must declare the tenor of their products. Penalties for false declarations of the nature and grade of the mineral products are punishable by a fine of four times the correct tax, and the government may purchase the lot to be exported according to the assays declared by the exporter. The exportation of amalgams of all classes is expressly prohibited. Export duties up to £40 may be paid in gold coin, but above this amount must be paid "in drafts on New York at 90 days sight, or at the option of the shipper, in the equivalent drafts on London." The Chamber of Commerce of Lima fixes weekly the value of the ton of standard copper and of the ounce troy of silver, based on the quotations of the London Metal Exchange; this quotation rules for the following week.

Meeting of the Pan American Scientific Congress

The secretary-general has issued the following list of receptions arranged for the meeting in Washington:

Reception by the president of the congress, His Excellency the Ambassador of Chile, Señor Don Eduardo Suarez Mujica, at the Chilean Embassy, 1013 Sixteenth St., Thursday, Dec. 30, 4:30 to 7 p.m.

Reception tendered by the secretary and the Board of Regents of the Smithsonian Institution to the members of the congress Thursday evening, Dec. 30, at 9 o'clock.

Theater party by the Secretary of State and United States delegation to the Latin-American delegations at the New National Theater, Friday, Dec. 3, at 8:30 o'clock. Other members of the congress are requested to make their reservations at once with the management of the theater.

Reception tendered to the members of the congress by the president and officers of the Cosmos Club Monday afternoon, Jan. 3, at 6 o'clock.

Reception by the Governing Board of the Pan American Union to the members of the congress at the Pan American Union, Saturday night, Jan. 1, at 9 o'clock.

The members of the Second Pan American Scientific Congress will be the guests of the American Association for the Advancement of Science on the occasion of a special meeting to be held in Memorial Continental Hall, Monday night, Jan. 3, at 8 o'clock.

The trustees of the Carnegie Institution of Washington will tender a reception to the members of the congress Tuesday night, Jan. 4, 9 p.m., at Sixteenth and P St.

Friday night, Jan. 7, the president will give a reception to the members of the congress at the White House.

Saturday night, Jan. 8, the Secretary of State and the United States delegation will give a banquet to the members of the congress at the Pan American Union; hour to be announced later.

Editorials

Exploitation of Juneau Mines

The exploitation of the great gold lode at Juneau, Alaska, by several companies, but especially by the Alaska-Gastineau and Alaska Juneau, is a subject of interest not only to thousands of investors in the shares of these companies, but also to the engineering profession in view of the unique problem that is to be solved and the different ways of going about it. The problem itself involves the mining and milling at a profit of ore that is expected to average only about $1.50 per ton. Nothing like this was ever accomplished. If it be admitted that it can be done, the available tonnage of the Juneau lode is so great that its extraction will hardly be completed within the lifetime of this generation.

The Juneau lode (we use the term rather for convenience than out of any belief in its accuracy) is a great zone of slate permeated by veinlets, stringers and masses of gold-bearing quartz. Dikes of metagabbro have intruded themselves into the lode, which dikes in turn carry auriferous quartz. The distribution of the veinlets, stringers and masses of quartz is irregular. The mineralization is not, therefore, in any way comparable with that of the great deposits of disseminated copper ore, which are generally masses of rock more or less evenly peppered with valuable minerals. The only similarity of these two classes of ore deposits is that both are very large and are capable of extraction by the most economical methods known in the modern art of mining.

As in the case of the porphyry-copper deposits, the Juneau gold lode was no new thing. Attempts to get gold from it have been made at frequent intervals during the last 25 years. All such attempts, however, were directed on the idea of mining the quartz veins or enrichment zones alone, and upon a very small scale—none of the early mills being so large as those that are erected and run as pilot mills nowadays. The mining and milling of a very large tonnage is of course one of the essential factors in reducing costs and enabling ore so poor as $1.50 per ton to be treated profitably.

The Alaska-Gastineau (Alaska Gold Mines Co.) is contemplating mining and milling ultimately at the rate of 6 to 7 million tons per annum. The immediate plans of the Alaska Juneau company are laid out for the mining and milling of about 2,500,000 tons per annum.

Both these companies are directed by the most successful mining engineers of the time. At the head of Alaska-Gastineau is Mr. Jackling (aided by his great staff), who is known as the brilliant developer of the Utah Copper Co., Chino, Ray, and Butte & Superior. At the head of Alaska Juneau are Messrs. Bradley, Requa and Mackenzie, who are known as the developers of Nevada Consolidated, while Mr. Bradley has been for many years the manager of the Bunker Hill & Sullivan mine in the Cœur d'Alenes, and the Treadwell group of mines on Douglas Island, Alaska, just across the Gastineau Channel from the Juneau mines.

It was but natural that the two groups of engineers should have different ideas. They agree respecting the nature of the ore deposit and more or less as to the probable grade of the ore. They differ as to how the exploitation should be conducted in order to obtain the best results. The main differences may be summarized as follows: The Gastineau engineers are planning to do what may be called bulk mining—that is, extracting everything from the lode and putting it through the mill. In the mill they have introduced the novelty of crushing with rolls. The Alaska Juneau engineers, on the other hand, are contemplating what may be called selective mining—that is, extracting only the richer portion of the lode—but this will be nothing like the selective mining of the small concerns of 20 or 25 years ago. The extraction of ore will be prosecuted on such a huge scale that block by block it will be bulk mining, but the poorer portions of the lode will be passed by. The governing principle is excellently illustrated in the following statement of Mr. Bradley: "The cubic contents of the vein above the Gold Creek tunnel level and between the eastern and western ends of the property totals approximately 500,000,000 tons of slate, metagabbro and quartz. From this there should be mined, from selected places, 80,000,000 to 100,000,000 tons of vein matter and quartz suitable for milling that should yield a net profit of from 70c. to $1 per ton, depending upon conditions of mining that cannot at this time be estimated within closer limits of ultimate profits. Areas will probably be found in which mining may profitably be conducted by sorting, leaving two tons in the stopes for every ton milled. Other areas will probably be found, all of which may be mined without the necessity of mine sorting."

In milling, the Alaska Juneau engineers are going to adhere to the conventional stamps. We shall have, therefore, an interesting comparison not only of bulk mining vs. selective mining, but also of rolls vs. stamps.

In introducing rolls in the Gastineau mill, Mr. Jackling has done nothing revolutionary except in so far as the metallurgy of gold is concerned. There was a time when stamps were the common means for the fine crushing of all sorts of ore. For the milling of most ore except gold ore—and except also the Lake Superior copper ore, for which steam stamps still prevail—the stamp battery has been displaced by rolls, which mechanically are superior. Even in gold milling when ore is to be treated by the cyanide process, stamps were displaced by rolls, and the rolls in turn have been, in some cases, displaced partially by ball mills. Mr. Jackling has simply gone a step farther in introducing for a process of amalgamation and concentration the crushing machinery that has proved itself the better in other branches of the art. Mr. Bradley and his associates, on the other hand, adhere to the use of the stamp batteries, such as they are already employing on the other side of the Gastineau Channel.

Mr. Jackling has already demonstrated by the milling of something like 1,000,000 tons of ore that by his method the Juneau ore may not only be mined and milled at a

cost of 75c. per ton, as to which many engineers previously were skeptical, but also that it may be done for a considerably lower figure. In so far as the milling is concerned, however, it will be necessary to segregate its cost from the mining cost before the comparison between rolls and stamps may be made. The net result of both the mining and milling methods, however, will be expressed in the net profit per ton of ore, and that is the figure which is awaited with the most interest.

Rise in Ocean Freight Rates

The rise in transatlantic freight rates, and in ocean freight rates generally, equals the most spectacular rises in prices for the commodities. This is a matter of great concern in the mining and metallurgical industry. A seller of copper, for example, who agreed three months ago to deliver copper to Europe at this time, finds his proceeds much shrunken if he failed to contract for freight room in advance and is obliged to pay current rates. Freight rates have been rising since the beginning of 1915, but during the last two or three months the advance has been very sharp. Previous to the beginning of the war a common rate for carrying copper from New York to British ports was about 16c. per 100 lb. A couple of months ago it was about 60c. Within the last two or three weeks $1 and upward has been paid.

A pamphlet on "Ocean Shipping," just published by the National Foreign Trade Council, throws light upon the conditions. Quoting from that pamphlet, but not literally:

"The shipping capacity of the world previous to the war was estimated at 44,000,000 tons, fully two-thirds consisting of tramp steamships, of which Great Britain alone owned 40% of the whole. The war has removed from private commercial employment between 20 and 25% of the world's steam shipping, or upward of 9,000,000 out of 44,000,000 tons, owing to destructive immobilization and impressments for governmental service. On the other hand, the aggregate of freight to be carried has probably increased. It is known that the world's trade showed a huge falling off during the first year of war, taking value as the basis; but considering bulk alone, it seems that the volume of traffic handled by the world's merchant marine has increased considerably since the war began.

"The primary needs of armies in the field are food and clothing. Industrial resources are mobilized for the purpose of turning out equipment and ammunition. This operates to the detriment of agriculture, already depleted of men sent to the front, and hence there is increased importation of food and raw materials, which taxes the resources of an already busy merchant marine. Moreover, the available labor becoming scarce and poor in quality, the discharge of ships is not carried out with the accustomed dispatch. The closing of the Panama Canal by the earth slides in October, 1915, dislocated the world's shipping, for it delayed many vessels sailing on trade routes via Panama and compelled their diversion to destination by longer routes via Magellan and other points. Shipowners and shippers suffered heavy losses. These delays naturally exercised a bullish effect on freight rates in general."

The secretary of the National Foreign Trade Council refers to the advance in freight rates in this way: "Rates first sharply increased, then doubled, trebled, and in some instances have become from five to seven times as large as before the war. To other parts of the world American exports have not increased in volume. The transportation has decreased, due to shifting of vessels to the European trade, and rates have greatly advanced. Shipowners decline to make the long-term contracts characteristic of peaceful times, and shippers of manufactures are more embarrassed by their inability to make definite calculations of the future selling price of their products, which is affected by freight, than by the abnormal size of the rates themselves."

Precisely these conditions have been experienced in the export trade in the metals, besides which there are many incidental difficulties. For example, the congestion in the railway yards at the Atlantic seaports has introduced unusual difficulties in getting freight on board ships, even when the prospective shipper has engaged the room. He may be unable to cause the freight to be moved from the railway yards to the docks during the lay-days of the ship. The only known means of circumventing this obstacle is to cause the freight to be delivered at the dock many days, or even weeks, before the sailing date of the ship. Consequently the shipper is obliged to carry his commodities, with increased interest charges, for a longer time than he contemplates normally. It is expected that freight rates will go down after the war, but as to whether the drop will be sharp or gradual there is difference of opinion.

Block Signals for Tunnel Haulage

Two fatal accidents have occurred within the last few weeks at the Morning mine, in Idaho, under somewhat similar circumstances, emphasizing the necessity of safeguards in the operation of electric-motor haulage underground.

In the first instance a machinist had been called into the mine to make some repairs. When his work was completed, he telephoned the man in charge outside, a distance of over a mile, to know if the track was clear. Being informed that it was, he started out on the motor. The man outside had hardly hung up the receiver when it flashed upon him that the ore train had just started in. He hurriedly called up to correct his error, but too late. The machinist had started out, and there was no way to stop him and no way to prevent a collision. The collision occurred; the machinist was horribly mangled and died a few days later. While this man was waiting for death to relieve him of his suffering, a motorman was killed in the same tunnel by another collision. In this case ore cars were left on the track and another train crashed into them.

Both these accidents were due to the failure of the human agency and are likely to be repeated from time to time so long as human frailty is the sole dependence. The men who committed the errors that caused the accidents were discharged, but that gives no assurance that their successors will not make similar fatal mistakes. No company having long hauls by electric motors under ground has adopted all possible safeguards to prevent such accidents unless it has a block-signal system installed.

The installation of such a system for mine tunnels cannot be withheld on a plea of cost of installation, because that is comparatively moderate. At any of our metropolitan amusement parks the scenic railways are all equipped with efficient, simple little block systems, and their trackage does not begin to compare with that of any mine tunnel where motor haulage is used. The amusement railway is safeguarding a greater number of lives per day, it is true, but when the size of investment or the amount of gross income is considered, there seems to be little argument for the tunnel ore-haulage system not being equipped with automatic block signals.

BY THE WAY

Ty Cobb says: "No, I don't drink! It dims my batting eye." Efficiency and alcohol won't mix. The man who drinks is never a safe man, says the "Inland Steel Safety Bulletin."

⁂

The accompanying picture of Mrs. Carrie Everson was drawn by Arthur L. Ormay from a reproduction in the Denver *Times* of an original photograph. Carrie Jane Billing, later Mrs. Everson, was born in Sharon, Mass., in 1842, moving to Denver in the early '80s, and died in San Anselmo, Calif. on Nov. 3, 1914. It is reported that the Colorado Scientific Society purposes educating her grand-daughter.

⁂

That optimism and pessimism in mining ventures were "not born yesterday," is evidenced by the following extract from the diary of Samuel Pepys, under date of Oct. 3, 1660: "This day I heard the Duke [of York] speak of a great design that he and my Lord of Pembroke have, and a great many others, of sending a venture to some parts of Africa to dig for gold ore there. They intend to admit as many as will venture their money, and so make themselves a company. £250 is the lowest share to every man. But I do not find that my Lord do much like it."

⁂

According to *Coal Age*, among a number of applications received recently by a large coal-mining company was the following orthographic gem: Sir: I have bin informed by the Engr. Agency that you are in need of a Transetman. I would like to accept a passisian of that kind if you think me caperable of holding the passion. I have had Six Years experence in R.R. Const. and Loc. and am a fairly good drausman and have bin in mines with Mineing Engr. good many times. Can furnish you with rep. if need to. Yours Verry Truly,

P. S. Can report in verry Short notice 5 days.

⁂

In a recent market letter is the following straight tip:

These stocks should be bought, and bought at once, in order to take full advantage of opportunities now at hand. We believe that all of the simon-pure investment coppers are endowed with remarkable speculative possibilities for the trader who is content with market turns, while to the conservative investor with the income point of view in mind the present opportunity is one not to be overlooked. We believe that Calumet & Hecla is a buy up to $1,000 per share, Utah Copper to $150, Anaconda to $100, American Zinc to $100, Calumet & Arizona to $100, Chino to $100, Granby, Inspiration, Osceola and Quincy to $100, Miami to $75, Ray and Chili to $50.

East Butte should double in price very soon, also Corbin, Kennecott, Ray Hercules, New Cornelia, First National, Davis Daly and Goldfield Consolidated.

Among the many lower-priced mines and properties, we think well of Success, Caledonia, Marsh Mining, Utah Metals, Hecla, Iron Blossom, Kewanas, McIntyre, Vipond, Rex Consolidated, Chief, Majestic, Fortuna and Nevada Douglas.

Hope certainly does spring infernal, but why omit Con Mercur, Montgomery Shoshone and Ely Central?

⁂

The Serbs in retreating from northeastern Serbia are reported to have destroyed the surface plant of the copper mines near Bor, in the Department of Timok, and to have permitted the workings to be flooded to prevent the Teuton forces from availing themselves immediately of this source of copper. The principal mine is the Tchoka Dhulkan and belongs to a group controlled by the Cie. Française des Mines de Bor. There are numerous small deposits of copper in the Balkan states, but this company was the principal producer. Its output in 1912, according to the "Copper Handbook," was 16,699,845 lb. The smelting plant comprised four small water-jacketed furnaces, two of 110 tons' daily capacity and two 210-ton furnaces, and a converter department with one stand and four shells. In the latter part of 1912 most of the employees were ordered into the Serbian army for the Balkan war, and for a long time only one furnace was operated. Near Maidanpek, in the same general district, a 200-ton smelting plant was built in 1907 by a Belgian company, which used the Knudsen process and made a 96% copper product. This plant has presumably met with the same fate as the Bor property.

⁂

Dr. Branner's Retirement

The resignation of Dr. John Casper Branner, Leland Stanford University, takes place on Dec. 31. He has already taken leave of the campus and will be gone for an indefinite period. He was invited to make his home at Stanford after his retirement, but it is understood that he has declined, as he desires to have a complete rest, and to remain entirely away from the scene of his former labor. Within the past two years the presidency was added to his duties as professor of geology, and while the presidency of the university may be accounted an honor, it also added very largely to the labor.

Doctor and Mrs. Branner will visit New Orleans and Washington and they may go to Panama. Doctor Branner will attend the Pan-American Scientific Congress, which will open in Washington Dec. 27, under the auspices of the Government, and will contribute to the congress a paper on "Recent Contributions to the Geology of Brazil and Their Relation to the Development of That Country."

Doctor Branner is a member of the committee in charge of the congress and also the committee on Economic Geology. Prof. Bailey Willis, who will succeed Doctor Branner as head of the department of geology at Stanford, is also a member of the latter committee. Prof. G. H. Clevenger, of Stanford, is a member of the committee on Metallurgy and Dr. Margaret Schallenburger, California commissioner of education, is on the committee on Education of Women.

The Producers

Written Expressly for
THE ENGINEERING AND MINING JOURNAL
BY BERTON BRALEY

* * *

DOWN there in Wall Street the brokers is brokin',
Tradin' in copper stocks day after day;
Sidewalks is crowded an' offices chokin',
Chokin' with people that's gamblin' away;
Some of 'em's slidin' to wreck an' to ruin,
Some of 'em's makin' a million or more;
Meanwhile us miners goes right on a-doin'
What we are paid for—just diggin' the ore.

Over in Yurrup the nations is clashin',
Turnin' their world into several hells,
Killin' an' woundin' an' crushin' an' smashin',
Fillin' the air with the shriek of the shells,
Usin' up copper fer ruin an' slaughter,
Drenchin' the earth in a torrent of gore;
We got our job on this side of the water,
Doin' our duty of diggin' the ore.

Down in the stopes we are drillin' an' shootin',
Minin' an' muckin'—a hard-handed crew;
Up in the cages the ore goes sky-hootin',
Leavin' us plenty more minin' to do;
Danger an' death all around us is lurkin',
We gits our wages—an' nothin' much more;
Still it's our job, an' we keeps on a-workin',
Doin' our duty an' diggin' the ore.

Copper wires stretches all over the nation—
Over the world, if you want the thing clear;
Copper's the magic of civilization
Spread by the work of the wise engineer;
He is the guy that you have to give credit.
Heat, light an' power are part of his chore,
Wizard an' prophet an' dreamer—you've said it;
But—don't forget that we're diggin' the ore.

PERSONALS

J. R. Finlay, of New York, is at Bonne Terre, Mo., on professional business.

Arthur Thacher, of St. Louis, has returned from Denver and is now in New York.

H. A. Wheeler, of St. Louis, has been examining zinc properties in Central Missouri.

C. D. Bell, of Bonne Terre, Mo., has moved to Joplin, Mo., to take charge of a new zinc property.

Walter Strache has sailed from New York for an extended trip through Central and South America.

T. Skewes-Saunders succeeds André P. Griffiths as general manager of Las Dos Estrellas, El Oro, Mexico.

W. H. Seagrave, manager for the Kennecott Copper Co. at Kennecott, Alaska, has gone East on a vacation.

O. M. Bilharz, formerly superintendent of the St. Joe Lead Co., is now operating in the Missouri zinc district.

Frank A. Glass, has been appointed superintendent of the Wilcox mine of the Canadian-Cuyuna Ore Co. at Woodrow, Minnesota.

H. A. Buehler, state geologist of Missouri, is giving special attention to the Joplin zinc district, in coöperation with the Bureau of Mines.

A. P. Rogers has returned to New York from South America where he has been for about a year on the West Coast, chiefly in Peru and Bolivia.

Dr. C. Offerhaus has finished the erection of the Kwarzchana copper plant of the Siemens Successors at Kwarzchana, Caucasus, Russia, which was designed by him, and has returned to Germany.

H. W. Hardinge has been honored by the Franklin Institute and the City of Philadelphia, being awarded the John Scott medal and maximum cash premium for the invention of his conical mill.

Charles A. Gibbons, Jr., has resigned his connection with the Central Chili Copper Co., Panulcillo, Coquimbo, Chile, where he has been in charge of the mining department for three years past. Mr. Gibbons will be at his home at Taunton, Mass., for the present.

W. R. Rust is reported to have resigned from the Tacoma Smeltery and the Guggenheim interests entirely. The Chichagoff Mining Co., is one property that Rust is personally interested in and indications are that he will enter other parts of Alaska in mining propositions, and possibly start an Alaskan smeltery.

Frederick G. Clapp, managing geologist of the Associated Geological Engineers, has recently completed some explorations in Texas and has gone to Elgin, Kan., where the Associated Geological Engineers are doing extensive geological work. Clyde T. Griswold of the Mining Department in the Carnegie Institute of Technology and Ralph W. Richards of Washington, D. C., are included in the party.

On Jan. 1 Russell Wayland takes P. R. Bradley's position as general superintendent at the Alaska Treadwell and the latter becomes consulting engineer for the two companies, succeeding J. H. Mackenzie in that office. Mackenzie becomes president of the Alaska Treadwell. L. H. Metzgar succeeds Wayland as assistant superintendent at Treadwell. David Landsburg remains as mine superintendent at Treadwell.

M. F. Chase, general manager, and Walter D. Main, assistant general manager and sales manager, of the Mineral Point Zinc Co. have resigned. Mr. Chase has been with the company for 17 years and has been in charge, for some time past, of all of the manufacturing operations of this and its allied companies in Illinois, Wisconsin, Kansas, Oklahoma and Ohio, while Mr. Main has similarly supervised the sales and commercial end of these subsidiaries of the New Jersey Zinc Co. No announcement has been made as to their future business but it is reasonable to suppose that it will be along the same ground lines in which they have become proficient.

David Schenck Jacobus, last week elected president of the American Society of Mechanical Engineers, was graduated from the Stevens Institute of Technology in 1884 and served that institution for 22 years as instructor and professor, retiring in 1906. For six years also he had charge of the Carnegie Engineering laboratory. Since his retirement from Stevens Institute as professor emeritus in 1906, Dr. Jacobus has acted as advisory engineer for the Babcock & Wilcox Co., with office at 85 Liberty St., New York. He also continues as a special lecturer in experimental engineering at Stevens Institute. He is a member of many other technical societies and the author of numerous papers.

OBITUARY

Gottfried Voland, head of the firm of Voland & Sons, manufacturer of balances, died Nov. 26, at New Rochelle, N. Y., aged 62 years.

Edward Smith died at Buffalo, N. Y., Dec. 5, aged 70 years. He was for many years connected with transportation on the Lakes and had been president of the American Ship Building Co. for two years past.

J. L. McCleary died at Virginia City, Nev., Dec. 6, aged 79 years. He was born at Lancaster, Ohio, went to Nevada over 50 years ago, and has lived at Virginia City and Candelaria ever since. For many years he had charge of the Virginia City water-works.

Edward Biddle died at Dallas, Oregon, Nov. 15, aged 71 years. He was born at Greece, N. Y., and when 24 years old went to California. Later he went to Virginia City, Nev., and was employed for several years as engineer for the Sutro Tunnel Co. From there he went to Oregon and established the Dallas Iron Works which he conducted for over 25 years.

George J. Maas, of Negaunee, Mich., died Dec. 2, aged 54 years. He was well known in the Lake iron country, where he did much exploring and developing. He produced a number of inventions which he patented, one being an instrument to determine the direction taken by a diamond drill bit, which is used the world over. He was born at Marquette, Mich., and had lived in Negaunee since he was three years old.

William A. Conner died at Plainfield, N. J., Dec. 8, aged 56 years. He was born in Baltimore and began his business career in Pittsburgh in 1876, when he entered the oil refining business, in which he reached the position of assistant manager for the Standard Oil Co. He took charge of the first plant built by the Standard Underground Cable Co. in Pittsburgh, and up to the time of his death was head of the manufacturing business of that company, including the operation of large plants planned and built by him in Pittsburgh, Perth Amboy, N. J.; Oakland, Calif., and Hamilton, Canada.

James Mapes Dodge, chairman of the board of the Link-Belt Co., died at his home in Philadelphia, Dec. 4. He was born in 1852, at Waverly, N. J. His grandfather was Prof. James J. Mapes, a noted chemist and scientist, and his mother, Mary Mapes Dodge, a well known author, for many years editor of the "St. Nicholas Magazine." Mr. Dodge spent three years at Cornell University and a year at Rutgers. At the latter institution he took a special course in chemistry under the late Professor George H. Cook, state geologist of New Jersey. After spending a short time at the Morgan Iron Works in New York, he entered the shops of John Roach, the shipbuilder, at Chester, where his marked mechanical ability and ingenuity brought him rapid advancement. Shortly after the Centennial at Philadelphia he went to Chicago. It was here that he formed the acquaintance of William D. Ewart, the inventor of the Ewart link-belting, and soon after he joined hands with Mr. Ewart and his associates in the development of the chain business. Mr. Dodge's early work was confined principally to development and manufacture, and here his genius had full play. New chains, new methods of manufacture, and new conveying and elevating appliances were brought out in rapid succession. After this period of development Mr. Dodge went East and entered into partnership with Edward H. Burr under the firm name of Burr & Dodge, representing in Philadelphia the Ewart Manufacturing Co., of Indianapolis. Out of this partnership grew the Link-Belt Engineering Co., organized in 1888. It was in 1889, after having become thoroughly acquainted with the needs of the anthracite coal industry, that Mr. Dodge developed his system of storing anthracite coal in large conical piles, and reloading it by machinery, accomplishing this result with little labor and practically no breakage. The invention was so complete, and yet withal so simple, that it is still without a rival in the field of anthracite coal storage. For this meritorious invention he was presented with the Elliott Cresson Gold Medal, in 1907, by the Franklin Institute. Though for many years a large employer of men, Mr. Dodge never met with any strikes or other labor difficulties. He was deeply interested in the personal welfare and advancement of his associates, and a conspicuous leader in the general introduction of the best elements in scientific management, having the double purpose of producing greater efficiency in the mechanical and human equipment, and greater pay with shorter hours and improved conditions for the men.

Editorial Correspondence

SAN FRANCISCO—Dec. 8

Increase in Miners' Wages has been voluntarily announced by several of the large mines in the Grass Valley district, Nevada County. Notices were posted at various mines on Dec. 3, announcing that all the large companies of the district will follow the lead of the North Star. The minimum wage for underground men will be $2.50 per day; men working in drifts $2.75. It is believed that the scale will reach $3 soon. There are 1,067 miners employed in the district and it is probably safe to say that not a half dozen of them are dissatisfied.

Salmon River Quartz Mines not prepared for winter work are closing down for the season, including the Homestake, Cub Bear, Trail Creek and Black Bear. A few men are left in each mine to do general work and look after the property. The closing down, which might otherwise have been avoided was caused by heavy snow storm in the first half of November on the north of the summit of the divide between Etna and Sawyer's Bar. The snow was followed by rain and sun and settled to a depth of about 4 ft., which makes it impracticable for travel without the use of a shovel. Motor stages have been discontinued. The mine owners in this district will take up the matter of opening a wagon road from Salmon River to connect with the Humboldt road which is now within a few miles of the boundary between Siskiyou and Humboldt County. The county supervisors will be asked to aid in this road improvement which is necessary to the proper development of the district. Siskiyou County is a large and rich county in minerals that can never be fully developed without good roads, and these must be built with the assistance of the county or state unless the mines are taken over by large investors.

Prices of Oil and Oil Products made a sharp advance at the beginning of December, said to be due to shortage of production in November, the total being more than 1,000,000 bbl. less than the actual sales in the month. The Oil Industry Association is inclined to predict further advance in prices, unless Congress gives relief to operators and prospectors against whom suits have been brought on lands within the withdrawal order of President Taft. In support of the contention that the shortage is the direct result of the refusal of the Government to permit development and the attempt to seize the wells developed, the association cites the fact that for the first time in years the California monthly production of oil is less than the actual sales. The fact is that the activity of the Government in the withdrawal of oil lands and the suits against holders of such lands have had very little to do with the shortage of production in either October or November. The production has been curtailed by order of the Independent Oil Producers Association and the advice of the large marketing concerns. The curtailment began immediately after the declaration of war in Europe. The advance in prices of oil and oil products is due to the fact that the Standard and the Union and the Associated and the Shell, who are all manufacturers and marketers, have decided to raise the price. The shortage of production has given them the opportunity.

Manganese, Magnesite, Chrome, Potash, Antimony and other industrial mineral substances produced in California are attracting a good deal of attention and comment, and the impression obtains among persons unacquainted or ill-advised that California is going to supply the world with these various substances just as soon as the investors come forward with the necessary means, money and machinery, for opening and developing these various deposits. The attention of large corporations has been called to both manganese and magnesite and also to antimony deposits in the past year and no doubt there will follow a thorough and careful examination of the possibilities of large production. In several instances small mines, long idle, have been reopened and some new properties opened, and the extracted ores shipped to the Eastern market. In fact several deposits not generally heretofore known, have been recently producing sufficient ores to pay a profit above the cost of extraction and shipment by motor, rail and water. The demand for manganese and magnesite ores has naturally increased in the past year and this has attracted attention particularly to California because there has been in the past only a comparatively small commercial production of these substances. The newspaper talk of California supplying the world with these and other minerals will not be looked upon seriously by large investors, although it is possible of course to very largely increase the production of all industrial minerals and metals which are or may be produced here.

New Railroad Construction is contemplated in the filing of articles of incorporation at Modesto, in Stanislaus County, by the Patterson & Western R.R. Co., a subsidiary of the Mineral Products Corporation. This company is developing deposits of manganese and quicksilver at Red Mountain, which is situated in Santa Clara County. The mineral deposits in this district are in Santa Clara, Alameda and Stanislaus Counties. Quicksilver was mined in this district 15 or 20 years ago by Alvinza Hayward and others. Manganese has been produced in this or adjoining districts for several years and within the past two or three years development of magnesite has been undertaken and is still in progress. Motor-trucks are being employed to handle the ores over roads that are not in good order, and which probably never will be put in order unless the operators of the properties bear the expense. The counties of Stanislaus, Santa Clara and Alameda could well afford to build first-class wagon and automobile roads, not only for the benefit of the mines that could be developed, but for the benefit of the automobile tourists who could and would take advantage of some of the finest scenery in the Coast Range of mountains. It is evident, however, that the counties will do very little toward such road building before it is too late to be of direct benefit to the development of the mineral deposits. So the operators are preparing for the construction of a railroad about 25 mi. long to run between the town of Patterson and Red Mountain. Rights of way have been secured, with the exception of one strip of land and condemnation suit has been brought in order to secure this right of way. The mineral deposits in this district have been known long enough and have been sufficiently developed to attract investors, but like many other districts in the state, the lack of transportation facilities has been a handicap which requires a large investment to overcome. In most cases the extensions of railroads into mining camps have been necessarily done by the operators of the mines or quarries and have not always been operated successfully. The development of mining property and the conduct of the railroad have not usually been advantageously combined; and it has been difficult to induce the large railroad corporations to undertake transportation by rail from such districts until the project has been proved a successful venture.

BUTTE—Dec. 9

Near Big Arm, South of Flathead Lake, extensive prospecting in early part of year resulted in location of more than 100 claims, some of them showing good mineral at surface. Veins carry gold silver and copper, gold being principal content at the surface. Veins range in thickness from 6 in. to 3 ft. and assay from $10 per ton to over $400. An area of over six square miles is known to be mineralized.

In the Scratch Gravel District, Lewis and Clark County, nearly 200 men are prospecting or developing claims. At Head property of Scratch Gravel Gold Mining Co., all machinery has been installed, with exception of pump, and hoisting will be resumed soon. Company expects to ship between 450 and 500 tons of ore per month. The Rock Rose Mining and Milling Co., of Helena, which owns a group of six claims adjoining Fort Harrison, expects to resume development work at its property. J. H. Rowland has started operations on Conrad property owned by Conrad estate which adjoins Franklin of the Cruse estate. Ore assays as high as 104 oz. silver. At Sunshine mine T. B. Miller and associates are sinking new shaft and have already encountered a 14-in. vein, carrying well in gold and silver. Men are at work on group of claims operated by Frank Donaldson, north of Cruse property, Brown Bros. of London, England, and a number of New Yorkers, owners of the Oriole mine, have started operations. The reopening of that mine, which has lain idle for 35 years indicates the prediction that by a concerted effort of the Helena people outside capital for the development of meritorious mines would be attracted, has come true. The Oriole claim is located within a short distance of the Lexington which has produced in past years more than $600,000 in

lead and silver. While the Scratch Gravel district is at present the center of attraction, other districts around Helena are by no means neglected. In the Marysville district the Piegan-Gloster mill of the Barnes King Development Co. is operating regularly.

SALT LAKE CITY—Dec. 10

A New Operating System is to be tried at the Chief Consolidated at Tintic, according to which the handling of all development work will be done under contract, leaving the regular forces free to devote their entire attention to the mining of ore already developed. It is thought that a considerable saving and better progress will be made in doing development under this arrangement.

The Enlargement of the Potash Plant 100% is called for by plans being drawn for the Mineral Products Corporation at Marysvale. As soon as the officers and the engineers work out the details, the contract for the building of the second unit to the only commercial potash plant in the United States will be let to Westinghouse, Church, Kerr & Co., according to the Salt Lake "Tribune." Howard F. Chappell, president of the company, has been in Salt Lake City, where a conference was held by Mr. Chappell, C. H. Macdowell, vice-president of the company representing the Armours; S. J. Jennings, vice-president, representing the United States Smelting Co., and R. B. Forsythe, general manager of the mine and plant. It was decided to go ahead at once with the construction of the additions, which will increase the output to 60 tons a day, but before the plans shall be drawn the engineers will contrive a new system of devices for conveying the alunite ores into the roaster. "We are more than pleased with the plant and our decision to double the capacity as soon as the details are worked out shows that we are successful," said Mr. Chappell. "We are shipping an average of three carloads a week from Marysvale to Jacksonville, Fla., and as the potash market is higher than ever before we are enjoying the benefit of the high price. I have been over the new discovery of alunite at Marysvale, and while it is a good ore, yet we took samples from it a long time ago and decided that the claims which we are working are higher in potash. We will add to the factory as we think the trade demands." Mr. Chappell would not comment upon the plant which the Southern Cotton Oil Co. is erecting on Great Salt Lake to extract potash from the waters of the lake

HOUGHTON, MICH.—Dec. 8

There Is a Renewal of Interest in the Work at the Lake Copper mine. Its remarkable showing of copper brought about exploration work in numerous other neighboring properties. Four months ago Lake was reopened under the management of Elton W. Walker, who made such a record in his handling of the Mass Consolidated. At the present time Lake is shipping copper rock at the rate of 8,000 tons a month. The rock averaged during November more than 40 lb. of mineral to the ton, which insures more than 25 lb. refined copper. The underground work has been pushed along as rapidly as possible. While comparatively limited advance openings have been made, practically every drill now breaking rock underground is operating in very high-grade amygdaloid. Of course the lode is different, in many characteristics, from any other lode in the Lake Superior district and there is much bunching of the rich spots. Over half of the drills are working today in the places that it was found necessary to abandon when the slump in the price of metal made necessary the suspension of all operations at Lake. In addition to the regular rock tonnage, the Lake has been taking out a substantial amount of mass copper, four large shipments already having been made to the mill, so that while the net refined showing in the smeltery is better than 25 lb. this total ought to be augmented to some extent. The plan for the present is to continue the openings gradually, as good showings develop and to increase rock shipments accordingly.

That the Wolverine Company plans to absorb the White Pine Extension, as an evidence of the expansion policy of the Stanton management, is positively denied. In the first place the Stanton management is willing to go on record to the effect that the Wolverine has a productive life of from 17 to 20 years. There is no doubt at all that the policy of seeking copper rock in the footwall, and back of the footwall, is working out very satisfactorily and has added materially to the length of life of the mine. It will take at least five years to open to the bottom of the property and 12 to 15 years to mine back to surface and plans are being made accordingly. The Michigan management of the White Pine Extension property, will at the same time, be in charge of Theodore Denglar, who has been in charge of the Wolverine and Mohawk properties of the Stanton interests for the past few years with such excellent results. Fred B. Close, who has been active in the diamond drilling and original development work at the Extension property will be superintendent in charge and will make his permanent residence in Ontonagon county within the week. William R. Bolley, formerly superintendent of the Baltic mine of the Copper Range Consolidated will be assistant superintendent, thus assuring the White Pine Extension as efficient active management as is possible to secure, in addition to the strength of the Stanton control in the east.

The Inclination and Desire of Lake Superior Shareholders of the Adventure property to have some actual operations started likely will find expression in a public letter addressed to the shareholders in the near future. The Eastern management evidently does not feel the necessity for taking any aggressive action at this time. Renewal of interest in explorative prospects at the Adventure has come about through the latest developments at the South Lake property, which last week cut the Butler lode and found it containing fair copper rock. While on lateral development of this lode on the South Lake, has as yet been done, the showing where the cut was made was better than anticipated and fosters the belief that this formation will have commercial merit for South Lake. This adds another to the list of formations which are well developed and commercially profitable at South Lake on the one side and at Mass on the other side of the Adventure. Each of these lodes may be cut from the Adventure's present underground openings. A 500-ft. crosscut from any of the lower levels could be accomplished at comparatively small cost and would illustrate the worth of these formations. At present, with so much talk of the South Lake's various showings and the proof in mine production at the Mass Consolidated, the desire that some activity should take place at Adventure is well founded. The Lake Superior shareholders believe that if the Eastern management persists in a do-nothing policy now, there never will be a chance for activity at the mine. Engineers here acquainted with the conditions believe that Adventure, with the present metal market, could be operated on production from abandoned openings with success. The proposal freely suggested in the Michigan district is that management be passed to the shareholders here who desire renewed operations and are willing to pay an assessment for that purpose.

PIOCHE, NEV.—Dec. 6

The Old Day-Bristol Properties during the year passed from Receiver H. E. Freudenthal to the Consolidated California-Nevada Co., Geo. E. Bent, superintendent. The 2-mi. tram, eliminating a 15-mi. haul, is being operated successfully, and several new orebodies have been recently developed on the properties. The production is about 1,000 tons of good-grade copper ore per month and conditions indicate a larger production in the future. A mill has recently been installed on the old Comet property which is successfully separating and concentrating lead-silver-tungsten ores. E. D. Smiley is manager. During the year there has been considerable activity in the Groom district, owing largely to a lease by Tom McCormac on the old Poucin property. The lease has shipped several cars of high-grade lead ore since a road to Indian Springs on the Las Vegas & Tonopah R.R. has been put in condition, and the opening of the road has encouraged prospectors to start work on adjoining claims. During the latter part of the year two motor trucks were put on the 80-mi. haul from the old Briscoe property to Pioche, and an average of about 100 tons of high-grade silver-lead ore will be shipped monthly. In October about 15 men were put to work sinking the main shaft on the Atlanta ground, and Supt. J. J. Stubbenbord advises that the force will probably be increased in the near future. There is already developed on the property a considerable body of low-grade gold ore, but cheap power must be secured to make it pay. A new compressor has recently been installed. Considerable development work, with satisfying results, has been done on the old Easter property since the installation of machinery. J. W. Taylor is in charge.

TORONTO—Dec. 11

With the Freezing of the Yukon River, the winter highway to the railroad terminus at White Horse was opened Dec. 6, three horse-drawn stages moving each way.

Coincident with the Reorganization of the Canadian Shell Committee, which has been superseded by a new body to be known as the Imperial Munitions Board, a commission has been created to inquire into the supply and sufficiency of raw material in Canada required for the production of munitions of war and the best methods of conserving the same. The commission includes Col. Thomas Cantley, president of the Nova Scotia Steel and Coal Co. as chairman; E. Carnegie, of Welland, Ont., George W. Watts, of Toronto, Robert Hobson, of Hamilton, Ont., Senator Wm. C. Edwards, of Ottawa, and George C. Mackenzie, of the Canadian Mines Department.

The Mining News

ALASKA

THOMAS CULROSS (Fort Wells)—Will install machinery. J. B. Howard will be in charge of installation.

E. E. FLEMING (Chichagof Island)—Sinking shaft on gold-copper property about 14 mi. from Chichagof mine. Will work all winter.

J. A. HERBERT COAL MINE (Seldovia)—Shipping coal to Seward regularly, where it is marketed by A. G. de Sherbinin. Quality of coal improving, as expected, on getting further in from outcrop

ALASKA PETROLEUM AND COAL CO. (Katella)—This company has just been given patent to its coal claims in Behring coal field. Property is about 20 mi. from salt water and on proposed extension of the Copper River & N. W. Ry. T. S. Lippy, of Seattle, is president, and C. E. Davis, secretary.

C. O. HOLDING AND DEVELOPMENT (Juneau)—Incorporated with capital stock $1,000,000. Principal office, Dover, Del. John McLaren, Lewis Schulder-Frei, and E. M. Beyhl, of 154 Nassau St., New York City, are principal stockholders. E. H. Austin, president; A. N. Ward, secretary, and J. K. Nevill, Alaska, agent. Has bought and will develop Lemon Creek properties.

ARIZONA

Cochise County

SOUTH VIRGINIA (San Simon)—Moffitt and Creswell are shipping about four cars per month copper ore to El Paso smeltery. Mine is situated just north of Johnny Bull property, about 6 mi. southwest of Steins, N. M

Gila County

IRON CAP (Globe)—New, double drum hoist, 1,500-ft. capacity, together with other new equipment ordered.

OLD DOMINION (Globe)—Copper production for month of November amounted to 2,443,000 lb.; smallest this year since May.

ARIZONA COMMERCIAL (Globe)—The company is considering plans for the construction of a power plant. Power is now purchased from the Old Dominion.

INTERNATIONAL SMELTING (Miami)—One of three reverberatory furnaces is in operation. Cottrell condensing process is used in flues leading from roasting furnaces and converters, but not in flues leading to reverberatory stack.

Greenlee County

CLIFTON-MORENCI-METCALFE strike situation remains about the same. Strikers indulging in manhandling nonsympathizers and defying law and order generally, though no spectacular breaches.

Maricopa County

MAX DELTA (Phoenix)—Mine 6 mi. south of Phoenix has resumed sinking and drifting.

Pima County

CAVILLO (Tucson)—Cavillo mine, 40 mi. west of Tucson, which has been shipping 40 tons a week, has been sold.

RAY-ARIZONA (Kelvin)—Small force of men recently put on at development. Claims adjoin Kelvin Sultana on the west.

RAY-HERCULES (Ray)—Two new churn drills to be put into service soon. Shipments of carbonate ores by leasers continue.

Yavapai County

WHITE SPAR (Prescott)—Being reopened for its antimony ores.

CHAMPION (Prescott)—Active operations begun. Property recently changed hands.

MOUNT UNION (Prescott)—To be reopened by English syndicate after several years' idleness.

PEAT (Cherry Creek)—Contracts let for considerable development work, including 500-ft. of sinking.

LADY ALLOY (McCabe)—Carload ore averaging $16 gold, $6 silver and 3% copper was shipped to Copper Queen smeltery last week. Will continue to ship carload per week.

CALIFORNIA

Amador County

CHROME DEPOSITS in Mountain Springs district are being developed by J. E. Medford of Ione.

ALLEN (Ione)—New shaft is down to 500-ft. point. Prospect of developing good copper-bearing ore

ORO (Plymouth)—Reported that this property will be reopened by Kennedy Mining and Milling Co., of Jackson.

RHETTA (Plymouth)—Formerly Bay State, is being reopened and equipped with modern machinery. Bayliss C. Clark is superintendent

ONEIDA (Sutter Creek)—This old mine reopened two or three years ago by South Eureka Co., but idle for past year, will be unwatered and further development undertaken by deepening shaft and exploring below lowest levels.

Butte County

FORBESTOWN CONSOLIDATED (Forbestown)—Reported sale of property including Gold Bank-Golden Queen and the Shakespear group and some placer ground made to C. W. Reece, of Salt Lake City for $270,000. Reopening and development of these mines has been in progress by M. J. Cooney, of Forbestown and Fred J. Stoer, of Oakland. Gold Bank-Golden Queen was chief producer in early days of quartz mining in Forbestown district.

Eldorado County

GOLDEN HATCHET (Placerville)—Will unwater shaft with a gasoline driven pump.

EUREKA SLATE (Placerville)—Large order of slate for Government warrants reopening quarries at Slatington. Improvements of tramway will cost $5,000. Motor trucks will haul product from end of tramway to Placerville for shipment by rail.

Inyo County

WILSHIRE (Bishop)—Operation suspended for winter; only watchman now at mine. During past season average battery assay $11.40 per ton; 5,000 tons mined and milled, producing a total of $55,000.

Kern County

BLACK HAWK (Randsburg)—Cleanup of 8 tons of ore at Red Dog mill last week returned $2,000.

Nevada County

PERRIN (Grass Valley)—Will reopen this mine formerly known as Prudential.

Placer County

CRANDAL (Ophir)—Property sold at public auction was bought in by William Jull, administrator of estate of E. Jull for amount of mortgage and cost, $4,200.

Shasta County

BALAKLALA (Coram)—About 9,000 tons a month being shipped to Mammoth smeltery at Kennett. Employs 125 men. George S. Ferguson is in charge.

Sierra County

ALHAMBRA (Poker Flat)—Work in tunnel begun; will continue during winter. Mill to be erected next spring. Caulfield and McFarlane in charge for Senator L. V. Ulrey, of Pennsylvania.

Tulare County

PORTERVILLE MAGNESITE (Porterville)—Nine cars of magnesite amounting to 600,000 lb. shipped during last week in November.

Tuolumne County

HOPE (Sonora)—Arrangements reported for installation of new machinery, including compressors and pumps. George W. Weston is general manager.

YANKEE HILL (Sonora)—Gravel property reported been taken over by El Oro Dredging Co., of Oroville, Charles Helman, manager. Installation of California type dredge is contemplated.

Yuba County

A. B. C. MINE (Brownsville)—Mine formerly known as Solano Wonder, now owned by Shaw & Batcher and J. C. Campbell is being put in shape for operation.

COLORADO

Ouray County

CAMP BIRD (Ouray)—For quarter ended Sept. 30 crushed 8,110 dry tons ore. Receipts from sale of bullion and concentrates $291,786; working expenses, $86,121.

San Miguel County

TOMBOY (Telluride)—Return for month of November: Mill ran 28 days; crushed 12,000 tons of ore, yielding bullion, $42,000; concentrates shipped, $44,500; expenses for period, $59,300; profit, $27,200.

IDAHO

Shoshone County

SUNSET-BANNER (Wallace)—This group, adjoining Beebe group on Beaver Creek, has been bonded to John D. Beebe for $75,000.

AMAZON-MANHATTAN (Wallace)—Work resumed on this Carbon Creek property, recently purchased by Interstate-Callahan, which has also secured Blue Grouse group, lying between Amazon-Manhattan and Interstate.

CASTLE ROCK (Wallace)—Crosscut to vein from 200 level showed 6 ft. of 1% copper ore; now driving west to cut downward extension of chimney of high-grade ore found in upper level.

EMPIRE (Wallace)—Controlling Horst-Powell copper mine on Little North Fork, contracted for 600-ton crusher, 20-drill compressor and hoist. Construction of mill building under way, mill to be completed in May.

AMAZON-DIXIE (Wallace)—Plans to sink 500-ft. vertical shaft at point short distance west of raise, crosscutting to vein at 250 and 500 ft. If developments in lower levels are satisfactory, mill will be constructed. Wesley Everett is manager

IDORA (Wallace)—Company plans to pool 300,000 shares of issued stock, which will be sold for $22,500 to raise money to meet payment on mortgage and provide funds for further development. Sec.-Treas. Charles E. Mullette states that mine is in position to pay own way henceforth.

CEDAR CREEK (Wallace)—Stated in circular letter issued to stockholders that lower crosscut tunnel has been extended 1,125 ft. Will cut vein at depth of 1,100 ft. In upper tunnel, milling ore is exposed for 300 ft., and in intermediate tunnel for 1,000 ft. Winze 125 ft. deep for intermediate level, with 260 ft. of driving, also shows milling ore

INDIANA

CALDWELL CHEMICAL CO. (Evansville)—Is receiving bids on picric-acid equipment for new plant at Spottsville, Ky., which will have capacity of 100 tons per month. Equipment will include coke ovens, coal-tar stills, preheaters, condensers, phenol recovery plants, etc. C. O. Koegel, 202 Woods Building, Evansville, Ind., is manager.

MARYLAND

UNITED STATES GOVERNMENT has let contract for construction of 16 steel retorts to be used in manufacture of nitric acid at Indian Head smokeless powder factory.

MICHIGAN

Iron

OLIVER IRON (Ishpeming)—New hoisting plant to be installed at Section 16 mine.

IRON MOUNTAIN LAKE (Ishpeming)—Shaft work will be resumed first of year; now down 350 ft.; will go to 600

CLEVELAND-CLIFFS (Ishpeming)—Is in market for $200,000 worth of machinery; rock drills, sharpeners, hoists, compressors, etc.

VIRGIL (Iron River)—Operations will be resumed about Jan. 1 by Wickwire Mining Co. New property, shut down when slump came year ago, is being unwatered.

ATHENS (Negaunee)—Shaft is now down about 1,100 ft. About 90 ft. per month is being made. New skip hoist is to be installed. Thus far cage hoist has been doing all of the work. Shaft is being concreted. Will go down to 2,400 ft.

MINNESOTA

Cuyuna Range

FERRO (Ironton)—Now being unwatered. New machinery and boilers will be installed.

MANGAN IRON AND STEEL (Ironton)—Work started on lath shaft to be sunk on company's property, which adjoins Cuyuna-Mille Lacs.

MINNESOTA DEVELOPMENT (Manganese)—Has started drilling on lands west of Iron Mountain mine, where it has considerable acreage under option.

MEACHAM (Crosby)—After idlness of several years underground operation is being gotten ready for production. Has modern concrete shaft but has never shipped any ore. Operated by Rogers-Brown Ore Co.

Mesabi Range

TIOGA (Chisholm)—Last building has now been moved from property, and operations will start soon.

VICTORIA (Virginia)—After idleness of four years, this property of Republic Iron and Steel Co. now has 150 men working underground. Product being stockpiled.

ORDEAN (Virginia)—Two shifts, aggregating over 100 men, started on stripping operations at this property, immediately east of Sliver; 600,000 yards of overburden will be removed, and property will ship next season.

MISSOURI-KANSAS-OKLAHOMA

JAMES MURPHY MILL (Galena, Kan.)—Shut down for improvement; $5,000 to be spent. Three sludge tables to be installed.

SAMBO MINING (Joplin, Mo.)—Situated near Lincolnville, Okla. Has 30-acre lease on Buck land. Will install 300-ton mill; framework already up. Charles Hart is manager.

SILVER COIN MINE (Galena, Kan.)—Has struck large body of ore at 159-ft. level, sheet formation. Has been handling dirt over custom mills, believes mine now justifies erecting concentrating plant, expects to let contract soon for 150-ton plant.

W. B. BASH AND ASSOCIATES (Joplin Mo.)—Have obtained lease of Ewers forty near Lincolnville, Okla. Will expend $4,000 or $5,000 in improving mill already on ground. Shaft is down to 150-ft. level; expect to go to 250 where drill holes show 20 ft. high-grade ore.

NORTH EMPIRE (Galena, Kan.)—Land has been drained. Mill has been operating on tailings, but will now work on dirt from ground as well as tailings. Produced car and half of ore last week. Ground has been idle for several years; will be consistent producer from now on. E. H. Stearns is superintendent.

G. C. MOORE AND ASSOCIATES (Galena, Kan.)—Have taken 5-acre lease from the Southside Mining Co. Land situated on west forty. Will install pumps and drain ground; many shafts are already down to the 65-ft. ore level; expect to drain ground to 150-ft. level where good run of ore has been developed through drilling; will lease part of land to miners; expect to erect custom mill to handle ore after ground is drained and opened up.

MONTANA

Silver Bow County

ANACONDA COPPER (Butte)—Production of copper at Washoe and Great Falls in November was 24,400,000 lb., against 24,900,000 lb. in October. Total production for 11 months of 1915 totaled 229,200,000 lb.

EAST BUTTE (Butte)—On Dec. 1, company paid off last of its indebtedness of $500,000. Original debt created by purchase of Pittsmont property was $2,500,000, all of which has been paid off from earnings in past six years. Will soon 100-ton flotation plant in operation this week.

BUTTE & SUPERIOR (Butte)—In November broke [illegible] net records for production. Total tonnage of [illegible] 52,150, which is 5,000 tons more than any previous month. From this, 15,050 tons of concentrates, containing 16,000,000 lb. of zinc were produced. Payrolls are estimated at between $190,000 and $200,000.

NEVADA

Churchill County

NEVADA WONDER (Wonder)—During fiscal year ended Sept. 30, mine produced 58,124 tons, gross value, $812,119, average $13.97 per ton. Expenses were $503,335; profit $308,783. Miscellaneous income was $278 and milling company's profit $18,196, making total profit of $327,557 for year.

Esmeralda County

GOLDFIELD CON (Goldfield)—Preliminary estimate for November: 22,160 tons milled; gross value, $199,800; operating expense, $117,000; net realization, $52,783.

Humboldt County

FIRST DEEP WORK IN WILLARD to prove depth is about to be undertaken at Kaiser lease on Sheepherder's Dream. B. T. Godfrey, of San Francisco, has bought in on lease and is now bringing in hoist for new work. Last finds in ground indicate that old high-grade streak has been recovered and it is asserted that there are several thousand dollars in sight at present.

ROCHESTER MINES (Rochester)—Made third bullion shipment for month, three bars, valued at $3,600. Two previous consignments bring November shipments up to $33,600.

Lincoln County

DEMIJOHN CON. (Pioche)—Has had 10 men on development work for last six months, in course of which some ore has been extracted.

AMALGAMATED-PIOCHE (Pioche)—Has worked continuously entire year with force of 100 men; product argentiferous lead-zinc sulphides. High-grade sorted and shipped crude, but a considerable tonnage of low-grade accumulated. Some form of flotation process expected to solve treatment difficulties. H. R. van Wagenen is in charge.

YUBA LEASING (Pioche)—During year installed 100-hp. gasoline engine and compressor at old No. 3 shaft, and built and put into operation 50-ton mill to treat gold-silver-lead ores from its lease of old properties along Yuba dike now controlled by the Amalgamated-Pioche. Mill is working satisfactorily, and another unit may soon be added to treat custom ores. A. Y. Smith is manager.

PRINCE CON. (Pioche)—Working force of about 100 men during entire year, succeeded in putting Pioche back among dividend-paying camps after lapse of about 40 years. Large production, coupled with favorable market, has enabled this company to pay $125,000 in dividends during year out of its lead-silver-manganese production of approximately 125,000 tons. In meantime development work exposed additional bodies of low-grade similar to those now being shipped, and considerable high-grade has been located below water level. A 100-hp. gasoline engine added to equipment during year. Under management of M. C. Godbe.

Nye County

TONOPAH ORE PRODUCTION for week ended Dec. 4 was 9,497 tons, valued at $201,406, compared with 9,951 tons week previous. Producers were: Tonopah Belmont, 3,111 tons; Tonopah Mining, 2,675; Tonopah Extension, 1,850; Jim Butler, 1,100; West End, 705; North Star, 112; miscellaneous leases, 194 tons.

Storey County

MEXICAN (Virginia)—On 2,500 level west crosscut No. 2A started and advanced 10 ft. through porphyry and quartz of low assay; on 2,700 level similar work and results. Mexican mill crushed 368 tons of custom ore, average $22.83.

SIERRA NEVADA (Virginia)—On 2,500 level advanced west crosscut 8 ft. through low-grade ore, disclosed in bottom of face, averaging $94. Stoping continued in No. 1. Shipped 125 tons to Mexican mill, average $13.63.

OPHIR (Virginia)—On 2,500 level west crosscut from southwest drift driven 9 ft. with face in porphyry and quartz of low assay. North drift from winze station advanced 8 ft. in loose ground. Saved 372 cars of ore; shipped 320 tons to mill.

CROWN POINT-BELCHER (Gold Hill)—Saved 260 cars of mill rock from No. 1 stope, 1,600 level. In joint incline water was held 65 ft. below 1,600 level and repairs made between 1,400 and 1,500 levels. Jacket mill received 690 tons dump rock and 192 tons mine rock; 90 tons shipped to gloryhole from shaft bins. Bar of bullion shipped.

UNION (Virginia)—East crosscut from top of raise to 2,400 level extended 4 ft., face in ore, average $20. At 9-ft. point north drift driven 4 ft. in ore, average $35. South Drift driven 4 ft. in ore, average $65. Saved from this work 61 tons, average $41.50. Raise in No. 1 stope in $18 ore; 59 tons of ore saved, average $16.52. Saved from No. 2 and No. 3 stopes 43 tons, averaging $8 and 80 tons averaging $35.60.

NEW JERSEY

Hudson County

NATURAL PRODUCTS REFINING CO. (Jersey City)—Manufactuer of bichromate of potash and bichromate of soda, is building an extension to its plant; estimated cost of which is $50,000.

NEW MEXICO

Grant County

OCTO (Lordsburg)—Has begun shipping silver-lead ore.

SAN FERNANDO (Tyrone)—Has taken over from O. D. Warnock group of gold-silver-copper claims 5 mi. south of Tyrone and will deepen 92-ft. shaft. Vein in bottom of shaft runs $18 gold, 14 oz. silver and 18% copper.

PHELPS-DODGE (Tyrone)—Company is awaiting plans of townsite and houses from Grosvenor Goodhue, New York, before proceeding with extensive construction. Contract for

15 "American" houses to cost about $3,000 each has been let; about 25 stucco houses costing $2,000 have been completed. Parker hospital will soon be finished at cost of $58,000.

SAVANNA COPPER (Silver City)—Deal just consummated whereby company disposes of holdings in Burro Mountain District, aggregating nearly 2,600 acres. Property adjoins Phelps-Dodge holdings and has considerable deposit of disseminated copper ore developed by drilling. Burro Mountain acreage alone is being disposed of, leaving the Savanna company some valuable gold claims in Pinos Altos Mountains.

Lincoln County

WHITE OAKS CON. (White Oaks)—Incorporated in state of Delaware for $250,000, has been admitted to do business in New Mexico.

Otero County

IRON DUKE (Jarilla)—J. H. Parker is opening up iron deposits and will begin shipping to Pueblo soon as 1-mi. extension of 3-mi. Rock Island spur from Orogrande is completed. Road is now being graded.

TENNESSEE

Polk County

TENNESSEE COPPER (Copper Hill)—It is reported that large powder mill will be established at Copper Hill, Tenn., to utilize sulphur and sulphuric acid produced from smeltery fumes.

UTAH

Juab County

TINTIC ORE PRODUCTION for November was 482 carloads, estimated 24,100 tons, valued at $600,000, compared with 643 carloads in October and 506 cars in September. Shippers were: Chief Consolidated, 113 cars; Iron Blosson, 88; Centennial-Eureka, 68; Mammoth, 54; Eagle & Blue Bell, 52; Gemini, 26; Grand Central, 16; Gold Chain, 8; May Day, 8; Dragon Consolidated, 8; Beck Tunnel, 7; Bullion Beck, 5; Colorado, 4; Lower Mammoth, 4; Yankee Consolidated, 3; Carisa lease, 3; Victoria, 3; Eureka Hill, 2; Mineral Utah 2; Uncle Sam, 2; Black Jack, 1; Godiva, 1; Ridge & Valley, 1; Plutus, 1; Victor Consolidated, 1; Minnie Moore lease, 1; Utah Ore Sampler, 1 car.

CHIEF CONSOLIDATED (Eureka)—Preparations being made for development of large acreage recently acquired in east and north Tintic, greater part being near Lehi-Tintic, Selma and Delamar.

EMERALD (Mammoth)—Mineralized ground has been cut by drift on 1,000 level. Country rock is brecciated limestone, with quartz, iron and manganese. Development is in progress in winze from 700.

GEMINI (Eureka)—Pumps have lowered water in this property, and in Ridge & Valley to 1,700 level, and are able to take care of flow by operating 3½ hours a day. Shipments amount to about 1,500 tons a month.

MAMMOTH (Mammoth)—November shipments were 54 cars; 438 cars shipped during 11 months, last five months showing output more than double that of first six. Recent find of lead-silver ore on 1,500 level being developed, and on 400 level there is large body of low-grade copper ore from which shipments are to be increased. Copper ore in other parts of the mine carries from 8 to 10% copper.

LOWER MAMMOTH (Mammoth)—After payment of recently declared dividend of $10,000 there will be $5,000 left in treasury. Both company and leasers are producing zinc ore from between 1,500 and 1,700 levels. Lead-silver ore also being shipped. Development both on 1,000 and 700 levels encouraging. Raise from latter level will later be connected with 700, to afford better ventilation as well as opportunity of prospecting new ground in southern part of property.

Salt Lake County

SELLS MINING (Alta)—Development in ore continues in recent strike at this property, and drifting is being done in ore northeast and southwest. Width has not been determined, except at one point, where there was about 10 ft. of shipping grade. Ezra Thompson, president of Cardiff has bought 50,000 shares of stock.

CONGOR MINING (Bingham)—Is developing vein from 4,000-ft. tunnel of Montana-Bingham. Car of sulphide ore has been shipped, running well in copper, and carrying some silver and gold. Vein is from two to three feet thick, and there is more than 1,000 ft. on dip to surface. Drifting on vein north and south. Work is about 100 ft. from face of Montana-Bingham tunnel in Bingham Amalgamated ground, but dip or rise of vein toward surface it is thought will carry apex on Congor claims. Two sets of leasers are also working in Montana-Bingham tunnel at around 300 and 500-ft. points.

Summit County

PARK CITY shipments for the week ended Dec. 3 amounted to 3,284,056 lb. November shipments were 147 cars or 6,518 tons, 86 cars having been shipped over the Union Pacific, and 61 cars over the Denver & Rio Grande.

ONTARIO (Park City)—Centrifugal pump of 1,000-gal. capacity per min. has been ordered, and will be installed on 1,700-ft. level.

COLUMBUS EXTENSION (Alta)—Work is being done with view to cutting downward extension of orebody in old Toledo workings, reported to have produced $1,000,000 in early days of camp.

Tooele County

IN DRY CANYON DISTRICT near Stockton, regular shipments are being made from Ferguson lease on Mono Development, from Hidden Treasure, and Queen of the Hills; latter property producing zinc ore, running 40% or over. Wandering Jew has car of ore ready for market.

CANADA

British Columbia

BRITISH COLUMBIA COPPER (Greenwood)—Is outputting at rate of 350,000 lb. blister copper with smeltery working at one-third capacity. Company is planning betterments, to cost $1,000,000, including 200-ton concentrator at or near Copper Mountain and power plant at Princeton. Delay in starting construction caused by lack of transportation; has been officially announced that if Kettle Valley Ry. is not extended from Princeton to Copper Mountain, mining company will build aërial tram 9 mi. long to transport output of proposed mill.

Ontario

TEMISKAMING & HUDSON BAY (Cobalt)—Mine, which has been closed down for some months, is about to resume.

NIPISSING (Cobalt)—In November mined ore estimated net value $164,846 and shipped bullion from Nipissing and customs ore $275,767.

KERR LAKE—(Cobalt)—Pumping on Kerr Lake has ceased and further drainage will be limited to pumping out of surface water and mud from basin.

MOOSE MOUNTAIN (Sellwood)—Car of concentrates shipped to New York in hope of perfecting briquetting process, which has been principal difficulty. Experiments being made by John L. Baker.

HOLLINGER (Porcupine)—Usual four-weekly statement for period ended Nov. 4 shows gross profits $184,769, from treatment of 28,401 tons of ore; average value of $10.34. Working costs $3.29 per ton milled. Mill also treated 10,495 tons of ore for Acme.

BEAVER (Cobalt)—Quarterly report for period ended Nov. 30 shows cash on hand, $122,674; silver in ore on hand, at smelters and in transit 220,015 oz. Additions to mill have been completed and it is now treating 125 to 150 tons a day. Main shaft has reached depth of 1,235 ft.

DOME (Porcupine)—Statement for six months ended Sept. 30 shows 162,363 tons of ore milled from which was recovered $731,802; average, $4.42 a ton. Total income for period was $800,360 and net earnings $433,902. Production for November will show recovery of $160,000 from 28,900 tons; average about $5.50 per ton.

MEXICO

Chihuahua

ROSARIO (Guadalupe y Calvo)—Being redeveloped by English company, is doggedly plodding along, packing in machinery on burros from Parral a 14-day trip. Have been no military operations in that section recently. Foundation for 200-ton mill has been laid, and all machinery has been shipped; some already on the ground. This mine was opened up and worked about 75 years ago by two Scotch brothers named MacIntosh, but was abandoned before it was really developed. Deepest shaft is only 450 ft. while main working shaft is only 150 ft. or 75 ft. below river bed. Estimated old dump contains 365,000 tons of $10 stuff.

Sonora

PORT AGUA PRIETA during October passed 134 cars (4,689 tons) ore, valued at $1,201,000; consisted of copper, $722,000; silver, $293,000; gold, $186,000. Moctezuma Copper, Nacozari, lead with 104 cars. El Tigre shipped 55 bars gold and silver bullion.

CANANEA CONSOLIDATED (Cananea)—Train service between Naco and Cananea has been resumed but definite date of resumption of work at Cananea has not been decided upon, but expectations are to start up within a few days. Plant is in good shape after the Villa evacuation and can be started up without delay. Men have been notified to return ready to resume positions. Some supplies have already gone in to relieve the distress experienced after the confiscation of all available food stuffs by Villistas.

CENTRAL AMERICA

Nicaragua

LINDA VENTURA (Wawa)—Mr. W. B. Milliken is erecting cyanide mill at the Linda Ventura mines, Wawa River, Bluefields, which he expects to have in successful operation in February. He will then return to his Denver office.

SOUTH AMERICA

Chile

BRADEN (Rancagua)—In November produced 3,684,000 lb. of blister copper, compared with 3,726,000 in October.

PERU

CERRO DE PASCO (Lima)—Production in November was 6,000,000 lb. of copper. This is approximately 1,000,000 lb. larger than average monthly production heretofore.

AFRICA

Belgian Congo

TANGANYIKA CONCESSION (Katanga)—During 10 months ended Oct. 31, Union Miniere, subsidiary of Tanganyika Concession, produced 24,530,000 lb. of copper. Production for entire year 1914 was but 21,444,000 lb.; in the 15 months up to Dec. 31, 1915, output amounted to only 30,000,000 lb. October production was 2,606,000 lb. Plans in hand for enlargement of plant to enable production of 50,000,000 lb. during 1916.

Rhodesia

GOLD PRODUCTION IN OCTOBER is reported at 81,161 oz.; for the 10 months ended Oct. 31 it was 760,044 oz., or $15,770,110. Other mineral production for the 10 months was 153,048 oz. silver, 2,906 tons copper, 26 tons lead, 1,486 tons asbestos, 48,261 tons chrome ore and 331,029 tons coal.

ASIA

Chosen

CHIKSAN MINING CO. (Chiksan)—Has contracted with New York Engineering Co. for a 10-cu.ft. steel gold dredge, having clay bypass and resoiling equipment.

The Market Report

Metal Markets

NEW YORK—Dec. 15

All the markets were dull and uninteresting during the last week. In the cases of both lead and spelter, however, there were advances that are rather inexplicable.

Copper, Tin, Lead and Zinc

Copper—Business of moderate proportions was transacted from day to day both for domestic and foreign account. The aggregate was probably a little larger than in the previous week. Some considerable orders were placed by Connecticut brass makers, presumably for ammunition purposes. The price of the large producers is generally 19¾c., r. t., and considerable business was reported done at that figure, but in some quarters small concessions were made. There was a disposition in certain office to accept orders for February, March and April deliveries at further concessions, sales for February being reported at 19.55c., r. t., and for April at 19.50c., r. t. Sales in England were reported at £97@97½.

Copper Exports from the United States week ended Nov. 27 are reported by the Department of Commerce at 6,370,971 lb. The larger items were 3,547,331 lb. to France, 1,120,459 lb. to Russia and 608,226 lb. to England. Imports were 1,649,210 lb. metal and 3,280,789 lb. in ore and matte; 4,929,999 lb. in all, the largest receipts being from Peru.

Exports from Baltimore for the past week included 1,120,201 lb. copper to London; 9.538,535 lb. copper to Havre, France.

Copper Sheets, base price is 25c. per lb. for hot rolled and 26c. for cold rolled, with usual extras. Copper wire is 21@21½c. per lb., carload lots at mill.

Tin—A fair volume of business was done at prices which changed but little during the week.

Lead—On Dec. 14 the A. S. & R. Co. unexpectedly raised its price to 4.50c., New York, and all of the independent producers immediately followed. The reasons that induced this advance have been the subject of a good deal of conjecture. About the beginning of the month the demand for lead was very good and independent producers were getting premiums over the price of the A. S. & R. Co., and at that time an advance by the A. S. & R. Co. was looked for. During the following week, however, the market was softer and not only did premiums disappear, but also independent producers who quoted the trust price failed to get business. The advance of this week occurred in what was supposed to be a wobbly market; certainly it was a dull one from the viewpoint of the independent producers. However, the advance had the effect of bringing out a considerable volume of new inquiries. The best explanation of the advance is that the A. S. & R. Co. has sold so largely for export that it had reduced its available supplies in this country to relatively small proportions. There is reason to believe that the stocks of lead at the several refineries in the United States are now pretty low.

Spelter—Although the business done in this metal was relatively small, a rather sharp advance in price occurred without there being any good reason for it so far as anybody knows. The volume of business transacted was only moderate. It was partly for domestic account and partly for export. The bulk of the business was for deliveries in the first quarter of 1916. In the first part of the week round lots for January-March delivery sold at 14c. In the latter part there was a further advance. The price for prompt spelter rose from 15 to 16½c. Transactions for early delivery were relatively small. The spelter market is confused by operations of speculators and traders, and the resale offers by consumers through brokers and otherwise. Some of the producers quote only to consumers.

Zinc Sheets, base price remains at $22 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Business has been steady, with good sales forward.

Minor Metals—Current quotations for **Bismuth** are $4 per lb., New York.—**Cadmium** is quoted as 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium** metal, 75c. per lb., New York.—**Cobalt metal,** 97% pure, is sold at $1.75@2 per lb.—**Magnesium,** pure, holds to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.

IMPORTS AND EXPORTS

Imports and Exports of the Minor Metals in the United States nine months ended Sept. 30, in pounds except platinum, which is in ounces:

	Imports		Exports	
	1914	1915	1914	1915
Nickel	28,197,471	38,966,138	21,474,688	21,259,631
Antimony	11,665,698	15,372,182	27,109	1,249,325
Aluminum	11,831,103	7,374,549	18,929	40,102
Quicksilver			27,000	180,491
Platinum, oz.	60,683	29,905	143	9

Exports include reëxports of imported material. Nickel and antimony include contents of ore, matte and regulus. Exports of aluminum manufactures—not included above—were valued at $724,219 in 1914, and $2,441,200 this year.

DAILY PRICES OF METALS IN NEW YORK

Dec.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
9	4.7150	56	19.45 @19.55	37½	5.25	5.15 @5.20	13.00 @13.50
10	4.7200	55⅞	19.45 @19.55	37½	5.25	5.15 @5.20	13.50 @15.50
11	4.7163	56	19.45 @19.55	37⅝	5.25	5.15 @5.20	14.00 @16.00
13	4.7113	55⅝	19.45 @19.55	37⅝	5.25	5.15 @5.20	14.00 @16.00
14	4.7125	55⅝	19.45 @19.55	37¼	5.40	5.30 @5.32½	14.00 @16.00
15	4.7163	55	19.45 @19.55	37½	5.40	5.30 @5.32½	14.50 @16.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Dec.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts per Lb
9	26½	77⅛	77⅜	97½	20.54	166¾	166½	28	5.90	82	16.27
10	26⅞	76⅝	77¼	97½	20.55	168⅜	168½	27¼	5.85	82	16.28
11	26⅞	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	26 11/16	76⅛	76⅝	97½	20.53	166¾	166½	27¼	5.84	82	16.26
14	26 11/16	76⅝	77¼	97½	20.53	167¼	167½	28¼	5.95	86	18.12
15	26½	78⅛	79¼	98	20.65	167½	167½	29½	6.17	93	19.60

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Dec. 15

Aluminum—Business has been rather quieter, though demand is still good, and prices have not materially changed. Quotations are 58@59c. per lb. for No. 1 ingots, New York.

The president of the Aluminum Co. of America announces that the company has already largely increased production, and is preparing to increase it still further, not including the Southern Aluminium Co. plant which will be completed later.

Antimony—Business has been steady but not especially active. Stocks are rather low, but seem to be sufficient for present needs; while some large lots are reported on the way from the East Chinese and other ordinary brands are quoted at 38@40c. per lb., New York. Futures are lower, about 34@35c. for February being named. Cookson's is scarce, and the small quantities available are held at 55c. per lb., New York.

Quicksilver—The market is strong and rather excited, while stocks are low and supplies slow in coming forward. San Francisco, the primary market, reports by telegraph sales at $120@130 per flask of 75 lb., with the market firm. New York quotation is $125 per flask for large lots; $130@135 per flask being paid for smaller orders. London price is £16 12s. 6d. per flask, with no discount from second hands.

Nickel—Business is good and prices steady. Ordinary forms are 45@50c. per lb., according to size and terms of order. Electrolytic nickel is 5c. per lb. higher.

Gold, Silver and Platinum

NEW YORK—Dec. 15

Gold—The large importations have resulted in some accumulations of gold at the New York Assay Office. The stock of gold bars there is the largest ever held at one time. Most of these bars have been made from English coin. There has been no large arrival of gold this week.

Silver has reacted owing to the satisfaction of the combined Mint and India orders; and though the London stock was somewhat depleted still buyers were satisfied and the market today is quoted dull.

Iridium—This metal is very scarce and in demand. It is difficult to quote, as most sales are a matter of negotiation, price depending upon necessities of buyers. A sale as high as $110 per oz. is reported.

Platinum—Supplies are still scarce and the market is excited and uncertain. Dealers are not willing to make any regular quotations except to customers. Sales are reported at $80@90 per oz. for refined platinum, and there is a prospect of higher prices. Hard metal may be quoted at $90@95 per oz. according to grade.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Dec. 11

The base price paid this week for 60% zinc ore was $85@87. Ore was in little demand, several buyers being entirely out of the open market. The base price paid for 80% lead ore was $70 per ton.

SHIPMENTS WEEK ENDED DEC. 11

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,464,000	165,000	1,299,500
Year	199,211,750	6,629,140	28,625,210

Shipped during week to separating plants, 7,144,000 lb. zinc ore.

JOPLIN, MO.—Dec. 11

Blende, high price, $93; base per ton 60% zinc, premium ore, $90; medium, $88@80; lower grades down to $70; calamine base per ton 40% zinc, $65@55; average selling price, all grades of zinc, $84.14 per ton. Lead, high price, $74.75; base per ton 80% metal content, $70@74; average selling price, all grades of lead, $62.92 per ton.

SHIPMENTS WEEK ENDED DEC. 11

	Blende	Calamine	Lead	Values
Totals this week	10,622,760	937,080	2,141,400	$555,780
Totals this year	557,500,380	42,710,730	87,288,100	25,758,550

Blende value, the week, $459,610; 50 weeks, $22,282,110.

Calamine value, the week, $28,770; 50 weeks, $1,126,920.

Lead, value, the week, $67,400; 50 weeks, $2,349,520.

Producers are trying to get together for several weeks' closing down during the holidays. It is not believed any will stop before Dec. 24, but a number will close down on Christmas eve, some for nine days and some for two or three weeks. The time occupied in general repair work, and giving the employees a rest is believed will bring better results later.

The $25 drop of the zinc ore market in two weeks does not look good to producers, and they believe if necessary to restrict the output to steady the market they could find no more opportune time.

The shipment of the week is again short, a drop of 3,370 tons in a fortnight. However, the week-end demand was considerably increased for next week's delivery.

Iron Trade Review

NEW YORK—Dec. 15

December is usually considered a dull month in the iron and steel trades, but this year there seems to be no decrease in activity and no slowing down as the year draws to an end.

Domestic business is increasing in all lines, structural steel being the last to come up. The mills are all full for some time ahead and in certain lines premiums for early delivery are heard of. New business cannot be taken care of promptly, but must wait its turn. This has been rather troublesome in the case of some building contracts.

Export business is again increasing. It is to some extent handicapped by the difficulty of securing freight room, and by the congestion of freight on the railroads running to the Eastern seaboard. In fact freight promises to be rather a troublesome question, as there is already complaint of car shortage. A severe snowstorm in the East this week has served to add to the freight congestion. It is over today, but the storm has been heavy and some days, which can ill be spared, will be needed to put the railroads in good running order again.

The pig-iron market continues strong and advancing. Basic is in a little less demand, but bessemer and foundry are called for in many quarters.

All sorts of reports are current as to new steel consolidations. The latest is that a new concern, to be organized with $250,000,000 capital, has asked for options on the Lackawanna Steel Co., the Youngstown Sheet and Tube Co. and several smaller concerns. The statements made are not fully confirmed. The Republic Iron and Steel Co. is also mentioned in this combination.

Nothing further of a definite nature has been made public as to plans for the future relating to the Cambria and the Pennsylvania Steel companies.

A Washington dispatch says the awards for structural steel required for battleships 43 and 44, to be built at the New York and Mare Island navy yards, have been announced by Secretary Daniels. The awards were as follows: To the Carnegie Steel Co., 51,883,400 lb., $1,686,777; to the Carbon Steel Co., 9,611,720 lb., $537,295; to the Pittsburgh Screw and Bolt Co., 3,593,800 lb., $165,708; to the H. A. Wagner Co., 228,000 lb., $25,365; to the American Steel Foundries 1,836,800 lb., $110,208; total, 67,152,620 lb. at $2,459,354. This material represents the amount needed for both ships.

The United States Steel Corporation reports unfilled orders on its books Nov. 30 at 7,189,489 tons of material. This is an increase of 1,024,037 tons over Oct. 31 and is the heaviest figure reported for many months.

Pig-Iron Production has been almost stationary. The reports of the furnaces, as collected and published by the "Iron Age" show that on Dec. 1 there were 284 coke and anthracite stacks in blast, having a total daily capacity of 103,000 tons; an increase of 1,200 tons over Nov. 1. Making allowance for the charcoal furnaces the total production of pig iron in the United States in November is estimated at 3,368,200 tons; for the 11 months ended Nov. 30 it was 27,036,300 tons. Of this total 19,552,490 tons, or 72.3%, were made by the furnaces owned or operated by the steel companies. The gain in November came from the merchant furnaces.

PITTSBURGH—Dec. 14

Belated buyers, or would-be buyers, of steel products, together with those who have newly arisen wants, have served to keep up the buying pressure in the steel industry at a time when quieter conditions had been expected. The tonnage placed is still fairly large, this being a reflection of the buying pressure rather than of the offerings, for the mills are offering practically nothing and are usually merely yielding to entreaty when they place additional business on books. In the old order of things there would now be active booking of third-quarter contracts, the mills in many branches of the trade being sold up to that time, but the mills will not book open contracts for that period and frequently demur about accepting specific orders for delivery so far ahead.

Inasmuch as so much steel is being consumed in inside work, with comparatively little outside construction going on, the advent of winter is not decreasing the pressure upon mills as it usually does. The weather, however, is beginning to affect production at both furnaces and mills, and the output of the past three months may not be duplicated in the next three.

The Steel Corporation increased its unfilled obligations by 1,024,037 tons during November, recording the second largest increase in its history, as October, 1912, had shown an increase of 1,042,000 tons. That business, however, was largely in open contracts, while the business booked last month, equivalent to almost double the capacity, as the shipments were about 1,200,000 tons, was chiefly in the form of actual shipping orders.

Steel prices continue to rise. The minimum price of 1.70c. on bars, plates and shapes has been entirely withdrawn by some large interests, who quote 1.80c. as minimum, and then only occasionally. Premiums for early shipment are increasing, and plates have sold at 2.50c. for prompt carloads and at 2.35c. for somewhat larger lots for January shipment. Hoops, bars and blue annealed sheets also command premiums for early shipment.

Pig Iron—Pig-iron prices have continued to advance sharply, even though the buying has not been heavy, and there is evidently danger of supplies being insufficient, causing a runaway market. The demand for bessemer lately has been unusually heavy owing to the fact that some of the war steel specifications require acid openhearth steel, and this condition has caused a heavy demand for low-phosphorus scrap. Foundry iron has sold at $18.50, Valley, and even sales at $19 are rumored, presumably under special conditions. Several sales of basic have been made at $18. Alice furnace at Sharpsville had an accident Sunday and a new stack will have to be built, involving at least two months' loss of production. Basic is quotable $1 a ton higher than a week ago and foundry and forge 50c. higher. We quote: Bessemer, $19@20; basic, $18; foundry, $18@18.50; forge, $17.50@18, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—There is a good volume of contracting at $100, while odd lots for prompt shipments are bringing that or a trifle more.

Steel—Mills state that billets and sheet bars are fairly quotable at not under $30 for bessemer and $31 for openhearth, f.o.b. maker's mill, Pittsburgh or Youngstown, but these figures represent chiefly the settlement price when consumers adjust extra tonnages with the mills with which they have regular contracts. Possibly a little bessemer could be picked up in the open market but there does not seem to be openhearth at any price. It is expected $34 will be done on bessemer sheet bars for second quarter. Forging billets are about $50 and rods $38 to $40 at mill.

SAULT STE. MARIE CANAL

Freight passing through the Sault Ste. Marie Canal in November was 9,168,431 net tons, an increase of 5,124,063 tons over November, 1914. For the season to Dec. 1 the total tonnage was: East bound, 54,557,241; west bound, 14,552,644; total, 69,109,885 net tons, an increase of 14,291,837 tons over 1914. The number of vessel passages this year was 20,594, showing an average cargo of 3,356 tons. The mineral freights included in the total were, in short tons except salt, which is in barrels:

	1914	1915	Changes	
Anthracite	2,166,555	1,942,630	D.	223,925
Bituminous iron coal	12,191,716	11,092,594	D.	1,099,122
Iron ore	31,413,765	45,138,789	I.	13,725,024
Pig and mfd. iron	237,096	193,352	D.	43,744
Copper	85,038	151,634	I.	66,596
Salt, bbl.	751,618	671,596	D.	80,022

Iron ore this year was 65.3%, and coal 18.9% of the total traffic passing. Of the total freight this year 61,716,005 tons passed through the United States and 7,392,980 tons through the Canadian canal.

FERROALLOYS

Ferrosilicon is in unusual demand and high grade, 50% up to 75%, is hard to get except on contract. Makers have had to refuse several orders for export. The price is now $83@85 per ton at Pittsburgh. Bessemer ferrosilicon has advanced $1 per ton, $30 being asked for 12 to 15%, at furnace. It is understood that plans are taking form for increasing the domestic production of this metal. A new operation at Baltimore is expected to be ready to become a market factor in January and it is understood another furnace is being added at Niagara Falls. The unprecedented demand for 50% and higher ferrosilicon is caused by the heavy orders for ammunition steel which specify a high silicon content.

OTHER ORES

Tungsten ore continues in strong demand and very high prices are reported. It is said that over $50 per unit has been paid for concentrates carrying 65% WO; from the Silver Comet mine in Nevada. The Vasco Mining Co. has been organized by William H. McKenna, of Pittsburgh, to operate a property in Colorado. The concentrate will be made into ferrotungsten at the works of the Vanadium Steel Co. at Latrobe.

IRON ORE

Shipments of Lake Superior iron ore in November were 4,115,129 long tons. For the season to Dec. 1 the shipments by ports were:

	1914	1915	Changes	
Escanaba	3,663,040	5,636,427	I.	1,973,387
Marquette	1,755,726	3,099,589	I.	1,343,863
Ashland	3,363,419	5,196,772	I.	1,833,353
Superior	11,300,748	8,307,381	D.	2,993,367
Duluth	6,318,291	15,457,419	I.	9,139,128
Two Harbors	5,610,262	8,633,980	I.	3,023,718
Total	32,020,486	46,261,568	I.	14,241,082

November shipments did not quite close the season, a few cargoes having been shipped after Dec. 1. The total of these was 57,236 tons, bringing up the shipments to 46,318,804 tons. Rail shipments will make the season total somewhat over 47,000,000 tons.

According to the figures of the Lake Superior Iron Ore Association, Dec. 1, Lake Erie docks held 8,812,499 tons of ore as compared with 8,375,014 tons Dec. 1, 1914, and 9,250,500 Dec. 1, 1913. During the season shipments of ore from Lake Erie docks amounted to 27,027,058 tons as compared with 17,650,073 tons in the season of 1914 and 26,125,758 tons in 1913.

The advance in Lake ore prices has helped to increase Eastern quotations. Some large sales have been made at $4@$4¼c. per unit of iron, delivered, and there is talk of 9c. per unit.

Lake Superior prices, as announced last week are: Old Range bessemer, $4.45; Mesabi bessemer, $4.20; Old Range nonbessemer, $3.70; Mesabi nonbessemer, $3.55; all f.o.b. Lake Erie ports. The base remains unchanged at 55% iron and under 0.40 phosphorus for bessemers; 51.5% iron for nonbessemers.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 437,251 short tons; shipments, 439,165 tons. Shipments of Greensburg and upper Connellsville districts, 44,859 tons. There is much complaint of labor shortage.

Anthracite Shipments in November were 6,297,215 long tons, an increase of 368,929 tons over November, 1914. For the 11 months ended Nov. 30 the total shipments were 62,640,373 tons in 1914, and 60,182,218 in 1915; a decrease of 2,488,155 tons, or 3.9% this year.

Chemicals

NEW YORK—Dec. 15

The market is showing a steady tendency and the general undertone seems to be good.

Arsenic—Business is moderate, but generally steady. Prices are about the same, $3.75@4 per 100 lb. being quoted.

Copper Sulphate—Stocks are rather low. Business has been good. Quotations are $10 per 100 lb. for carload lots and $10.25 per 100 lb. for smaller parcels.

Nitrate of Soda—This article continues strong, slow deliveries and high ocean freights helping to keep up prices. Spot is held at $3.15@3.25 per 100 lb., while $3.15 is named for December and January, and $3@3.10 for later deliveries.

Imports and Exports of Raw Materials for chemical manufacture in the United States nine months ended Sept. 30, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Sulphur	15,036	17,869	96,624	16,248
Pyrites	776,871	675,106		159
Chrome ore	56,081	38,649		
Magnesite	92,925	20,144	1,196	414

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total imports of sulphur this year were 287,900 tons.

PETROLEUM

The monthly statement of the "Oil City Derrick" shows new wells completed in November as follows: Pennsylvania grade, 466; Lima-Indiana, 62; Central Ohio, 106; Kentucky, 12; Illinois, 84; Kansas, 206; Oklahoma-Arkansas, 709; Texas Panhandle, 38; North Louisiana, 11; Gulf Coast, 89. This is a total of 1,813 wells, having an aggregate daily production of 174,697 bbl. There were 216 gas wells and 293 dry holes. There were 2,594 new wells being drilled at the close of the month.

Another advance in crude oil has brought Pennsylvania grade up to $2.10 per bbl., an advance of 75c. since last January.

Exports of mineral oils from the United States in October are reported by the Department of Commerce at 204,607,069 gal. For the 10 months ended Oct. 31 the exports were 1,889,556,766 gal. in 1914, and 1,938,230,760 in 1915; an increase of 48,673,994 gal., or 2.6%, this year.

Assessments

Company	Delinqc	Sale	Amt.
Allah Gold, Utah	Dec. 1	Dec. 20	0 0025
Argenta, Ida.	Dec. 26	Jan. 22	0 001
Basalt, Nev.,	Nov. 29	Dec. 20	0 0025
Beaver Butte, Utah	Dec. 11	Jan. 7	0 0025
Buffalo, Con., Utah	Dec. 18	Jan. 8	0 002
Cedar Creek, Ida.	Dec. 30	Jan. 29	0.01
Clear Grit, Ida.	Dec. 14	Jan. 5	0 0015
Columbus Ext., Utah	Dec. 11	Jan. 3	0 02
Confidence, Nev	Dec. 24	Jan. 14	0 10
Cons. Imperial, Nev.	Nov. 30	Dec. 21	0 01
Dry Canon Cons., Utah	Dec. 18	Jan. 7	0 001
E. Hecla Ext., Ida. (post.)		Jan. 11	0 0015
Eureka M & M., Ida.	Nov. 26	Dec. 27	0 001
Federal Ely, Nev.,	Dec. 16	Jan. 17	005
Four Timbers, Wash.	Dec. 24	Jan. 20	0 001
Golden State M & M., Calif.,	Dec. 6	Dec. 28	0 005
Hancock Cons., Mich.	Jan. 3		1 00
Hypotheek, Ida.	Dec. 20	Jan. 20	0 005
Idaho & Los Angeles, Ida.	Nov. 26	Dec. 27	0 005
Jack Waite, Ida.	Nov. 20	Dec. 20	0 01
Laciede, Ida.	Dec. 6	Dec. 27	0 003
Lucky Calumet Cop., Ida.	Dec. 27	Jan. 28	0 005
Lynn Big Six, Nev.,	Nov. 30	Jan. 3	0 005
M & P Gold, Utah	Dec. 13	Jan. 3	0 0025
Murray Copper, Utah	Nov. 30	Jan. 10	0 001
National Copper, Ida.	Nov. 20	Dec. 18	0 01
Nevada-Anaconda, Utah	Dec. 29	Jan. 29	0 002
Nevada-Douglas, Nev.	Nov. 30	Dec. 31	0 10
New Baltic, Mich	Jan. 15		0 50
Nyala Metals, Nev.,	Dec. 17	Jan. 8	0 01
Oreano, Ida.	Dec. 18	Jan. 18	0 001
Phoenix, Mich.	Jan 1		1 00
Rescue Eula, Nev.	Dec. 6	Jan. 10	0 01
Rio Grande Grub Stake, Utah	Dec. 25	Jan 15	0 006
Seg. Belcher & Midas, Nev.	Dec. 12	Jan 6	0 02
Sheba Gold, Utah	Dec. 6	Jan 8	0 05
Sonora M & M., Ida.	Nov. 4	Dec 17	0 003
Sunset Dev., Ida	Dec. 8	Jan 3	0 002
Tintic Standard, Utah	Nov. 29	Dec. 27	0 005
Tonopah Midway, Nev.	Dec. 11	Jan 11	0 01
Uvada, Utah	Nov. 22	Dec. 27	0 02
Utah-Arizona, Ariz.	Dec. 14	Jan. 6	0 004
Victoria, Utah	Dec 28	Jan. 29	0 01
West Toledo, Utah	Dec 16	Jan. 3	0 01

Stock Quotations

Stocks generally declined during the last week with recoveries Monday and Tuesday. Alaska Gold went to a low of 21⅝. Thomas W. Lawson is effervescing today (Dec. 15) with predictions of a "terrific copper boom in January," and the prudent ones will probably shortly take to tall timber.

COLO SPRINGS	Dec. 14
Name of Comp	Bid
Acacia	‡ 02½
Cripple Crk Con.	‡ 0005
C. K & N.	‡ 02
Doctor Jack Pot	09½
Elkton Con	29½
El Paso	75
Findlay	03½
Gold Dollar	‡ 02
Gold Sovereign	06
Golden Cycle	2 00
Isabella	19
Jack Pot	06½
Jerry Johnson	‡ 05
Lexington	‡ 005
Mary McKinney	14
Pharmacist	‡ 006
Portland	1 74½
Raven B. H	03
Vindicator	1 90

SALT LAKE	Dec. 14
Name of Comp	Bid
Beck Tunnel	07½
Black Jack	09
Colorado Mining	08
Crown Point	00½
Daly-Judge	7 50
Emma Cop	20
Gold Chain	50
Grand Central	53
Iron Blossom	1 02
Lower Mammoth	05½
May Day	18
Opohonga	00½
Prince Con.	78
Seven Troughs	01½
Sliking Coal'n	3 37½
Silver King Con.	2 20
Sioux Con.	03½
Uncle Sam	08
Yankee	36

TORONTO	Dec. 14
Bailey	04½
Chambers Ferland	24
Conlagas	4 50
La Rose	65
Peterson Lake	35½
Right of Way	04
Seneca Superior	65
T. & Hudson Bay	21 00
Timiskaming	61½
Trethewey	16
Wettlaufer-Lor	08
Dome Exten	36½
Dome Lake	25
Foley O'Brien	50
Hollinger	‡29 15
Imperial	04½
Jupiter	18½
McIntyre	97
Porcu Crown	90
Preston E. D	06½
Vipond	66
West Dome	17

SAN FRANCISCO	Dec. 14
Alta	10
Andes	08
Best & Belcher	05
Caledonia	04
Challenge Con	04
Chollar	04
Confidence	15
Con. Virginia	19
Gould & Curry	03
Hale & Norcross	03
Jacket-Cr. Pt.	01
Julia	01
Mexican	26
Occidental	75
Ophir	21
Overman	08
Potosi	‡ 02
Savage	07
Sierra Nevada	42
Union Con	65
Utah Con	01
Belmont	4 60
Jim Butler	1 07½
Lone Star	03
Manhamiara	03
Midway	15
Mont.-Tonopah	30
North Star	14
Rescue Eula	07
West End Con	80
Atlanta	21
Blue Bell	03
Booth	36
C O D Con	03
Comb. Frac	05
D'field Daisy	03
Jumbo Extension	1 10
Pitts.-Silver Peak	06
Round Mountain	38
Sandstorm Kendall	06
Silver Pick	07
Central Eureka	05

N. Y. EXCH.	Dec. 14
Name of Comp.	Clg.
Alaska Juneau	10
Am.Sm.&Ref.,com.	99
Am. Sm. & Ref., pf.	110½
Am. Sm. Sec., pf. A	89
Am. Sm. Sec., pf. B	85
Anaconda	86½
Batopilas Min	4
Bethlehem Steel	474
Bethlehem Steel, pf.	150
Chile Cop.	24½
Chino	53½
Colo. Fuel & Iron	52
Crucible Steel	73½
Dome Mines	28½
Federal S. & R., pf.	90
Great Nor., ore., ctf.	48½
Greene Cananea	45½
Guggen. Exp.	77½
Homestake	123
Inspiration Con.	45½
International Nickel	197½
Miami Copper	33½
Nat'l Lead, com.	64
National Lead, pf.	111½
Nev. Consol.	16½
Ontario Min	11½
Quicksilver	4½
Ray Con.	25½
Republic I&S, com.	55½
Republic I&S, pf.	112½
Tennessee Copper	57½
Utah Copper	80½
U. S. Steel, com	86½
U. S. Steel, pf.	116½

N. Y. CURB	Dec. 14
Alta Con	15
Beaver Con	43
Big Four	05
Braden Copper	16½
Buffalo Mines	1.10½
Can Cop Corpn.	2⅛
Cashboy	06½
Cerro de Pasco	35
Con Ariz. Sm.	1½
Con. Coppermines	2
Con. Nev.-Utah	1/16
Dia Black B.	03
Florence	38
Goldfield Con.	1½
Goldfield Merger	16
Howe Sound	4½
Kennecott Cop.	53½
Kerr Lake	4½
Magma	14½
McKinley-Dar-Sa	65
Mines of Am	3½
Mother Lode	28
Nevada Hills	19
New Utah Bingham	4½
Nipissing Mines	8½
Oro	05½
Ray Hercules	31
St. Joseph Lead	14
South Utah	25
Stand'd Oil of N.J.	565
Standard S. L.	1½
Stewart	1 1/16
Success	58
Tonopah	7
Tonopah Ex.	4
Tonopah Merger	57
Tribullion	75
Yukon Gold	2½

LONDON	Dec. 2
Alaska Tre'dwell	£6 12s 6d
Burma Corp.	1 11 3
Cam & Motor	14 3
Camp Bird	0 8 6
El Oro	0 10 6
Esperanza	0 11 0
Mexico Mines	4 5 0
Nechi, pfd.	0 12 6
Oroville	0 14 0
Santa Gert'dis	0 10 6
Tomboy	1 4 0
Tough Oakes	0 13 1½

BOSTON EXCH	Dec. 13
Name of Comp.	Clg.
Adventure	1½
Ahmeek	392½
Alaska Gold M	22½
Algomah	1
Allouez	55
Am. Zinc	63½
Ariz. Com., ctfs.	6
Bonanza	35
Butte-Balaklava	2½
Butte & Superior	70½
Calumet & Ariz.	66½
Calumet & Hecla	525
Centennial	15½
Copper Range	55½
Daly West	3½
East Butte	14½
Franklin	8½
Granby	75½
Hancock	15½
Hedley	28½
Helvetia	40
Indiana	5
Island Crk. com.	48½
Island Crk. pfd.	88½
Isle Royale	25
Keweenaw	2½
Lake	15
La Salle	5½
Mason Valley	1½
Mass	10½
Mayflower	3½
Michigan	1½
Mohawk	83½
New Arcadian	9
North Butte	29½
North Lake	1½
Ojibway	1½
Old Colony	3
Old Dominion	57
Osceola	82
Quincy	82
Santa Fe	3
Shannon	7½
Shattuck-Ariz.	33½
Superior	23½
Superior & Bost.	1½
Tamarack	45
Trinity	9
Tuolumne	33
U. S. Smelting	44½
U. S. Smelt'g, pf.	48½
Utah Apex	3½
Utah Con	11½
Victoria	2
Winona	3½
Wolverine	55
Wyandot	1½

BOSTON CURB	Dec. 13
Bingham Mines	8
Boston Ely	28
Butte & Lon'n Dev.	33
Calaveras	2½
Calumet-Corbin	10
Chief Con	1
Cortez	45
Crown Reserve	65
Davis-Daly	1½
Eagle & Blue Bell	1⅞
First Nat. Cop.	4½
Houghton Copper	2
Iron Cap Cop., pf	6½
Majestic	1½
Mexican Metals	35
Nevada-Douglas	83
New Baltic	2½
New Cornella	1.00
Ohio Copper	23
Osceo	1
Raven Copper	10
Rex Cons	32
Smokey Dev.	15
So. Lake	5½
Tonopah Victor	‡ 35
United Verde Ext	4½
Utah Metal	9½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48 855	28 983	26 553	22.731
February	61 642	57 506	48 477	28 357	26 573	22.753
March	57 870	58 067	50 241	26 669	26 788	23.708
April	59 490	58 519	50 250	27 346	26 958	23.709
May	60 360	58 475	49 915	27 825	26 704	23.570
June	58 990	56 471	49 034	27 199	25 948	23.267
July	58 721	54 678	47 519	27 074	25 219	22.597
August	59.293	54 344	47 163	27 335	25 979	22.780
September	60 640	53 290	48 680	27 986	24 260	23.591
October	60.793	50 654	49 385	28 083	23 199	23 925
November	58 995	49 082	51 714	27 263	22 703	25 094
December	57 760	49 375		26 720	22 900	
Year	59.791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	17.686	‡	72.601	‡	88.000
November	11.739	18.627	53.227	77.744	*	93.273
December	12.801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47 884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33.080	‡	151.554
November	33.304	39.224	139.391	167.670
December	33.601		147.102	
Av. year	34.301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4 111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3 937	3.718	19 606	19,122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	26.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3 384	4.499	‡	23.994
November	3.683	5.155	3.585	5.078	18.500	26.278
December	3.800		3.662		19.097	
Year	3.862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5 377	8.436	5.228	8.255	21.413	39.819
March	5 250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5 074	14.781	4.924	14.610	21.393	68.100
June	5 000	21.208	4.850	21.038	21.345	100.614
July	4 920	19.020	4.767	18.856	21.568	97.250
August	5 568	12.781	5 418	12.611	‡	67.786
September	5 380	13.440	5.230	13.270	‡	67.841
October	4 909	12.800	4.750	12.596	‡	66.536
November	5.112	15 962	4.962	15.792	25.016	88.409
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14 94	$14.59	$13 23	$13.45	$13.99	$13.90
February	15.06	14.55	14 12	13.45	14.08	13.90
March	15 07	14.55	13 91	13.45	14.10	13.95
April	14.90	14.55	13 90	13.45	14 13	13.95
May	14.90	14.61	13 90	13.60	14 27	13.83
June	14 90	14.70	13.90	13.67	14.06	13.77
July	14.90	14.94	13 90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14 90	16.86	13 90	15.95	14.03	15.70
October	14.84	16 95	13 75	15.96	13.97	15.80
November	14.59	18.26	13 43	17.30	13.83	17.20
December	14 70		13.45		13.83	
Year	$14 88		$13 78		$14.01	

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Gas-Fired Reverberatory Furnace at Sulitjelma, Norway

By C. Offerhaus*

SYNOPSIS—At Sulitjelma, Norway, the concentrates from the Elmore vacuum oil-flotation process are roasted in an 8-hearth Wedge furnace and smelted in a gas-fired reverberatory furnace having a regenerator for preheating the combustion air. A strongly basic slag is made; magnesite brick and water-cooling pipes are used in the back part of the furnace.

The tailings of the wet concentrator at Sulitjelma, Norway, containing 1% to 1.6% Cu, have been successfully treated for a number of years by the Elmore vacuum oil-flotation process. Over 80% of the copper content of the mill tailings is saved in the Elmore concentrates, which contain 5.8% to 6.8% Cu, the Elmore tailings carrying from 0.13% to 0.25% Cu. The oil consumption is about 2 liters per 1.2 tons of mill tailings. Addition of acid is not made here, as it proved unnecessary. The following are average figures covering six months' operation of the Elmore plant: Wet-concentrator tailings, 1.11% Cu; Elmore tailings, 0.23% Cu; Elmore concentrates, 6.78% Cu. An average analysis of the Elmore concentrates is as follows: Cu, 6.5%; S, 35.3; Fe, 36.8; SiO_2, 12.7; Al_2O_3, 4.83; CaO, trace; MgO, 0.72%. The oil sticks to the concentrates, and this has a marked hindering influence on the further treatment of this material.

Formerly these concentrates were made into briquettes, first with an addition of about 4% of lime, and later with 0.2% of NaCl, added in solution. They were then dried and together with coarse ore were smelted in Knudsen converters. However, the concentrates accumulated and in the autumn of 1911 the Sulitjelma Aktiebolaget decided to build a plant consisting of a Wedge roasting furnace and a reverberatory matting furnace to treat 70 to 90 tons of concentrates daily. As is well known, the coarse ore is smelted at Sulitjelma by the Knudsen process.[1] The melted contents of a converter after a blow are poured into a small gas-fired reverberatory furnace—regenerative system—that serves only as a settler to separate the slag and matte; the slag containing 2.5% Cu is lowered to 0.5% to 0.6% Cu by this treatment. Most of the time, from lack of coarse ore, only one of the 15-ton converters is in operation, and in this case it does not pay to run the gas-fired settler. The contents of the converter are poured on the floor, broken up as soon as cold and smelted once more in a small water-jacketed furnace having a diameter of 1 m. at the tuyeres. The reverberatory furnace of the new plant should serve also as a settler for the molten contents of the converter, thereby eliminating the resmelting. The new plant was finished during the summer of 1912 and has been in operation since that time.

SULITJELMA SMELTING PLANT IN NORTHERN NORWAY

Oily Concentrates Difficult to Roast

The roasting plant consists of one large modern Wedge roaster with 8 hearths (the drying top hearth included)—a total hearth area of 175 sq.m.—water-cooled shaft and rabble arms. This furnace is so well known that a detailed description is not necessary. It was guaranteed to roast 80 tons of Elmore concentrates containing about 35% S down to 8% S in 24 hr. However, this capacity was never reached. The highest reached, after doubling the number of revolutions, was 60 tons of Elmore concentrates, including 10% of ground quartz,

*Metallurgical engineer, Siemens Copper Co., Artvin, Caucasus, Russia, or care of J. van't Hof, Sloterdyk, via Amsterdam, Holland.

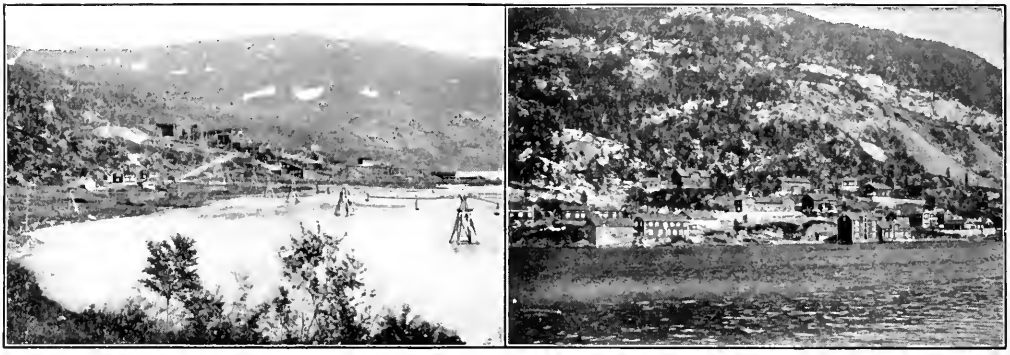
[1]Chem. Ztg., 1909, No. 38; "The Mineral Industry," Vol. XVII, p. 315.

and the average daily treatment during nine months was 47 tons, including 10% of quartz, which was roasted down from 30.72% to 8.12% S. These figures tend to show that Elmore concentrates do not roast easily, and the explanation therefor is the oil film which covers each grain of ore, making it difficult to ignite. It might be mentioned in passing that it is also difficult to sinter this material, probably for the same reason, and pot roasting does not give satisfactory results at all. The Dwight-Lloyd machine showed a smaller capacity than was expected and gave about 15% fines, which had to be recharged.

The wet Elmore concentrates are weighed, then fed into a rotary drier, through which the hot gases of the roasting furnace pass in the opposite direction. The concentrates are discharged into the buckets of an elevator, which delivers them to the upper drying hearth of the Wedge roaster. The calcines drop into two stone bunkers situated under the furnace floor and are discharged through gates into steel cars having a capacity of about ½ ton of roasted material. The cars are taken up by a lift to the level of the reverberatory-furnace charging floor and thence trammed to the charging hoppers.

The reverberatory furnace was in principle built after the type of the Anaconda furnaces, but recovery of the waste heat of the furnace gases in generating steam was not desired, as the company has very cheap water power (1 hp.-yr. costs at Sulitjelma, interest on the initial cost of the power plant included, 15 kr., about $1.20) and does not have any use for steam. The heat of waste gases is utilized in preheating the combustion air. The new reverberatory furnace is gas-fired, of the regenerative type, with Weardale burners; overall, it is 24 m. long and 6 m. wide. An accompanying drawing shows the reverberatory plant, with gas producers, furnace and regenerator in longitudinal and cross sections and presents the main dimensions of the furnace. The gas producers *A* are of the Schmidt & Desgraz type, with circular nonmovable grate, water-sealed; the diameter of the shaft is 2½ m. They are worked with pressure air from the fan *B* and steam from a small boiler *C*. These producers can gasify 8 to 10 tons of English coal (Hamilton double nut) and give, if not forced, a good hot gas, low in carbonic acid.

The gases of the three producers come together in a main flue *D* and are divided by both gas valves *E* over the roof and back-wall tuyeres. The combustion air comes from a low-pressure ventilator *F* and is divided over the regenerator and the double roof, as shown in the drawing. Part of the air is preheated in the regenerator, passing through vertical tubes of refractory material built in groups of seven and going back through the channel *G* to the back part of the furnace. Another part of the combustion air is preheated in the double walls of the channel connecting the furnace with the regenerator, and also in the double roof of the furnace. By means of two sliding valves *H* it is possible to make a connection between the preheated air in the regenerator and that of the double roof. The combustion gases pass to the front of the furnace, ascend, and then go down through the downtake and the submerged channel *I* to the regenerator. At *J* there are dampers which divide the combustion gases over the proper regenerator and the direct channel *K*. In the regenerator the gases pass on the outside of the tubes. At *L* the combustion gases come together and go to the chimney *M* (artificial-suction arrangement). The producer-gas channels and regenerator are built of "chamotte" brick; those parts of the furnace exposed to high temperatures, for example, side walls and roof, are of silica brick. Silica bricks from Höganäs, Sweden, have given full satisfaction. They are very refractory, do not expand much, are straight and can be cut well. The upper roof is built of third-quality chamotte brick, which do not cost any more than red brick in Sulitjelma. The upper roof is, as will be seen by the drawing, independent of the lower roof, which construction proved satisfactory. The crossbeams in the upper roof bent somewhat from the heat, and in cases of wide furnaces the I-beams should be connected with second ones laid over the top, which will not suffer from the heat, as they would be air-cooled. A larger I-beam would answer the same purpose.



TWO VIEWS OF SULITJELMA COMPANY'S PROPERTIES IN NORTHERN NORWAY

The view at the right shows the gravity concentrator and the Elmore vacuum oil-flotation plant at Sandtnes. At the left, miscellaneous company buildings at Furuland

Basic Lining and Water Cooling Employed to Resist Basic Slag in Hottest Part of Furnace

As stated before, the Elmore concentrates contain an average of 12.7% SiO_2. The company does not possess a siliceous material that contains copper, and quartz flux must be brought from a long distance. Therefore

it is necessary to make a slag that is low in silica and high in iron, some slags being as low as 28% and 30% SiO_2. The back and side walls of the furnace up to the fourth door were built of magnesite brick to the level of the bath; as this material does not resist a strongly basic slag at high temperature, the magnesite lining up to the fourth door is water-cooled by a series of pipes, laid in the brickwork.

A detailed drawing shows the cooling pipes assembled, and the general plan of their position in the furnace. The pipes are seamless tubes with an inside diameter of 56 mm., the thickness of the walls being 10 mm. The cast-iron covers consist of two pieces with a planed channel in which the tube fits tightly. They serve to increase the cooling surface, to facilitate the laying of the brick and to protect the tubes. This construction is better and more convenient than iron cast around the pipes, as is generally done.

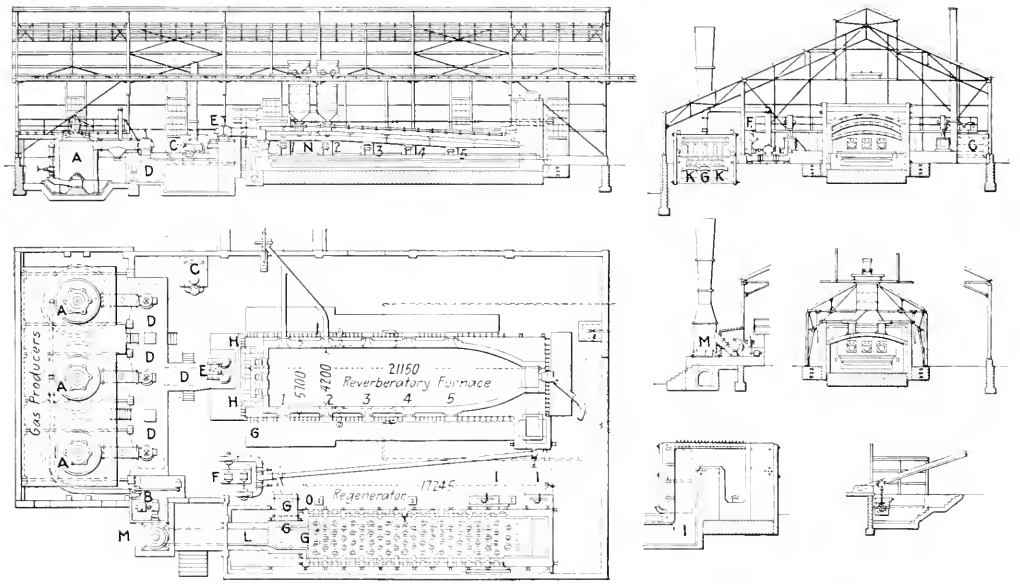
A layer about 300 mm. in thickness, consisting of six parts of ground magnesite brick (5 mm.) and one part of granulated slag, both by volume, is used in the back part of the hearth. This mixture is put in slightly moist and tamped with hot iron tamping bars. This bottom has given satisfaction. The hearth is not attacked by the bath of matte. However, a charge that is being dropped may not spread over the surface of the bath, but sink to the bottom.

The writer therefore recommends that at least the back of the hearth be lined with magnesite, when working with a strongly basic slag. The front of the furnace, the hearth and the side walls, up to the fourth door, may be built of any kind of refractory material, as the slag of a temperature that exists here will hardly attack the brickwork under any normal conditions of operation.

The charging hoppers through the roof of the furnace are iron castings and are lined with magnesite brick. The silica brick near the charging holes are eaten away by the slag formed by dust that strikes the walls when dropping a charge. For this reason it is considered advisable to transfer the charging hoppers to the crown of the arch. The tapholes are under the second and third doors from the back.

The regenerator is of the tube type, with vertical tubes of chamotte; it is so built that it cannot become stopped up, and this was only possible at the expense of its efficiency and dense construction. The regenerator also serves as a dust chamber and is provided with doors on both sides for removal of the flue dust. A dense regenerator with large surface to interchange the heat could not be built in this case, as the narrow passages would soon become clogged with flue dust.

The three gas producers gasify 5 tons of coal each in 24 hr. As previously stated, one producer is able to gasify 8 to 10 tons of English coal. Therefore it is possible to run the furnace with two producers, having one in reserve. However, it is preferred to run them all, as it is easier to make a gas of good quality if not forced too much. Under these conditions the producer gas contains 2% to 4% CO_2, and an average temperature of 500° C. at the furnace valves *E*. The temperature of the preheated air from the regenerator taken at *G* is 500° to 550° C., and that of the air preheated in the double roof at *N* is 420° C. The furnace temperature taken at the first door from the back is about 1,500° C., at the fifth door 1,275° to 1,300° C. and at the skimming door 1,200° C. The combustion gases enter the regenerator with a temperature of 1,000° to 1,100° taken at damper *J* and leave at about 390° C.



REVERBERATORY SMELTING PLANT OF SULITJELMA AKTIEBOLAGET IN NORTHERN NORWAY

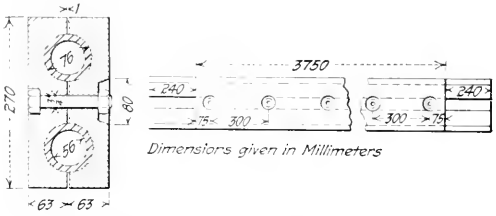
The reverberatory furnace is fired with gas from Schmidt & Desgraz producers and the waste heat of the furnace gases is utilized to preheat the combustion air. The back and side walls of the furnace are lined with magnesite brick up to the level of the bath and are further protected by water cooling

The loss of heat caused by the water cooling of the fire bridge and side walls is about 2,500 Cal. per min., corresponding with about 3% of the coal consumption.

The charging of the furnace is done below with lever arrangement. The chamotte plate which covers the charging hole is pushed back, the sliding valve of the hopper is opened and the hot charge drops into the furnace. Two charges of 1½ ton each are alternately charged from two hoppers, and as soon as the 1-ton charge is smelted, the next one follows. Attention may be called to the fact that the roasting furnace does not keep pace with the smelting furnace, and the latter is always waiting for its charge.

Composition of the Sulitjelma Slag

As mentioned before, conditions at Sulitjelma make it necessary to make a slag as basic as possible. The average composition of a normal reverberatory-furnace slag is as follows: SiO_2, 32.5%; FeO, 51.5; Al_2O_3, 10.8; CaO, 1.1; MgO, 2.1; S, 2; Cu, 0.5%. The average SiO_2 and Cu covering a period of nine months was 32.6% SiO_2 and 0.55% Cu, the matte averaging 36.3% Cu. The copper content of the slag goes down occasionally to 0.45% Cu and lower. The high average copper content of the slag, considering the grade of matte,



ARRANGEMENT OF WATER PIPES FOR COOLING REVERBERATORY-FURNACE WALLS

is due to its high specific gravity and also to the fact that sometimes a thick slag with a high formation temperature is made, which tends to keep the matte suspended. The formation of this thick slag is caused by the fluctuating sulphur contents of the charge, which can hardly be avoided if running only one roasting furnace. If the roasted ore contains a small amount of sulphur, the constant amount of silica flux is not sufficient to make a slag of the desired composition. A matte rich in copper and a slag low in silica and high in iron are formed—the so-called thick slag, which forms a third layer between normal slag and matte. The following is an analysis of such a slag: SiO_2 16.1%; FeO, 50.6; Fe_2O_3, 16.2; Al_2O_3, 10.1; CaO, 0.70; S, 1.5; Cu, 4%.

The reverberatory furnace is skimmed once every eight hours. The clay wall built in the slag door is partly cut away, and the slag flows to a cast-iron settling pot through a cast-iron launder bent at an angle of 90° and leading to an opening in the floor. The first straight piece of this launder is provided with a rectangular hole, through which the slag drops into a stream of granulating water from a 6-in. pipe slightly flattened at the end. The granulated slag is then carried to the sea through a launder built of masonry and lined on the bottom with old crusher jaw plates. The hole in the launder lets just as much slag through as can be taken care of by the water, and if for any reason there is an excess of slag that cannot be stopped, it flows through the bent launder to the opening in the floor at the side of the granulating launder. As a safeguard in case of explosions or stopping up of the granulating launder, which runs partly underground, a brick is cut to fit the opening in the slag launder. This can be readily placed or removed as desired.

Frozen Tapholes Opened by Oxygen Method

Matte is tapped as wanted by the converter plant, or if too much accumulates in the furnace it is tapped, through sheet-iron launders lined with brick, into a 2-ton ladle suspended by means of a carriage on a sloping rail; the ladle is pulled to the old converter building and poured at once into a small converter. If by carelessness of the furnacemen the taphole freezes so that a bar cannot be driven, it is not drilled as usual, but opened in the following manner:

An iron tube 3 or 4 m. in length, with an inside diameter of about 10 mm. and walls of 3 mm. thickness, is connected at one end, by means of a rubber pressure tube, to an oxygen flask. The other end is heated to redness by inserting it in the furnace door. The red-hot end is then inserted in the tapping hole, the reduction valve of the oxygen flask opened and oxygen introduced at a pressure of about 6 atmospheres. By the rapid burning of the iron tube in oxygen, there is generated so much heat that the taphole is burned through in a short time. This method is of especial value if a tapping bar has been broken off in the hole, and it is much quicker than drilling—even with a machine drill.

It is an advantage under the present conditions at Sulitjelma to make a matte in the reverberatory of not too high a concentration; for example, about 35% Cu. In doing so less strain is put on the roasting furnace, which is able to handle more concentrates. The grade of the matte is increased from time to time to 40% or 45% by the molten contents of the Knudsen converters (about 50 tons of matte and slag daily), which are dumped into the reverberatory furnace. The matte made in the Knudsen converters contains 50% to 55% Cu and sometimes more—if crusts are formed in the converter and it becomes necessary to run the charge longer than usual in order to melt the crusts down. The converters have a basic or neutral lining, so converting a 35% matte has no disadvantage. The Knudsen converters at Sulitjelma have been basic-lined for over seven years, and the ordinary small converters of 1 and 1½ ton capacity, for several years. However, only the bottoms of the small converters are lined with magnesite brick, the walls being lined with ordinary neutral refractory brick.

The average charge of the roasting furnace during a long period was 47 tons of concentrates, corresponding to 40 tons of calcines. As it is not possible to give the reverberatory furnace all the charge it can handle, it has, of course, a bad effect on the amount of coal used. With the same amount of coal and a hot charge, it is possible to smelt 70 tons of ore, and in this case the coal consumption would be 23%.

The back and side walls of the hottest part of the furnace need repairing every four weeks. Matte is accumulated in the furnace, and as much of the slag as possible is tapped out. Then almost all of the matte is

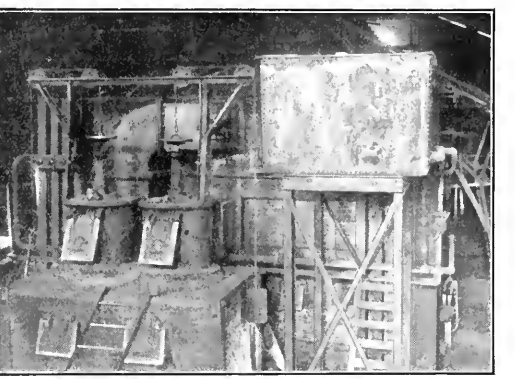
also tapped out. The gas is shut off, and the magnesite mixture already mentioned is thrown against the walls of the almost dry furnace. Advantage is taken of this opportunity to burn the soot out of the gas flues. The gas flues must be cleaned every fortnight, and this means loss of smelting time, as the gas must be cut off for about five hours and the furnace loses a great deal of its heat. The gasways in the furnace itself must be cleaned once a week. They can be cleaned one at a time without shutting off the gas.

The flue dust forms a loose deposit on and between the tubes of the regenerator—most of it in the front part near the damper—and must be cleaned out every two or three weeks. No trouble is experienced in taking out the dust from the doors at each side of the regenerator, this being done without interfering with the running of the furnace.

Before closing I should like to make a few general remarks concerning the heating of reverberatory furnaces for smelting concentrates. The chief duty of the reverberatory furnace is to melt down a charge prepared beforehand. It is confirmed by experience that the number of charges that can be made in a certain period of time will rapidly increase with the temperature of the furnace. It follows that such a furnace in which it will be possible to attain the highest temperature will work the most economically. The combustion gases must leave the furnace with temperatures no less than 1,100° to 1,200° C. Up to the present the most efficient way to recover the heat of these gases is in generating steam, and where it is profitable to use steam it is advisable to heat the furnace with semi-gas, oil or coal dust. Semi-gas and oil have been used a long time and are known to work satisfactorily. Coal dust up to the present time is only used in a few places and has been reported a success. It is certainly suitable for reverberatory furnaces, and probably even better than semi-gas. Gas firing can be economical only when there is no use for steam.

In case of gas firing, the ordinary regenerators to preheat the air, built with large surfaces to interchange the heat and of dense construction, cannot be used, as they would soon become stopped up with flue dust. The regenerators must serve also as dust chambers. Regenerative furnaces with large and long chambers without filling material have been used and are reported to have given satisfaction. However, the first cost is considerable, and they occupy a great deal of space.

TAPPING MATTE FROM GAS-FIRED FURNACE



GAS VALVES AT BACK OF SULITJELMA FURNACE

Mexican Mining Taxes

Some of the larger mining operators in Mexico recently transmitted to General Carranza a petition with regard to the excessive taxation that is imposed upon the Mexican mining industry by his recent decrees covering the yearly pertenencia tax and the tax on metal exports. The original English version of this petition, which was translated into Spanish for delivery to General Carranza is as follows:

To His Excellency, Venustiano Carranza
Chief Executive of the Republic of Mexico:

Your petitioners have the honor most respectfully to lay before you the following considerations:

1. Your petitioners represent many of the more important American and foreign-owned mining undertakings in Mexico, both the larger and the smaller. Their interests, however, are identical with the interests of those mining undertakings which are Mexican-owned, and their present plea is in behalf of the mining industry in Mexico as a whole, whether the ownership is native or foreign. They seek no privileges, no exemptions, no preferences. The treatment they hope for, and here petition for, is such treatment only as shall be applicable to all persons or companies alike, who are similarly situated, large and small, Mexican and non-Mexican.

2. The mineral industry in Mexico at the present time is virtually dead. Not more than 3% of the mines are operating. Mines are flooded and caved in. Plants are damaged and destroyed. Machinery and equipment are injured or wrecked. Materials and supplies are exhausted. Operating forces are scattered and demoralized. Necessary means of transportation are either wholly lacking or obtainable with the greatest difficulty and in insufficient amount. This vital need will not adequately be supplied until after the lapse of years. To resurrect the industry will be nearly equivalent to establishing it anew.

3. The investments already made in the mineral industry of Mexico run into many millions of dollars. Again to place the industry on a successful operating and producing basis, these investments must be greatly increased, and very large amounts of additional capital must be expended. Further, all expenses of operation will be enormously increased, particularly in respect to the matter of securing facilities of transportation and of procuring necessary materials and supplies.

4. To the extraordinary costs and disbursements thus involved in a restoration of the industry must be added the very heavy losses, both direct and indirect, which those concerned in the industry have had to bear throughout the

revolutionary period, now in its fifth year. Aside from the wiping out of profits, these losses have resulted from damages to mills, smelteries and surface equipment, caused by revolutionary forces as well as by lawless bands, from the flooding of mines with water through the enforced stoppage of pumping operations because of the lack of fuel and otherwise, from the seizure of animals, supplies, provisions and many other goods, and from the maintenance of unprofitable operations, and the direct importations of food and provisions in order to supply the necessities of life to employes or their families.

5. These burdens are necessary and unavoidable, the hard facts of the situation being as they are; and your petitioners realize that nothing can lighten the load of expense which must inevitably be borne, if they are to save the investments they have already made and if the future, however remote, is to yield them a return. But there is an added burden threatened, which is neither necessary nor unavoidable, nor the inevitable consequence of existing conditions, and which may easily prevent a revival of the industry. This is a burden which it is within your power either to lift or to impose. It is the burden of greatly increased taxes upon an industry already taxed in heavy measure; the burden, in other words, imposed by your Decree of Mar. 1, 1915, as modified by your Decree of Aug. 31, 1915.

6. In asking you to remove this added burden, your petitioners would have you consider not only the relief thereby afforded to private interests, but the public benefits which must accrue to the Mexican people living in the numerous communities which are dependent upon the mining industry for a livelihood or engaged in the many commercial pursuits to which the mining industry gives rise, through the rebuilding of a great industry now prostrate and helpless. Interests of necessity obliged, if they proceed, to expend vast sums of money in a country ravaged by years of civil war, furnishing employment and means of subsistence to thousands of persons to whom no other occupation is open, creating wealth and prosperity to the certain benefit of the state and the body politic, in localities where there is now only poverty and distress, requiring the rehabilitation of the railroads and thus furthering the welfare of the whole people, increasing the imports and exports of the country, and generally promoting the commerce of the land, both domestic and foreign—and doing all this at their own risk and cost and in the face of enormous difficulties—should not, it is respectfully submitted, be discouraged, and not only discouraged, but in many cases dissuaded from remaining in the field, by the imposition of exorbitant taxes.

7. Your petitioners submit and earnestly maintain that the taxes laid upon the mineral industry of Mexico under the Constitutional laws of the Republic, prior to the issuance of your decree above mentioned, are already so high that to raise them would be unjust and harmful to the industry. Such taxes, however, have been fixed by law, and your petitioners accept them as among the necessary charges inevitably to be met. They do not seek to escape them. They are prepared to pay them, as they have paid them heretofore. And they make no protest against paying them in gold. They readily concede that the Mexican government is entitled to receive its lawful due in full, and without deduction by reason of depreciated currency or otherwise. Their protest is directed solely against the multiplication of such taxes, especially at a time when the industry is struggling for its life and before it can be known whether it is to survive or perish.

8. The established pertenencia tax of 6 pesos per pertenencia up to 25, and 3 pesos per pertenencia on all over 25, is an equitable tax, considered in relation to the subject matter; and as one item in a series or group of taxes to which mine-owners are subjected, and since it is to be paid in gold, it should be highly satisfactory to the state as a source of revenue. At the same time it is not unduly burdensome on the taxpayer. At least the taxpayer has adjusted himself to it and is prepared to meet it. Moreover, it is graded in accordance with sound economic policy, inasmuch as the rate is reduced one-half on all pertenencias over the minimum of 25. Under your decree this policy is reversed, and the rate is progressively and rapidly raised as the number of pertenencias increases above the lower minimum of 10. In addition, the tax per pertenencia for those included in the reduced minimum is doubled. To enforce the new taxes decreed would be oppressive and, it is feared, in many cases confiscatory. In the development of mining enterprises along the best lines, the control of large areas is imperative. But the development must proceed gradually. Both the initial and the ensuing costs are great. The larger part of the territory must remain unworked for years, awaiting the growth of the enterprise. But with the first establishment of the enterprise, new industries, new communities and new source of wealth are created. In the meantime the mine owner must carry the pertenencia tax, yearly, on all his claims, developed or undeveloped, productive or nonproductive, operated or not operated. Furthermore, to increase these taxes would be to tax mineral holdings out of all proportion to the taxation on other lands and real estate in Mexico. It would probably discourage small companies and individuals from holding property which might be worked some day when affiairs have been reëstablished on a normal basis in Mexico. Property so released would fail to bring revenue to the Mexican government unless large and wealthy corporations could afford to redenounce them and hold them until normal conditions were again established. The result would be to discourage the companies or individuals with limited resources. It should be remembered, moreover, that the areas held in reserve, on which the tax is nevertheless regularly to be paid, in practically all cases are of low-grade character, unsuited for ordinary development and unworkable except in connection with operations on a large scale, conducted on a systematic plan involving much time and steady outlay.

9. The established export taxes on gold and silver in bullion of 2½% and on gold and silver ores of 3½% are neither light nor easy to bear, but neither are they unreasonable. They are, however, it is confidently believed, as much as the metal industry can stand, in connection with other taxes, with a view to the yield of the maximum revenue to the state from this source. The gross value of metals out of which such taxes must be taken for a long time to come must also be charged with greatly increased cost of production, to say nothing of the added interest on new capital invested. Under your decree the export tax on silver and gold would amount to approximately 6½% when contained in bullion and approximately 8¼% when contained in ores. It is firmly believed that these increased taxes would prove so excessive and so burdensome, particularly on low-grade mines, as to make it inadvisable to attempt operation under them with any hope of profit. It is believed that the new taxes on copper and lead would result in a large curtailment of production, because nearly all of the old high-grade lead-producing mines in Mexico have been exhausted and the present source of lead in Mexico is the low-grade lead mine developed and equipped at a large expense and operated upon a particularly low margin of profit. The character of the copper production in Mexico is much the same as that of the lead. Mexico has but a few copper mines. These are very low-grade and in the aggregate have yielded but a small return of profit to their owners. Clearly, it is to the best interests of the Republic of Mexico, as well as to the mineral industry at large, for the government to encourage and assist the lead and copper producers as much as possible in order to stimulate prospecting and developing of mines of this character. The basis of the entire smelting industry rests upon the lead and copper production of the country. An adequate supply of these two metals insures the development of all classes of mines and thereby brings correspondingly increased revenue to the government. The imposition of such heavy taxes as have been proposed on these two metals will result in the strangulation of a large portion of the mineral industry of Mexico.

10. Finally it is submitted, that if the new and increased taxes here complained of are removed and if some assurance is given that federal, state and municipal taxes on mineral property and mineral production and operation will be allowed to rest on the basis of the laws existing from 1905 to 1910 and if the coöperation of the government can be had in facilitating the importation and reasonable dispatch in transportation and delivery of coal, coke and fuel oil to the various mines and plants, and of dynamite, cyanide and other materials most urgently required by the industry, without additional import taxation, your petitioners and all those in a like situation with reference to Mexican mining operations will be given that encouragement which they sorely need in assuming the heavy undertaking before them of reviving the mineral industry in Mexico; and they confidently predict that such encouragement will result in the earliest possible restoration of the industry in all its branches, with steadily increasing revenue and prestige to the Mexican government; otherwise, they must be greatly discouraged and seriously hindered, if not altogether checked, in going forward with their undertakings.

For the foregoing reasons your petitioners most earnestly appeal to you to abrogate the Decrees of Mar. 1, 1915, and Aug. 31, 1915.

This is one of several strong memoranda which have been drawn by organizations of the Mexican mining people in the United States and in Mexico in an endeavor to obtain modification of the excessive taxation that has been heaped on the mining industry.

Development of Dredging in Yukon Territory*

SYNOPSIS—Dredging in the Yukon began on Lewes River in 1899 with 3½-cu.ft. buckets; today dredges with 16-cu.ft. buckets are operating in the Klondike River valley. Steam thawing of frozen ground was one of the important developments in the Northern dredging field, having greatly extended the dredgeable area and reduced the wear on the dredges. Conditions are extremely variable and heavy equipment is the rule. Operating costs of the Yukon Gold Co. for the last six years are given.

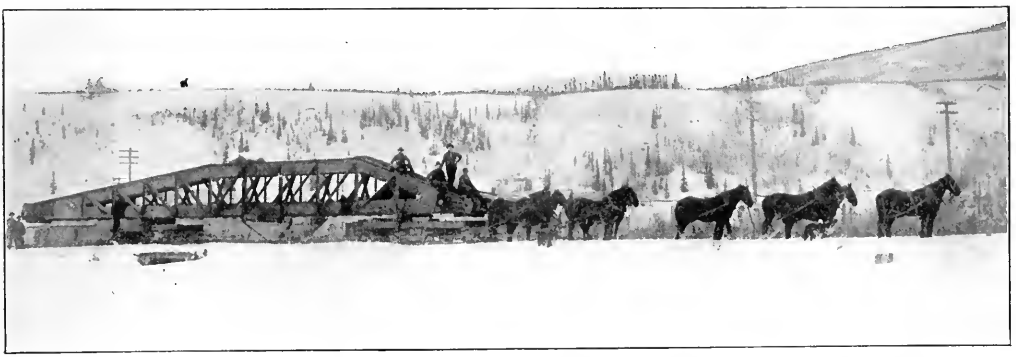
The first dredge in the Yukon was a small, 3¼-cu.ft. bucket, New Zealand-type dredge built on Lewes River in 1899. In 1901 it was moved and rebuilt on No. 12 Below on Bonanza Creek, and in 1903 moved to the Discovery group. This dredge, which was practically obsolete by 1905 and entirely unsuited for the work, proved the practicability of dredging on the Klondike creeks. The next dredge to be built was the Canadian-Klondyke No. 1, a 7-cu.ft. dredge which began operation in August, 1905, in the valley of the Klondike River, opposite the mouth of Bear Creek. These two dredges may be said to have shown the way to the large development which followed.[1]

The first three dredges of the Yukon Gold Co. were built on Bonanza Creek in 1906 and began operation early in 1907. These were followed in 1907 and 1908 by four 7-cu.ft. bucket dredges, two on Bonanza and two on Hunker Creek. In 1910 the Canadian-Klondyke Mining Co. built the first of its 16-cu.ft. dredges, which began operation in November of that year. In 1911 the Yukon Gold Co. built two all-steel dredges, each having 7-cu.ft. buckets. The Canadian-Klondyke company in 1913 built Nos. 3 and 4, both 16-cu.ft. machines. This comprises the dredging equipment now in use in the Klondike field. In 1907 two Risdon dredges were built on Walker's Fork, one of which was later moved to Miller Creek, where it is now operating, and a dredge was installed on the Bonanza Basin which has since been abandoned.

Electric Power Essential to Economical Operation

In order to operate successfully, and within the limit of expense, electric power was a necessary adjunct to the dredging. In 1906 the Yukon Gold Co. installed a 2,000-kw. hydro-electric plant at the junction of the Twelve Mile and Little Twelve Mile Rivers, 32 mi. from Dawson. The Granville Power Co. followed four years later with a plant on the north fork of the Klondike River. The Canadian-Klondyke company takes its power from this plant.

In terms of investment, the Yukon Gold Co.'s first seven dredges cost $1,000,000. The power plant cost $550,000 and the two all-steel dredges $500,000 more, making a total investment in dredging equipment alone of over $2,000,000. The three large dredges of the Canadian-Klondyke company are estimated to have cost $475,000 each. The power plant of the Granville Power Co. cost over $1,000,000. These figures do not take into account investment in shops, buildings, and accessory plant.



HAULING THE DIGGING LADDER OF DREDGE NO. 5 OVER A WINTER ROAD IN THE YUKON

In order to make a success of a dredging enterprise so far from the source of supply, the equipment must be complete and of the best possible kind. A single breakdown or loss of a part which could not be replaced might mean the loss of a season's work, so that the supply of extra parts and the shop equipment for repairs is much greater than ordinarily required.

Generally speaking, the dredging equipment does not differ greatly from the equipment in use in California. The machines follow the lines of the dredges developed in California, but, in the building, were increased in strength of parts over anything of the size previously built. The service is extremely severe and the season short, so that all digging and working parts subjected to strain are reinforced and made heavier than is usual in dredging practice. The best of material is used; all important shafting is of nickel steel, the buckets are of chrome-nickel

*A paper presented by O. B. Perry at the seventeenth annual meeting of the Canadian Mining Institute, Toronto, Ont. This will be printed in the annual volume, prior publication being granted the "Journal" by courtesy of the Institute Council.

[1]T. A. Rickard, "Min. and Sci. Press," Aug. 12, 1908.

steel or of manganese steel; the pins are of high-carbon steel, nickel steel or chrome-nickel. The tendency has been to increase continually the strength, and, therefore, the weight of the principal parts. The last two dredges built by the Yukon Gold Co. of all-steel construction are 20% heavier than anything of the size in use at present.

Two Classes of Gravels Dredged

Dredging in the Yukon is now being conducted on two classes of deposits, river valley and creek beds. The deposit in the valley of the Klondike River is, where thawed, well adapted for dredging. The material is free wash gravel, rounded and clean, averaging from 30 to 40 ft. in depth. The bedrock is sufficiently decomposed to be dug with ease. The top burden, in the thawed portion of the deposit, has been largely removed by stream action and presents little or no difficulty to dredging.

The creek deposits present altogether different characteristics. The deposits are shallow, for the most part ranging about 18 to 20 ft. to bedrock. The gravel is angular and contains little sand. The gold is confined almost entirely to bedrock. The creek gravels are overlain by a deposit known locally as "muck," which is made up of organic matter, fine sand and water, almost invariably frozen, and, where undisturbed, covered with a blanket of moss. The depth of the covering of muck is from 4 to 8 ft., with an average of about 6 ft. In the dredging operation on the creeks it is necessary to take up from 4 to 6 ft. of the bedrock itself, which is a sericite schist and usually massive and blocky in character.

Operations in the Yukon district are subject to difficulties which are not met elsewhere, except in Alaska. These may be described under two heads: (1) Climatic; (2) character of deposits.

The extreme cold of the Northern winter limits the operation to an open season of about six months. Dredging cannot be begun until there is sufficient thaw to produce water for flotation and to clear the ponds of the winter ice, which forms to a depth of from 5 to 7 ft. Both the start and finish of the seasonal operation are hindered by cold. All moving parts, such as the tailings conveyor, must be housed in and warmed by steam coils. Also, steam is used freely to keep the ladder and bucket line clear and to keep the gold tables in good condition. The dredging operation is terminated when the creeks freeze to such an extent that water for flotation is no longer available.

The creek deposits present many obstacles to dredging. In the first place, the deposits are shallow, which causes many moves of the dredge, both "stepping ahead," as the operation is called, and side moves across the pond. The shallow ground also increases the labor for outside work, such as setting "deadmen," removing stumps, etc. The muck itself is not difficult to handle, if thawed, particularly if sandy in character, but it often carries, buried in it, stumps, roots and other material, which tend to choke the feed hoppers and cause delays. Digging the bedrock in order to recover the gold is the most difficult part of the process. It is slow, hard work that entails heavy wear on the entire machine and causes continual replacement of all digging parts. The greatest obstacle to dredging is the frozen condition of a large percentage of the creek gravels, which condition must be removed before dredging operations can be successfully conducted.

The short season during which it is possible to operate has led to many departures from usual methods. The determined effort is to get all that is possible out of the dredges in the short time allowed, and the result is a remarkably high efficiency for the time the machines are operated. For example, last season the dredges of the Yukon Gold Co. averaged 87.2% of the possible running time, as compared to a fair California average of 78%. Each season has shown a gain in yardage per dredge-hour over the season previous, until the present rate is higher in most cases than that of dredges of the same size in California, where conditions are much more favorable.

NO. 7 DREDGE ON UPPER HUNKER CREEK

NO. 3 DREDGE ON BONANZA CREEK

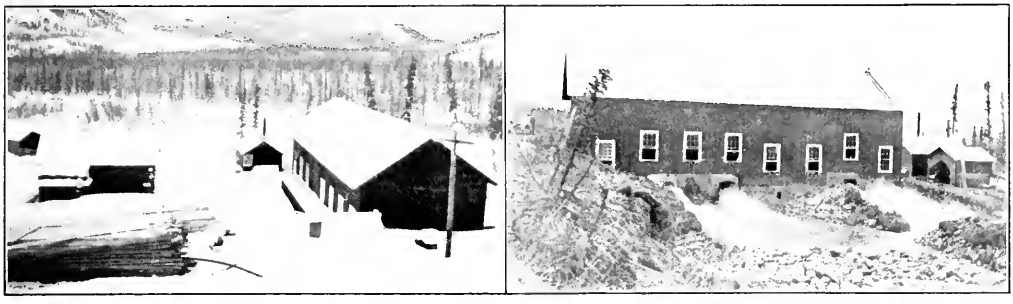
The No. 7 dredge completed its work on Upper Hunker Creek in 1911, and was then dismantled and removed to the Iditarod district, Alaska, where it has since had a remarkable yield from the rich ground on Flat Creek

How Repair Work Is Conducted

The California practice is to run the dredges continuously until they get to the point of requiring a complete overhauling, when they are shut down for 10 days or two weeks and the necessary repairs made. In the Northern practice this is changed. All the heavy repair work is done in the closed season. In the autumn, when work is suspended, the dredges are stripped of their bucket lines and conveyors. The buckets, screens, pumps and all parts subjected to heavy wear are taken to the shops and thoroughly overhauled. The dredges are put in a state of as nearly perfect repair as possible before the season opens

MACHINE SHOP AND WAREHOUSES OF THE YUKON GOLD CO. ON BONANZA CREEK

Dredge tailings and two dredges in background



POWER HOUSE OF YUKON GOLD CO. IN WINTER AND IN SUMMER

This power plant is situated on the Little Twelve Mile River. It contains three Pelton impulse wheels direct connected to three 650-kw. Westinghouse generators and supplies power to eight dredges, the machine shop and for other miscellaneous requirements

Machinery warehouse during flood of 1910 View below the power house in the spring of 1910

SPRING CONDITIONS THAT HAD TO BE MET IN THE YUKON IN 1910

and then operated with a view to keeping them going throughout the season.

During the operating season all repairing upon the dredge is minimized. Instead of replacing worn bucket lips on the dredge a few at a time, as is often done, the entire bucket line is taken off and replaced by another line which has been re-lipped and entirely overhauled. This operation requires only a few hours. The worn buckets are then hauled to the shop, repaired and kept on hand for the next replacement. If the distance to the shop is too great, the buckets are repaired on the ground by a shop crew. Portable compressors and special tools are provided for this work. The same method is used with lower tumblers and other parts exposed to heavy wear. When the lower tumbler plates become worn, instead of replacing the plates, the tumbler itself is removed and a newly repaired tumbler substituted. The old tumbler is then sent to the shop or repaired and replated on the ground, as the case may require. Each autumn all belting is taken off and sent to warm storage.

Strengthening Dredge Parts

Many detail changes have been made in the dredge machinery. The buckets have been re-designed several times since operations began. Some parts have been found to be inadequate for the heavy work. The digging ladders have all been reinforced and heavily shod on the bottom, screens rebuilt, pump capacity increased and sluices and gold-saving apparatus changed and improved.

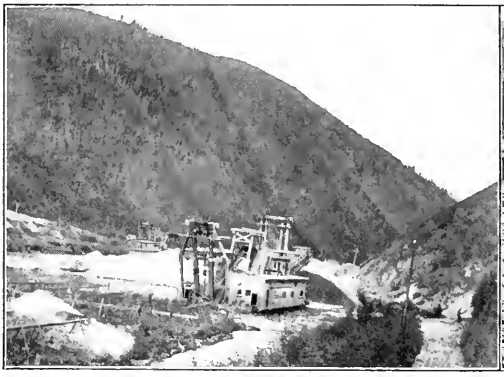
The closest possible supervision is kept over the running time and performance of the dredges. Each dredge is connected by telephone with the dredge office and reports its running time and stoppages daily. The superintendence is so arranged that the superintendent or his assistant visits each dredge at least once per day, and is on hand for any unusual repair jobs. In case of a shutdown for repairs, if only for a few hours, the crews are doubled up and shopmen sent out for any special work. Electrical repairmen are on hand day and night for any failure or trouble in the electrical apparatus.

As a further stimulus to increasing the dredging rate, a bonus system was tried during the season of 1912, but abandoned. The conditions varied so widely from one dredge to another, and the dredges being of a different age and in different condition made it difficult to arrive at a satisfactory standard of measurement. The bonus did not act as a stimulus, but rather aroused antagonism. The operators are all picked men, who get higher pay than they receive on other dredge operations, and a trip north, which they like. No further incentive seems necessary for the men to give the best that is in them.

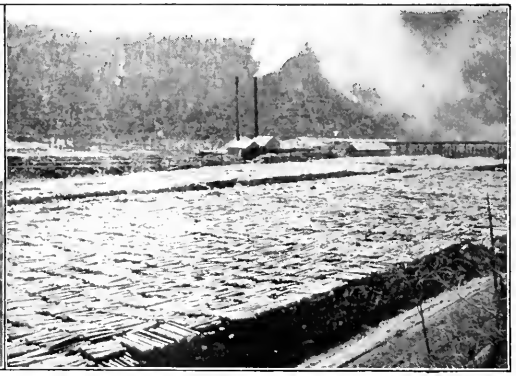
As illustrating the improvement in dredging in the Klondike since its inception, No. 5 of the Yukon Gold Co. dredged last season through the tailings of the old Lewes River dredge and made a good profit. This dredge took up 2 to 4 ft. of bedrock which the old dredge was unable to handle and obtained a good yield in ground that had been worked by hand by opencut methods before being dredged by the small dredge.

Frozen Ground the New Problem in the North

While the short season and severe service have led to numerous improvements in detail and to increases in strength and size of the dredges, and continue to offer problems which the dredge operator must meet, the greatest development in the Yukon as compared to the ordinary dredging operation has come in the handling of frozen ground. The heavy bedrock encountered on the creeks and the necessity of digging it to considerable depth to recover the gold were in themselves serious matters. No experienced dredge operator would have thought, in the beginning, that any dredge could handle the bedrock which the machines are digging today with comparative ease. When the business was further complicated by having large areas solidly frozen, the problem of dredging such areas at a profit became one of extreme difficulty. The results of attempts to dredge partly thawed areas and frozen bedrock were enough to show that the frozen condition must be completely changed before dredging could be successful. Necessity compelled the adoption of the present method of thawing, which is the development, on a wholesale plan, of the method which was in use in the drift mines in the Klondike before dredges were thought of. Preparing the ground for dredging by thawing with steam was an entirely new feature of dredge mining, and the success of the method has made millions of yards of gravel available for dredging which could not otherwise be worked at a profit.



TWO DREDGES ON UPPER BONANZA CREEK; THAWING PLANT IN FOREGROUND



OVER 7,000 CORDS OF WOOD STORED ON THE ANDERSON LEASE FOR THAWING

The steam point as originally used was a short piece of ⅜-in. pipe drawn down at one end to a point with an orifice left for the steam to escape; the other, or head end, had a nipple welded to it for steam-hose connection. The point, with steam turned on, was gradually driven into the face of the drift, then allowed to steam until the bedrock and gravel were thawed to the height of the drift. From two to six points were used in each breast, spaced from 1 to 2 ft. apart. This simple operation contained the essential features of the method whereby over three million yards of gravel are now being thawed in a season.

Thawing to a Depth of 40 Feet

In the thawing operation for dredging, the points are driven from the surface down through muck and gravel and into the bedrock from 4 to 6 ft. The points were gradually lengthened in practice, first, to 24 ft., then to 30, and last season were being successfully driven 40 ft. to bedrock. The points are made up of triple-extra-heavy hydraulic pipe with drop-forged head and tool-steel tip. The small boilers first used have been replaced by larger sizes until the boiler equipment now comprises eight plants with a total boiler horsepower of over 2000. The 150-hp. locomotive type has been adopted as the unit, and the plants usually consist of a pair or, sometimes, three such boilers.

The preliminary work for each season takes the following form: (1) The dredgeable area ahead of each boat is barred for frost. From the bar-hole results the naturally thawed and frozen areas are blocked out. The bar tests are checked by drilling where thought necessary. (2) Surveyors "pick up" the thawed areas which are mapped, and planimeter measurements are made of the frozen areas. (3) The estimated course of the boat is laid out for the year and its probable position calculated for each month of the season. (4) The total square yards of frozen ground which the dredge will dig in a season is measured from the map on which the season's work is laid out and the necessary wood for thawing is determined and its location decided.

The "sweating" of the naturally thawed ground must also be taken into account. The duty per cord, both in thawing and in sweating, to dispose of the surface frost, has been determined by experience. Knowing the square yards of frozen ground to be thawed and the area of naturally thawed ground to be "sweated" and the duty per cord of fuel, the total fuel requirement for the season is a simple computation.

The thawing operation has been described elsewhere[2], so that I need only give the sequence of events in a normal operation: (1) Steam-line boxes are strung out by horses, if they are available, otherwise men are used; (2) gooseneck boxes and headers coupled on; (3) bar-holes for starters put down; (4) starters used to thaw holes about 8 ft. deep; (5) starters pulled and long points placed in starter holes; (6) points driven down through gravel and into bedrock; (7) points allowed to steam in bedrock from 12 to 48 hr., depending on the formation; (8) points pulled, cleaned and straightened; (9) header moved and starters put down and cycle begun again.

The improvements that have been made in steam thawing since it was adopted for large-scale dredging operations are too many to attempt to detail in a short paper. They have taken the following general lines: (1) Reduction in fuel; (2) increase in efficiency of hose and points; (3) reduction in cost of driving.

The fuel has been reduced by improving the quality, reducing the radiation losses, purifying the feed water and improving the combustion. Experiments were made both with coal and fuel oil as a substitute for wood. The points have been greatly improved in material and manufacture, and the hose has been improved in quality and its life increased. Metal hose has been used for this work with success. The cost of driving has been reduced by improvement in the method of driving, correct spacing of points and correct pressure and amount of steam.

Costs Vary Widely Owing to Different Conditions

The question most often asked in connection with dredging in the North is: What does it cost to thaw and dredge frozen ground? This is a difficult question to answer on account of the wide variation in conditions. All of the creek deposits contain some areas of naturally thawed ground. The percentage of frozen and thawed areas varies on the same stream, and still wider variations occur from one stream to another. This variation reflects itself in the cost per cubic yard, the cost going up or down as the percentage of frozen ground increases or diminishes.

Another variable factor is the cost of thawing or preparing the frozen ground for dredging. Thawing on Hunker Creek, for example, is a much more difficult and expensive operation than thawing on Bonanza. In 1911 the thawing for dredge No. 4 on Hunker Creek cost $2.18 per sq.yd. as against $1.085 ahead of No. 5 on Bon-

TABLE 1. THAWING COST, YUKON GOLD CO., 1909-1914

Year	Total, Sq.Yd.	Frozen, Sq.Yd.	Naturally Thawed, Sq.Yd.	Naturally Thawed, %	Thawing Cost in Dollars	Cost of Thawing per Sq.Yd.
1909	298,061	212,903	85,158	28 6	$275,112	$1.5571
1910	396,837	256,033	140,804	35 5	500,689	1 7727
1911	555,393	432,693	122,700	22 1	696,034	1 6166
1912	692,522	509,574	182,948	26 4	804 854	1 455
1913	651,505	445,624	205,881	31 6	685,570	1 546
1914	586,737	402,660	184,077	31 4	602,174	1 428

TABLE 2 DREDGING AND THAWING COSTS, YUKON GOLD CO.

Year	Cu.Yd. Dredged	Thawing Cost per Cu.Yd., Cents	Percentage of Thawing Cost of Total	Total Cost per Cu.Yd., Cents
1909	2,381,880	15.45	48 37	31.94
1910	3,249,788	14 14	45.57	31 09
1911	4,151,249	17.62	49 72	35 43
1912	5,157,280	15 02	49 03	30.64
1913	5,133,575	13 57	45 94	29.53
1914	4,890,781	12 18	44.09	27.62

TABLE 3. DETAIL OF 1913 THAWING COSTS

	Total Expenditures	Cost per Sq.Yd., Cents	Percentage of Total
Fixed salaries	$ 1,614.00	0 4	0 23
Labor	289,195.38	65.2	42 18
Fuel	295,928.03	66 7	43 17
Shop expense	1,722.16	0.4	0.25
Preliminary expense	36,021.74	8 1	5 25
Material and supplies	23,180.50	5 2	3.38
Stables	6,589.27	1 5	0 96
Transportation	198.00	0 1	0.03
Miscellaneous	380.33	0.1	0 06
Depreciation	30,731.37	6.9	4 48
Power	9 45	....	0 01
	$685,570 23	154 6	100 00

Square yards thawed, 443,567.
Number of points driven, 63,004
Cost per point driven, $10.881.

TABLE 4. THAWING AND DREDGING COSTS OF INDIVIDUAL DREDGES OF YUKON GOLD CO.

Dredge	Situation	Percentage of Area Naturally Thawed	Thawing Cost per Cu.Yd., Cents	Total Cost per Cu.Yd., Cents
No. 1	Bonanza	22 1	12 55	31 93
No. 2	Bonanza	34 6	12 28	32 55
No. 3	Bonanza	14 0	18 36	33 79
No. 4	Hunker	7 2	17 95	32 11
No. 5	Bonanza	44 8	12 34	27 01
No. 6	Bonanza	18.6	16 38	33 36
No. 8	Upper Bonanza	33 7	12 97	27.92
No. 9	Eldorado	58.6	7 49	21 16

[2]T. A. Rickard, "Min. and Sci. Press," Sept. 12, 1908.

anza. The depth being practically the same, the cost of thawing per cubic yard was twice as great in the one case as in the other. Purely local conditions govern this cost, such as depth of ground, character of material, ease or difficulty in driving, time of steaming, cost of fuel, etc. Since the gold, practically speaking, is all confined to the bedrock, the cost per square yard of bedrock thawed becomes the controlling factor in determining what ground can be dredged at a profit and what must be left.

The appended tables show the thawing and dredging cost for the last six years of the Yukon Gold Co.'s operation. Table 4 shows the variation in working cost for the different dredges in one season. As the conditions change, the dredge holding the lowest cost for one season may show the highest cost for the next. When the costs for the eight dredges are totaled and averaged the results over several seasons are remarkably uniform.

While Table 1 shows a gradual reduction in the thawing cost, it does not reflect the improvement in efficiency, which has been marked. It is a rare occurrence now for a dredge to strike a piece of ground that is not thoroughly thawed. The improvement in this direction is shown by the gain in duty per dredge-hour, which increased from 162 cu.yd. per hr. in 1910 to 204 cu.ft. per hr. last year.

I have previously referred to the operation of the Canadian-Klondyke company in the Klondike River valley. This company has built three 16-cu.ft. dredges, the largest size in use in California. The dredges have operated into December, making a total working season of 270 days. The president and general manager claims for the big dredges an operating cost of 6c. per cu.yd. No detail has been published showing how this cost is computed. As previously set out, the Klondike River gravels, where thawed, present exceptionally good conditions for dredging. It is doubtful, however, if as low a cost as 6c. per cu.yd. can be reached if the same items are included as given in the cost figures appended hereto. In the 1913 operation of the Yukon Gold Co. the items of gold tax and selling charges alone amounted to 1.98c., or practically 2c. per cu.yd. Depreciation, taxes, insurance, etc., add another 2c. in fixed charges, which would leave only 2c. per yard for labor, power, repairs and supplies if a 6c. cost were to be realized in this operation. However the costs of the Canadian-Klondyke company may be computed, they are undoubtedly low, and the company has contributed greatly to the development of dredging in the Yukon.

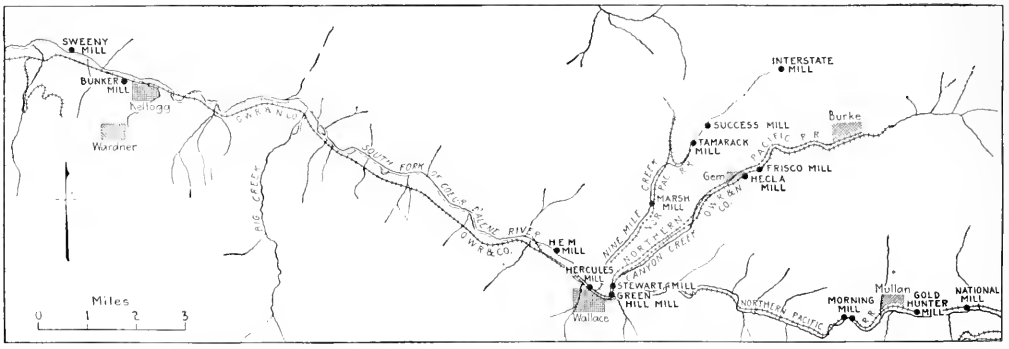
The development of another method I have not touched upon, as it is, as yet, untried for any large-scale operation, that is, the preparation of large areas of frozen gravel by the stripping method, or so-called "natural thawing." This method has been fully dealt with in a recent article[3] by E. E. McCarthy, who reports the results of the large-scale experiments conducted by the Yukon Gold Co. in 1906, 1907, 1908, and shows why the results were not such as to lead to the adoption of the method for its operations.

The dredging operation of the Yukon Gold Co. has added over $16,000,000 in gold to the wealth of the world; other companies have produced over $4,000,000, making a total of about $20,000,000 for Yukon dredging in less than 10 years of life.

[Since this paper was written, the total production mentioned in the last paragraph has been increased by about $4,000,000.—Editor.]

Flotation at Gold Hunter Mill

The Gold Hunter mine and mill, owned by the Gold Hunter Mining and Smelting Co., are situated in Hunter Gulch, about a mile northeast of Mullan, one of the mining communities of the Cœur d'Alene district. The orebody lies in the line of continuation of the Morning and You Like veins of the Morning Mine of the Federal Mining and Smelting Co. The mine has been operated since 1884, and while it originally produced high-grade silver ores, it is now in the same condition as the rest of the older mines of the camp, working on the comparatively low-grade and complex orebodies of the sulphide zone.



MAP SHOWING THE SITUATION OF THE PRINCIPAL CŒUR D'ALENE MILLS

Having approximately the same orebodies that exist in the Morning property, it is not surprising that the Hunter ores are complex and difficult to treat. The minerals known to be present are galena, sphalerite, pyrite, tetrahedrite, stibnite, siderite, barite and quartz. These minerals are unevenly distributed, and all of them do not occur in the general run of ores, although highly complex bodies containing many of them are sometimes encountered. As compared with the general character of the ore treated by the Morning mill, the Hunter ore supply contains more pyrite and less galena, but has a somewhat higher percentage of silver. In common with all the complex ores of the district, a great deal of difficulty

[3] "Min. Mag.," April, 1914.

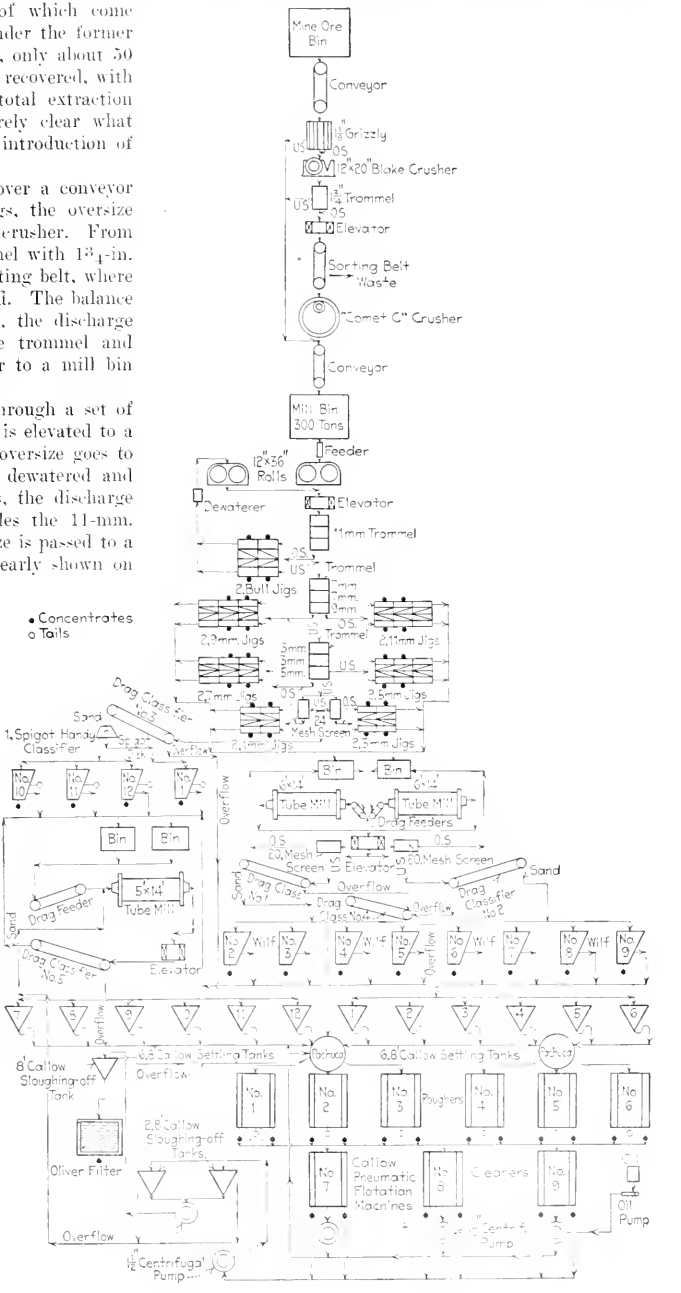
has been found in treating the Hunter ores profitably, and it may be said that not until flotation became a permanent part of mill treatment was continuously profitable operation possible.

The Gold Hunter mill at the present time treats about 310 tons of ore per 24 hr. From this about 35 tons of concentrates are produced, about half of which come from the flotation department. While under the former system of table and vanner concentration, only about 50 to 60% of the valuable minerals could be recovered, with the addition of the flotation units the total extraction has risen to 80%, thus making it entirely clear what a great difference has been made by the introduction of flotation in this district.

Ore from the mine-ore bin is passed over a conveyor belt to a grizzly having $1\frac{1}{8}$-in. openings, the oversize of which is put through a 12x20-in. Blake crusher. From the crusher the material goes to a trommel with $1\frac{3}{4}$-in. holes, the oversize being elevated to a sorting belt, where a portion of the waste is removed by hand. The balance of the oversize goes to a Comet crusher, the discharge of which meets the undersize from the trommel and grizzly and is carried on a belt conveyor to a mill bin having a capacity of 300 tons.

From the mill bin the ore is passed through a set of 12x36-in. rolls, the discharge from which is elevated to a trommel having 11-mm. openings. The oversize goes to two bull jigs, the tailings of which are dewatered and crushed in another set of 12x36-in. rolls, the discharge going back to the elevator which precedes the 11-mm. trommel. From the trommel the undersize is passed to a set of screens and jigs, the flow being clearly shown on the accompanying flow-sheet drawing. The sand is dewatered in a drag classifier and concentrated on four Wilfley tables, the concentrates from which are collected in a bin. The table tailings are then reground in a 5x14-ft. tube mill, elevated, dewatered and reconcentrated. The flow from the jigs is reground, classified and concentrated on Card tables, as is shown in the flow sheets. At this point preparation is made for treating the tailings from the concentrators by flotation. The pulp is thickened in Callow settling tanks and then delivered into two small Pachuca tanks, where mixture with the frothing oil is accomplished. Creosote oil in the proportion of about $\frac{1}{3}$ lb. per ton of ore is mixed in the tanks and then delivered to six Callow roughing flotation machines. Three of these are supplied by each of the Pachuca tanks. From the roughing machines the concentrates are sent to three Callow cleaners, these being machines of the same type as the roughers. Each of them is supplied by two of the rougher machines. The concentrates, finally cleaned, are pumped into two 8-ft. Callow sloughing-off tanks and then to a third Callow cone, whence they are delivered to an Oliver filter. The filter delivers concentrates containing only about 8% of moisture. All solutions from the flotation department are returned to the Pachuca tank for further use, the object being to avoid the loss of any oil that may remain in them.

The Callow machines are of the well-known light-froth type in which air is supplied through a filter bottom



FLOW SHEET OF THE GOLD HUNTER MILL

into the frothing cells. In this case the air pressure is about 8 lb. per sq.in., this pressure supplying sufficient buoyancy to keep a froth continually overflowing the cells.

Among the important points brought out in the practice of flotation at the Hunter mill is the absolute necessity of giving a great deal of care and watchfulness to the small details of operation. The flow of pulp to the roughing and cleaning machines must be absolutely constant in quantity, and what is even more important still, the dilution must be constant. At this mill the pulp is comparatively thick—that is, contains a high percentage of solids—but as a general rule of flotation this does not apply, since different dilutions may be necessary for the successful working of different kinds of ore. It is important, however, that after the proper working conditions have been determined, they shall be maintained absolutely to get proper results. The accompanying flow sheet shows clearly all the details of the operations of the Gold Hunter mill.

THE GOLD HUNTER MILL, NEAR MULLAN, IDAHO

Buys Ore Lands in Cuba

The Midvale Steel and Ordnance Co. announced Dec. 8 that it had obtained 300,000,000 tons of iron ore in Cuba through the purchase of all the stock of the Buena Vista Iron Co. The property owned by this concern lies adjacent to holdings of the United States Steel Corporation and the Pennsylvania Steel Co.

The company stated that improvements planned would entail the expenditure of more than $6,000,000. Those already outlined call for six new openhearth furnaces, a blooming mill and two turbo-generators for the Worth Brothers Co.'s plant at Coatesville, and of several additions to the Midvale plant at Nicetown, at a total cost of $2,380,000. The new facilities will enable the company to handle orders recently obtained from the Government for 14- and 16-inch guns 50 ft. in length.

Broad Pass Region of Alaska

Broad Pass is the western part of a wide glacial valley which is bordered by steep, straight mountain walls lying parallel with a great east-west range on the north and connecting the upper valleys of Chulitna and Susitna Rivers.

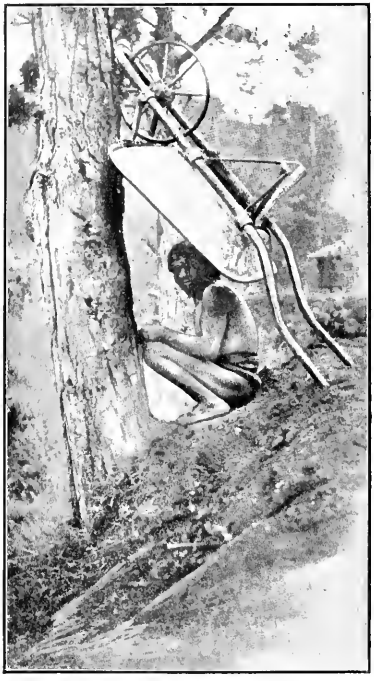
The geologic conditions in the region appear to be favorable to mineralization, but no valuable orebodies have yet been discovered. The most favorable reports came from the district just west of Broad Pass, near the head of Chulitna River, where prospecting has been carried on for several years. Valdez Creek, an important gold-placer district, lies about 30 mi. east of the pass. Along some of the streams between Broad Pass and Valdez Creek there are prospects of placer gold, which, however, has not been found in commercial quantity. Copper prospects, too, have been discovered in several parts of the region, and at one place, Coal Creek, there is a small area of coal.

The railroad, which will probably soon reach this region, will aid greatly in its development. The wealth of the Broad Pass region appears to be mineral rather than agricultural, and it can be profitably exploited only by a greater population and through better means of transportation.

The district is described fully in Bulletin 608 of the Geological Survey.

Safety First, Igorot Variety

The modern Safety-First idea, when applied by an aboriginal, does not always effect the security which it was intended to do, as shown by the accompanying illustration from the current issue of the Pan-American Union. The Igorot roadbuilder is safely(?) hiding under a modern American iron wheelbarrow upturned, awaiting the result of a blast on some road work nearby. He is showing the atavistic instinct of the ostrich by being apparently perfectly content with his safety precautions when he has protected his head from the flying rock, while the honorable torso is wholly exposed between the handles of the wheelbarrow.



SAFETY-FIRST POSE OF AN IGOROT

Details of Practical Mining

Compressed-Air Equalizing System at Copper Queen

By Fred M. Heidelberg*

Power for the Copper Queen Consolidated Mining Co., Bisbee, Ariz., was generated formerly at five of the company's shafts. About the middle of 1908 a central power house was built. Five 400-hp. Stirling boilers, with economizers and superheaters attached, were to furnish the steam, two 3,500-cu.ft. per min. Ingersoll-Rand compressors were to supply the air, while three 500-kw. Curtis vertical turbines were to furnish the electrical power.

The air consumption was the big variable and worked the greatest ravages on the plant. The compressors were connected directly to the air system. The governors on all compressors were controlled so as to keep the pressure about 90 lb. gage. The equipment using air consisted of three hoists—one Sullivan, one Fraser & Chalmers and one Nordberg—several hundred air drills and many other kinds of minor hoists and air machines distributed about the different shafts. It was found that since the Gardner hoist was so far from the power house, it could be run more economically on air than steam; therefore air was used, thus adding another Sullivan hoist to the air-consuming engines. More mine development made it necessary to install a 7,000-cu.ft. per min. Nordberg compressor to take care of the increased air requirements. The average consumption of air during the year 1912 was about 10,000 cu.ft. per min., while the maximum and minimum instantaneous requirements of the compressors were 14,000 and 2,000 cu.ft. per min. respectively. The minimum would take place between shifts when no air-using machines would be working. One 3,500-cu.ft. compressor would run at little more than half speed. The maximum was furnished when all three compressors were running at full speed.

Naturally, the maximum instantaneous supply would take place when all hoists and most of the drills were working at the same instant. The demand on the air system would be so great that all the compressors would jump from about half speed to full speed. Besides the undue racing of the compressors the demand on the boilers would be strong, since 30 lb. of steam for the Nordberg compressor and 40 lb. of steam for the Ingersoll-Rand compressors were required to produce 1,000 cu.ft. of air. Also, the air pressure would drop from 90 lb. to below 65.

Such conditions mean tearing the plant to pieces. Consequently, after a thorough investigation it was decided to install an air-storage and balancing system which would store up the air when consumption was light for use when the air consumption was large and keep the pressure nearly constant through a great part of the storage. This would allow fewer compressors in use and allow them to be run at a nearly constant speed.

General Features of the Design

In essence the plant consists of a steel-tank storage for air kept at a nearly constant pressure by a hydrostatic head.

The layout is shown in Fig. 1. The storage consists of six tanks, 9 ft. in diameter, 40 ft. long, spaced 11 ft. 6 in. centers. The volume of the six tanks is slightly over

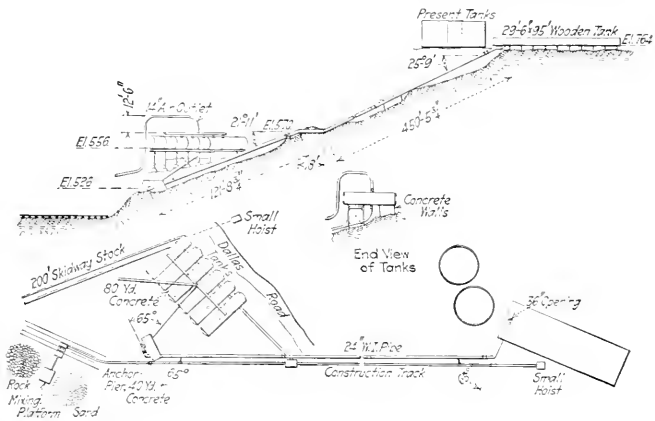


FIG. 1. GENERAL LAYOUT OF EQUALIZING SYSTEM

15,000 cu.ft., and they will store approximately 115,000 cu.ft. of free air at 93 lb. gage.

The air outlet at the top of each tank is 8 in. diameter and connects to a single-piece 14-in. header with 14x8 welded tees. The water inlet at the bottom of each tank connects to an 18-in. header by means of 12x18 tees welded to the header. This 18-in. header connects with the 24-in. line of the water tank by means of a 24x18 tee. The 24-in. line is of wrought-iron pipe and drops 30 ft. below the bottom of the tanks to form a U. At this U is a 24-in. gate valve. A 6-in. gate valve for draining and cleaning opens into the atmosphere at this point. From this U the pipe extends about 620 ft. to the wooden water-storage tank on top of the hill. The opening to the wooden tank is 36-in. and is connected by a 36x24 elbow.

There are five expansion joints in the pipe line, each allowing for a 2-in. expansion. Four of these expansion joints are between the U and the water tank and one between the U and the air tanks. Since one section of the long pipe is inclined at an angle of 21° 11′ and the other at an angle of 27° 11′, it would tend to slide down

*Box 1179, Bisbee, Ariz.

and close the expansion joints. Consequently an anchor pier 2x4 ft., top dimensions, extending with battered sides down to rock, was put in on the up side of each expansion joint to hold the upper section of pipe. Under each section of pipe a supporting pier 18 in. square on top was placed. At the U a large anchor pier was built. The pier was to have top dimensions of 6x21 ft. and was to extend with battered sides to rock not less than 4 ft.

Fig. 2 gives the details of the wooden water-storage tank. The dimensions are 29½x95x5 ft. The foundation

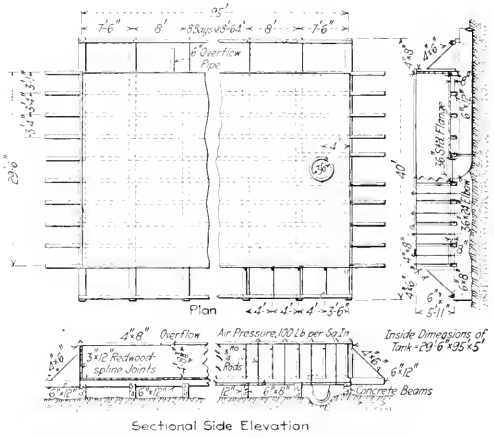


FIG. 2. DETAILS OF CONSTRUCTION OF WOODEN WATER-STORAGE TANK

consists of thirteen 12-in.-wide concrete beams spaced to make 95 ft. These piers are built on the rock and upon them were placed ten 6x12's spaced to make 29 ft. 6 in. The sides and bottom of the tank were lined with 3x12 splined redwood. The bottom of the tank was nailed to the 6x12's, while the sides were nailed to 4x6's. Braces of 4x6 were then inclined, as shown, to hold the sides plumb. A 4x8 cap was then placed around the entire periphery of the tank. Both a water outlet and inlet from the pump were provided.

The volume of the water tank is 2,800 cu.ft. per foot in height, which is slightly over one-fifth the volume of the air tanks. The total drop in head equals the drop in the water tank plus the rise in the air tank. The rise in the tanks varies for the same volume of water. At any rate one foot drop in head in the water tank displaces approximately 21,000 cu.ft. of free air at 93 lb. gage. This little example illustrates the delicacy of the system.

The water tank provides a large quantity of water with a small drop in head until the tank is empty. If there is just enough water in the system to bring the water to equilibrium when the air tanks are just full of water, the level of the water in the pipe will be about 108 ft. from the U, measured along the pipe. It is the volume from the bottom of the water tank to this point of equilibrium in the pipe that will produce the greatest drop in air pressure—that is, to zero gage. The length of pipe from this point of equilibrium to the bottom of the water tank is 512.2 ft., representing a volume of 1,630 cu.ft., approximately one-ninth the volume of the air tanks. This is a small quantity of air. It will be seen, therefore, that at no time should more water be put into the system than will just fill the air tanks at atmospheric pressure with the water at equilibrium.

The additional head of 30 ft. from the bottom of the air tanks to the U serves as a safety precaution. The air will just go around this point when the air pressure is between 103 and 105 lb. On a test at 103 lb. the system worked. When the pressure was raised to 105 lb. the air went around the bend and forced the column of water up with such force that part of the water-storage tank was wrecked.

The air tanks are supported at four places. The two back supports consist of concrete walls running under each tank. The two front supports are channel columns with channel struts between. The columns are directly under the tanks and were designed to take a load of 55,000 lb. each. Each tank rests in four cast-iron saddles, one over each support. Although the struts have no load to carry, they were designed to hold an empty tank at the center of the span, since the empty tank would be rolled over the beam in that manner while erecting. The curved air-delivery pipe is carried up 12 ft. 6 in. above the 14-in. header of the tanks to insure no water getting into the air system.

The distributing lines were located about as follows: In the power house the air discharge of all the compressors connected to a drum 4 ft. diameter and 80 ft. long. A 14-in. pipeline connected this drum with a smaller drain drum just outside of the power house. Two lines lead from this drain drum—one a 14-in. line connected to the balancing system several thousand feet away; the other, a 10-in. line, leads over to the Gardner shaft and

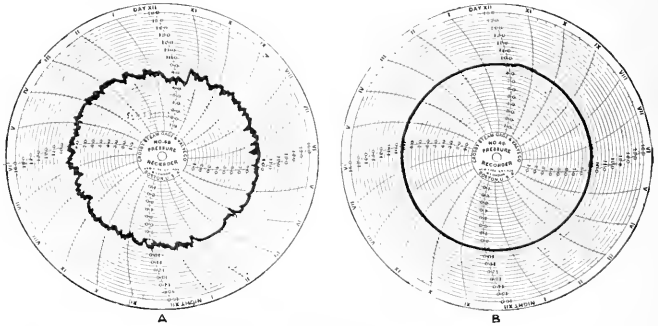


FIG. 3. CHARTS SHOWING PRESSURE CURVE BEFORE AND AFTER EQUALIZING SYSTEM WAS INSTALLED

supplies air to all the mines in the northern part of the camp. An 8-in. line connects to the 14-in. line near the balancing system, to furnish air to the Lowell shaft. Drain drums were provided wherever there was a dip in the pipe lines.

Constructing the concrete piers was simple. The concrete-mixing plant was located at the end of the railway spurs shown in Fig. 1. From this point to the top of the hill a construction track was run parallel to the pipe line. A small hoist was located on top to pull up mate-

rial. On the opposite side skids were installed with hoist, to handle the heavy tanks and material. The concrete was distributed as follows: Foundation beams under wooden water-storage tanks, 30 yd.; piers under pipes, 30; the anchor pier at U, 40; walls and piers under tanks, 80; total, 180 yd. The timber in the tank on the hill amounted to 22,400 ft. b.m.

In order that the right amount of water should be got in the reservoir, a set of gage-glasses were connected to one tank of the battery so that the height of water in the air tanks could be ascertained. By closing the gate valve the water in the storage tank could be kept from varying until enough new water could be added to bring the quantity to the required amount. Outside of keeping the required amount of water in the tank, the system gives no trouble. Its operation is automatic, and the pressure rarely varies over three pounds.

By way of comparison, two pressure charts are shown in Fig. 3. Chart A is an average one before the balancing system was installed, and shows the great variations in pressure in the air-supply system. It will be noted that in one place the pressure dropped and it was more than an hour before it could be brought up again. Chart B, on the other hand, was taken after the system was installed and shows very little variation in pressure during a 24-hr. period. These two charts tell the story.

Wash and Change Houses*

The value of change houses is not properly appreciated by the miners themselves, if the extent to which the houses are used is an indication. A great many men do not change their clothes on coming to the surface after a shift, but go to their destination in the clothes in which they have been working. The proper appreciation of the necessity of changing wet clothes, especially when the weather is severe, is a matter on which the miners need education. Several mine operators have erected commodious and well-equipped change houses only to have their proper use disregarded and the fixtures broken. The advantage to be gained by a wash and a change to clean dry clothes after work is a real one that makes for health and lessens exposure, but many, if not most, of the miners seemingly have not realized this, even where opportunity has been offered. The disregard shown by employees of companies that have erected change houses has probably influenced other operators to refrain from erecting or equipping similar buildings.

The value of change houses is a subject that can be handled in a general campaign of education among the miners; the necessity for such a campaign is great, and it is to be hoped that it will be undertaken in the near future. Mines that have no change houses should erect them. A plain wooden building, properly heated and having running water for wash purposes, is all that is essential. Shower baths, individual lockers, and otherwise elaborate structures, although of undoubted benefit where there are sufficient reasons for erecting them, are naturally not to be looked for where only a few men are working; but a warm shelter for changing clothes should be available, even at small mines. The exposure resulting from men going home a considerable distance in wet clothes in cold weather undoubtedly furthers disease, particularly tuberculosis, and to induce appreciation of this by proper education of the miners is one of the things that will help to reduce the prevalence of pulmonary tuberculosis in several mining districts.

The Bureau of Mines has published Technical Paper 116, "Miners' Wash and Change Houses," covering the subject of hygiene considerations and giving plans and descriptions of change-house equipments and an excellent bibliography.

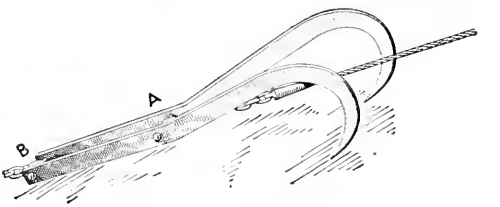
*Excerpt from Technical Paper 105, Bureau of Mines, "Pulmonary Disease Among Miners in the Joplin District, Missouri."

Runaway Tubs or Hutches

Under the title "Runaway Tubs," a correspondent of the *Iron and Coal Trade Review*, London, describes a method devised to prevent dropping of men being hoisted on an incline in case the hoisting rope breaks, as follows:

The risk run in lowering men down an incline or dook in hutches or tubs has again been brought to notice in the recent accident at Norton colliery, whereby two men were killed and nine injured. The speedy conveying of workmen to the various points underground has been rendered necessary by present conditions, and the practice has grown of taking a large number of workmen in one journey, thereby increasing the risk of injury.

To overcome or reduce to a minimum this risk the writer devised an apparatus—a sketch of which is shown herewith—to hold the train of hutches or tubs in case the rope should break when coming up or going down an incline. The apparatus consists principally of two flat bars of steel bent, spread and connected as in the sketch. The haulage rope is attached at A and the connection to the train of tubs is made



SAFETY HOOK FOR INCLINE HOISTING

at B. The sketch shows the connections clearly and indicates the spread of the bars necessary to clear the rope and pulleys and still be inside the rails. In a model the design was tested on all inclines up to 60°, and in every case, whether in lowering or raising, the hutches or tubs were held.

The writer would not recommend its use on roadways where short light rails are laid, but only on permanent laid roads. There is no fear of the hooks catching unless the rope breaks; so long as a strain is on the rope it is not possible for them to act. The appliance also prevents a sudden jerk being put on the rope through tubs catching when going down and then clearing; under such conditions the hooks would catch.

Resetting a Derailed Shovel

An old steam-shovel engineer, according to *Brick and Clay Record*, makes the following suggestion: If the front wheels are off of the track, fill the dipper with rock or other heavy material, loosen up one jack arm and swing the dipper over this side. This will raise the other side of the shovel. Put a number of men on the up-side jack and tighten it down as hard as possible. Swing dipper over high-side and screw down low-side jack. Continue this operation until the shovel is off the center bearing. If there is a key in the kingbolt, the trucks will be raised off the track.

If the rear trucks are derailed, lay blocks in the usual manner in order to assist the wheels to climb on the rails. If this is unsuccessful, drop the dipper and boost by means of the thrusting engines.

Details of Milling and Smelting

Baggaley Patent for Utilizing Heat of Molten Slag

U. S. Pat. 1,160,817, granted on Nov. 16, 1915, to the late Ralph Baggaley, of Pittsburgh, covers a method of utilizing the heat of molten slag by passing water, air, or other fluid to be heated, around a series of small receptacles into which the molten slag is poured. The apparatus suggested consists of a multiplicity of open-top conical slag "tubes" depending within a passage or container, and means for periodically inverting the device to discharge the cooled slag. One form of apparatus resembles a Walker casting machine, the lower part of the mold containing a water space connected with a central boiler and drum. A variety of constructions is shown for heating either air or water, all dependent upon passing the fluid around the depending tubes of solidifying slag and the periodic inversion of the slag tubes for the purpose of emptying.

This is a subject that has attracted the attention of many metallurgists, but owing to local conditions has seldom been worked out successfully. Mr. Baggaley stated in his patent that he had devoted many years to this investigation and had ascertained that the following features were either essential to, or at least seemed desirable in, the development of a successful apparatus for the utilization of molten slag:

1. The slag must not be able to shrink away from actual contact with its container at any time.

2. The slag must be delivered in such small units that it will congeal promptly.

3. A great number of such small units must be provided in order to obtain sufficient heating surface.

4. The volume of water to be heated must bear a proper proportion to the volume of slag which does the heating.

5. As the slag units congeal, cool and shrink, they should be free to fall by gravity so as to remain in actual contact with the container on all sides.

6. The slag-supply ladle should contain the same quantity of slag as the power-generator units, so that the slag may be poured quickly, without measuring.

7. The whole vessel should be well protected on all sides to prevent heat radiation.

8. As the slag tonnage is very large, the spent slag should be handled by machinery.

9. The feed water should be preheated to approximately 210° F., in order to secure proper efficiency in the apparatus.

10. The apparatus must be absolutely safe at all times against explosions or other accidents.

11. The free and complete discharge of the spent slag by mechanical means is important.

12. The possibility of water leaks into the molten slag must be absolutely guarded against to prevent disastrous explosions.

13. The apparatus must be durable in ordinary use.

14. The apparatus should not be more expensive to build than good boilers of the same capacity.

15. When the spent slag, after being discharged from the generator units, is used for the purpose of preheating the feed water, care should be exercised to prevent excessive sulphur in the feed water. This can be neutralized by any of the well-known chemical methods, or the hot spent slag may be delivered into a submerged container in the feed-water tank in a manner to prevent the slag from coming into actual contact with the feed water.

16. In order to provide sufficient heating surface, as well as to simplify the discharge of the spent slag, it is essential that the small slag units be located in one or more holding vessels which are separate and distinct from the boiler.

17. In order to maintain a supply of dry steam a dome or storage boiler should be provided, distinct from the water-storage boiler.

Handling Low-Grade Matte at Anyox, B. C.

The rehandling of low-grade matte is a problem at many smelting works. At the Anyox plant of the Granby Consolidated Mining, Smelting and Power Co., in British

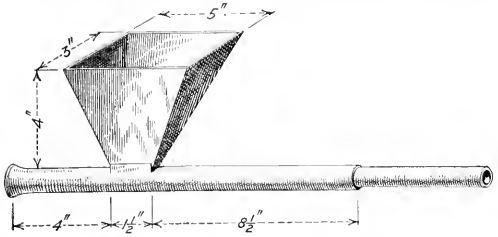
DRAG SCRAPER DIGGING AND LOADING MATTE AT ANYOX

Columbia, the management has eliminated much hand labor by applying the back-haul scraper principle to this problem. The low-grade matte is poured into long beds, and upon solidification the edges are broken with powder so as to give the special digging bucket or scraper a start. A donkey engine operates the digging bucket, which is pulled along on the bed, digs into the matte and is then hauled up the incline shown in the accompanying view. The bucket dumps into the railroad cars, and the matte is transported by a high line to storage bins and redrawn for the furnace charge.

Originally the converting of the first matte was done directly, but it was later found that it would be more economical to raise the grade by reconcentration. When resmelting was first started, the matte was stored in beds and dug up with pick and shovel. This was expensive, and it became necessary to find some mechanical way of doing it. The amount of hand labor and the cost of loading the matte have been much reduced. With six men, including the hoist man, as much as 600 tons of matte has been loaded in a day by the new arrangement. The objectionable feature of this method of loading is that the proportion of fines made is too great. This could be reduced by making shorter beds and thicker layers of matte, but the ground space at Anyox does not permit this improvement.

Cement Gun for Pointing Up Boiler Settings

A gun for squirting cement into the cracks of brick boiler settings is described by Harry Roebuck in *Power*, Dec. 7. From a length of brass tubing about 1 in. diameter was sawed a piece 14 in. long. Four inches from the end an opening ⅞ in. wide and 1½ in. long was cut with a sharp chisel, the tube being slipped on an iron rod held in the vise, while cutting. The cut was made along the center of the opening, and the metal was



CEMENT GUN FOR BOILER SETTINGS

bent out straight along the two sides. To the two sides was attached a hopper, 4 in. deep and 3 by 5 in. at the top, made of tin. The short end of the tube was given a flare of about a quarter of an inch, and a short piece of loosely fitting broom handle for a plunger completed the gun.

The plunger should not be too snug a fit, and the sand should be screened through a fine screen, or trouble will be experienced from sticking of the plunger. By rinsing the apparatus in a bucket of water each time before loading, the cement will flow more freely.

Making Babbitt Castings

A recent article on babbitt casting, by J. H. Van Deventer, in the *American Machinist*, embodies the following points.

If babbitt is heated to over 900° F. the chances of getting a scaly job are very good. The high limit is 850° F., which is too high to be tested with the finger, but can be judged from a pine stick, being the point at which such a stick when thrust into the metal hesitates whether to burn or not and finally decides to do so. This is too hot for pouring, unless the shell to be run is less than ⅛ in. thick. For ordinary work the metal is right to pour when it will char the pine stick but not produce flames.

There are three kinds of hand ladles for pouring babbitt—the good kind, the bad and the indifferent. A good ladle is one with a lip designed to pour a heavy *solid* stream. That is, a ladle with a rounded lip, preferably with a dross dam, is best.

When remelting scrap, boil green hickory wood with the metal to remove the dross. Beware of blowing out a cast-iron shell with compressed air before babbitting. Air lines contain water, and this won't mix with babbitt. Hand bellows are safer. A large casting too heavy to lift can be dried by burning gasoline in it. Use sal ammoniac in the melting pot if you want clear metal.

Remember that a thin section will cool quicker than a thick one and must be poured hotter. Remember that powdered rosin sprinkled and rubbed on a damp job will prevent explosions. Smoking a mandrel with lamp black will do if rosin paper or clay wash is not available. A heavy cord dipped in clay wash will act as core for an oil groove.

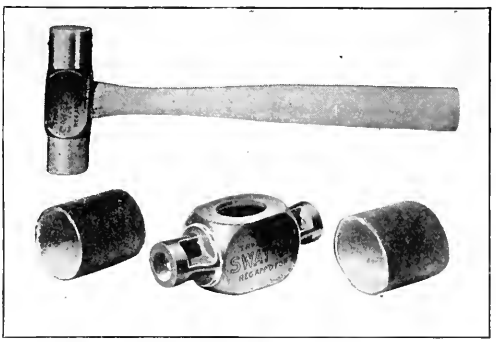
Slow cooling makes bearing metal coarse-grained. Open up the box as soon as the babbitt is cold. Dirt and dust rise to the highest point on the mold. Risers and a high pouring gate will get them outside of the bearing.

If you must pour a bearing cold, use a mixture that contains plenty of antimony. It won't shrink as much as other mixtures will. Remember that air is lighter than babbitt and vent at the highest point. You cannot depend on air getting out where the babbitt goes in. Give it a private exit. Overheated metal, lack of proper vent and slow pouring are back of most spoiled bearings. Hence, last and most important of all, *pour quickly*.

Soft-Metal Hammer

The soft-metal hammer shown is intended not only for general machine-shop use, but also for sheet-metal work, garages and repair work of various kinds.

The body of the hammer head is made of tough bronze that is practically indestructible, and it will stand all



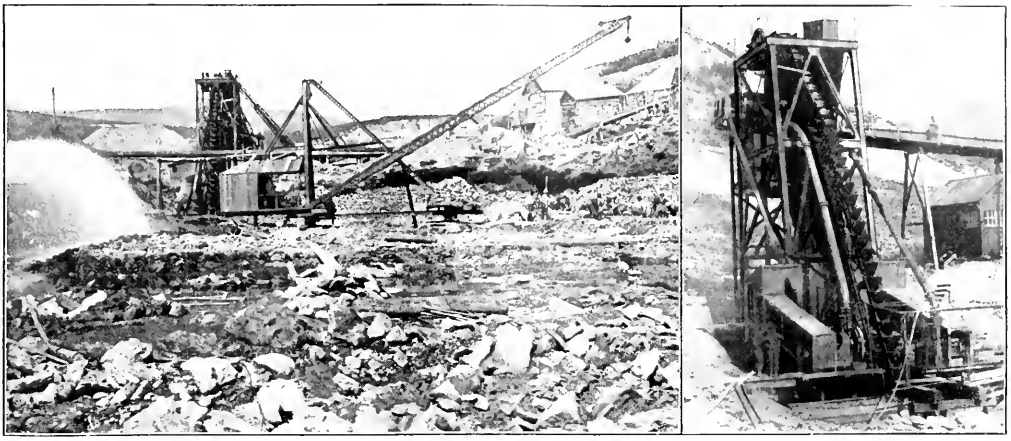
SOFT-METAL HAMMER HEAD AND MAILING TUBE MOLDS

the reheating necessary to melt out the old metal preparatory to renewal. It is so made that short sections of paper mailing tubes may be used as molds for the soft metal. The lower picture shows two of these sections and a bronze head.

The hammers are furnished with handles and soft ends in 1-, 2-, 4- and 6-lb. sizes. They are recent products of the Bauth Manufacturing Co., 901 Gerke Building, Cincinnati, Ohio.—*American Machinist.*

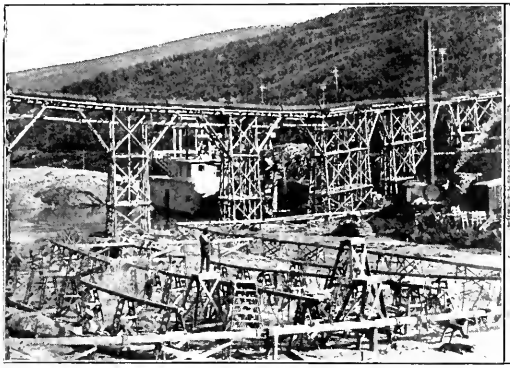
Yukon Gold Co.'s Operations

CLEANING BEDROCK AT ELEVATOR No. 3. PREVIOUS TO THE APPLICATION OF DREDGING THE BONANZA CREEK GRAVELS WERE HANDLED BY HYDRAULICKING IN CONNECTION WITH MECHANICAL ELEVATORS. LOWER VIEW SHOWS THE UPPER SLUICE OF ELEVATOR NO. 3

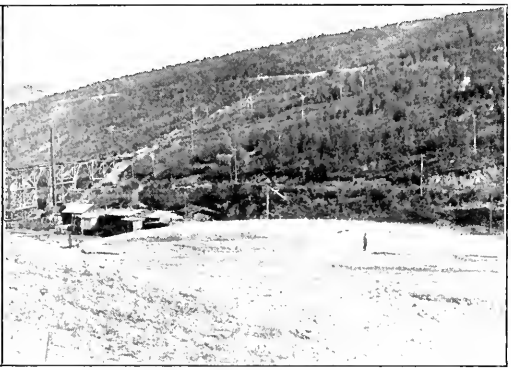


MECHANICAL ELEVATORS USED BY YUKON GOLD CO. IN THE EARLIER OPERATIONS ON BONANZA CREEK

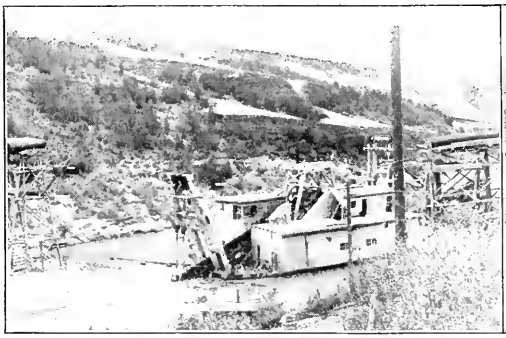
Hydraulicking in connection with portable mechanical elevators was abandoned on Bonanza Creek when it was found that the dredges could be built strong enough to dig the bedrock and handle the large boulders or slabs that may be noted in the foreground of the above picture. The derrick shown in the center background was used to facilitate the removal of boulders and bedrock slabs preparatory to cleaning bedrock. The dredges now dig this bedrock and operate more cheaply than the elevator method. At the right is shown a nearer view of one of the mechanical elevators. These elevators were mounted in a portable steel frame, fitted with flanged wheels. The excess water is elevated from the pit to the sluice by a 12-in. centrifugal pump driven by 100-hp. motor. There was also a 10-in. auxiliary pump used when a rush of water was encountered



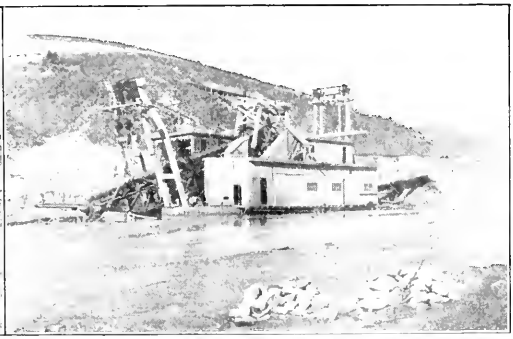
NO. 5 DREDGE APPROACHING THE BONANZA INVERTED SIPHON



HYDRAULICKING ON BONANZA CREEK ABOVE THE SIPHON



NO. 5 DREDGE PASSING THROUGH THE SIPHON



NO. 5 DREDGE ABOVE THE RESTORED SIPHON

Library Service Bureau

The Library Board of the United Engineering Society, in order to bring the usefulness and facilities of the engineering library closer to the individual members of the profession, has inaugurated a service bureau which will maintain a staff of expert searchers and translators for researches and translations for those who are at such a distance from New York that they are unable to avail themselves of the facilities of the library.

The service bureau has also arranged to keep those who may desire it posted on the current publications of any engineering subjects that they may specify. In this connection, reference cards giving the title, author and exact citation of all published articles on the subject are mailed to the subscriber. Then, if copies or translations are desired, they will be furnished on application, at previously stipulated prices.

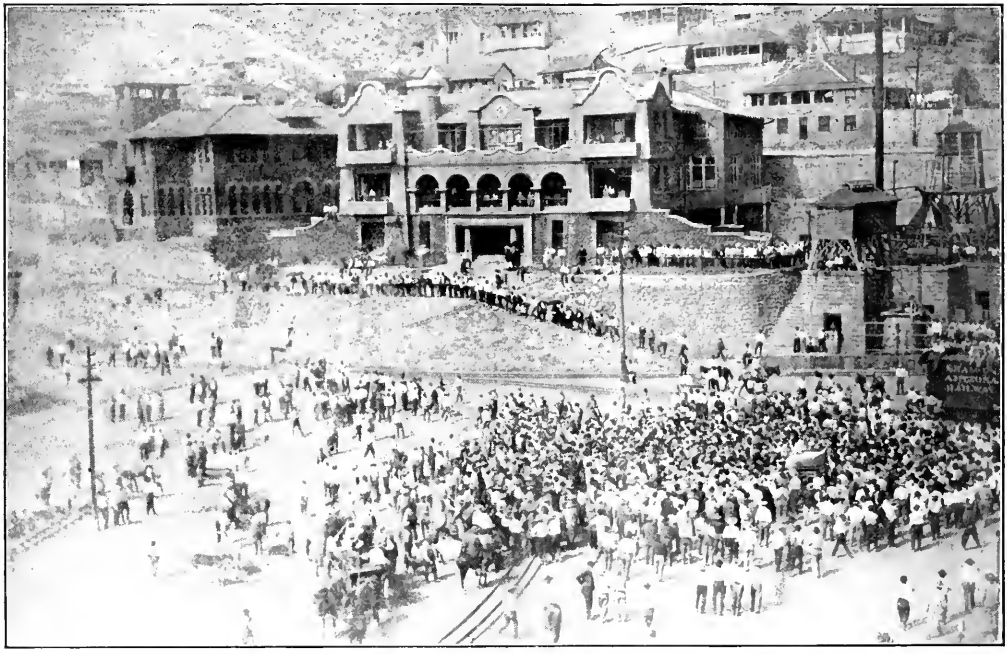
The prices charged for this work are kept down to the merely self-supporting basis, because the United Engineering Society does not carry on any work of a commercial character.

The engineering library has over 60,000 volumes on technical subjects and receives currently over 1,000 engineering and scientific periodicals. In addition, access is had to the New York Public Library and the library of the Chemists' Club, so that researches can be covered on almost any engineering subject.

Requests for information and rates should be addressed to the Library of the United Engineering Society, 29 West 39th St., New York City. E. Gybbon Spilsbury is chairman of the Library Service Committee, which is making every effort to bring this service to the attention of the profession at large, for whom it is designed and to whom it is conceived to be of great potential benefit.

The Clifton-Morenci Strike

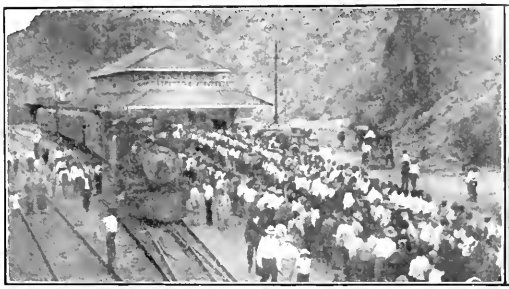
The Lake Superior strike of 1913 introduced many features of labor warfare that were humorous in their very outrageousness. The Clifton-Morenci strike is even more picturesque. One of the accompanying illustrations shows the concentration camp. What? Of strikers, or strike-breakers? No. Simply of miners who would like to go to work and are not permitted to do so by the labor leaders, aided and abetted by the county and state officers.



STRIKERS IN THE CLIFTON-MORENCI DISTRICT OF ARIZONA LISTENING TO A WESTERN FEDERATION SPEECH IN FRONT OF THE MORENCI HOTEL

It's hard to get news from Clifton and Morenci. The correspondent, or indeed anybody else who enters town, has first to pass an inspection something like what an entry into Russia used to entail. If the sheriff and the labor leaders pronounce him O. K. he gets 24 hr. in which to transact his business and depart. However, if during his visit he turns out to be a *persona non grata*, he is apt to be caused to depart on shank's mare and barefoot. If *non gratissima*, tin cans are tied to his person, which also is appropriately placarded according to the views of the labor leaders and officers of the law.

It looks as if democratic government had ceased to exist in this part of Arizona. Irvin Cobb or Sam Blythe ought to go there as war correspondents to tell the country about the death of liberty in a part of the United States. However, if we were their editors, we should not

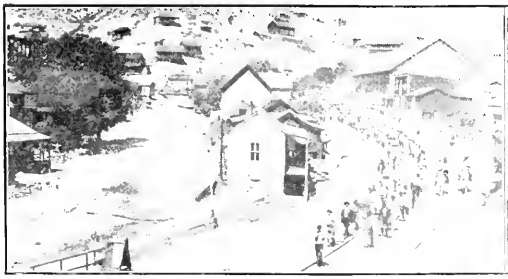


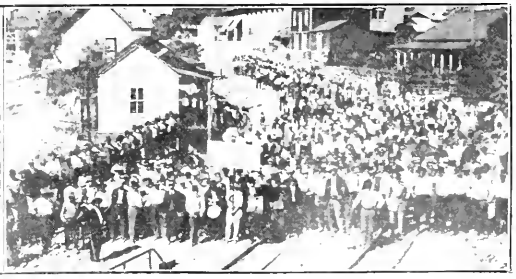
AWAITING ARRIVAL OF PRESIDENT MOYER OF WESTERN FEDERATION OF MINERS

STRIKERS AT MORENCI ON THE DAY THE MANAGERS LEFT THE DISTRICT

STRIKERS IN CLIFTON-MORENCI DISTRICT BEING DRILLED BY LIEUT. LEE OF ARIZONA NATIONAL GUARD

THE REFUGEE COLONY AT DUNCAN, ARIZ., ABOUT 40 MI. SOUTH OF CLIFTON





"VIVA LA WESTERN FEDERATION OF MINERS"". STRIKERS PARADING UNDER THIS BANNER AT METCALF, ARIZ. The group at the right has just "induced" the clerks in the Arizona Copper Co.'s store to join the union. The head bookkeeper is holding the drum to show his conversion

venture to send them there unless we could get von Mackensen to help.

We hear, however, that the property of the mining companies is being taken care of fairly well. The sheriff is attending to that, and nobly is doing his duty. He is hiring a corps of deputies to guard the property. He hires them among the strikers. Thus as deputies they are guarding what as strikers they are threatening. The mining companies are paying the wages. Herein we have a truly humorous situation. As a financial arrangement it is something like that of the cat and rat farm.

Copper in Germany

The following interesting article by Gilbert Hirsch, its Berlin correspondent, recently appeared in the New York *Evening Post* (copyright, New York Evening Post Co., 1915), by whose courtesy we reprint it, only slightly condensed. It was dated Oct. 21. The comments that are introduced are our own.

There is no copper famine in Germany; there is not going to be one. England, to be sure, has decreed that no American copper shall go to Germany, and no American copper goes there. Some copper did get through by way of Holland and Scandinavia in September of last year; but England put an end to that by bringing pressure to bear on Holland and the Scandinavian countries. This interfered with the business of Scandinavia and Holland, prevented Italy from getting some of the copper which she needed to arm herself for participation in the war, cut down the output of the American copper mines and caused a boom in the German copper industry. As to the ultimate object—a shortage in the German ammunition supply—it does not exist and is not in prospect.

The cutting off, to be sure, of the 35,000,000 lb. of copper which Germany was accustomed to get from America every month has had an appreciable effect. In times of peace Germany, the second largest copper manufacturing country in the world, makes articles containing 225,000 tons of copper. This year it makes none of these articles, devoting its entire copper supply to military purposes. No copper money is minted, and the resulting shortage in small change is already making itself visible in the requests posted in many retail stores, that customers give the exact change in payment. You hear of how carefully the copper from used ammunition is being saved; of the rounding up of all the available copper in every position captured from the enemy. You see women walking through the streets carrying between them copper kettles or gramophone horns to sell to the authorities. If you are a householder, you are invited to fill out long detailed forms describing everything you have made out of copper or brass and specifying whether or not the artistic or historical value of each piece is double the value of the raw material contained in it; for the German government has determined not to melt down anything that might be considered a work of art.

Precautions Against Shortage

From all these symptoms one might conclude, if not acquainted with German psychology, that Germany is face to face with a real copper famine. But all these measures, like the use of the bread-card, and the prospective milk card, are precautions against a shortage and not the confession of one.

At the outbreak of the war Germany had more than 75,000 tons of raw copper—much of it American copper—on hand in factories and warehouses. Measures were at once taken to increase the ouput from the German mines. In normal times they produce some 50,000 tons yearly.[1] Since the war began many of them have increased their production more than 50%. But the chief recourse of the military, in case of pressing need, will be the old copper. It is impossible to estimate exactly how much there is in a country which, like Germany, has been mining copper for a thousand years. Yet no doubt the German lust for statistics will be satisfied here as it is everywhere else. A few days ago the householders sent in to the proper municipal centers their blank forms all *regelmässig* filled out, and the necessary computations will be very quickly made.

The government has announced that it will begin buying up these articles, if it finds such a course necessary, by Nov. 16. It is not believed that these compulsory sales will actually take place in November, nor in six months from November, for the amount of copper which the government has already received through voluntary sales is said to be enormous. The price paid is an extremely good one—1.3 marks per kg.—that is, about 37c. for 2¼ lb. The German government which is, just now, poor in so many things, is, thanks to the unexpected success of its war loans, very rich in money. And its liberal payments for copper within the past year have enabled many a poor family to live for months on the proceeds of its own kitchen utensils.

One hears the hope frequently expressed on the part of housewives, and with a great deal of fervor, that these voluntary sales will make a later confiscation unnecessary. I have heard a woman discuss, with tears in her eyes, the possible loss of a copper and brass wash-tub which had cost her no end of time and trouble to keep clean, just as she might discuss the possible loss of a troublesome but dearly loved son on the field of battle. There is, in the German woman's love of her copper things, an intensity that is peculiarly racial. One feels as if, in some mysterious way, the Germans must belong to those races, like the ancient Persians and Egyptians, among whom copper, and not gold, was the royal metal.

As the German production of copper wares for home consumption has amounted in recent years to an average of 125,000 tons per annum, there is no question that the supply on hand is enormous. Not all of it, of course, is in private possession. There are hundreds of thousands of tons in street-railway wiring. And when, a couple of days ago, I put the copper problem to one of the persons most intimately concerned with the stretching of all Germany's resources, the answer was:

"Our roofs. Take a city like Dresden, where so many of the roofs are of copper. If we get hard up, we just have to go down there and take the roofs off a few *Rathhäuser* (municipal buildings) and we are saved." And there are many roofs in Belgium and in northern France which can also be used, if need be, for the same purpose.

And if the worst comes to the worst, a substitute can be used. To those who are familiar with copper and its peculiar qualities, this sounds like an impossibility. But

[1] The most authoritative statistics credit Germany with a copper production of 25,000 metric tons in 1913, which was larger than the average for several years immediately preceding. The official report of the Mansfeld mines, the principal producer, showed no increase in 1914.—Editor.

the German chemists and physicists during this war have obeyed the order "invent" in much the same spirit in which the German soldiers have obeyed the order "fire" or "charge." When a substitute for a thing has to be invented, it is invented. There have been invented since the outbreak of the war substitutes for rubber, for eggs, for wool, for meat, for leather, for string, for coal, for gas. In Germany the same word is used to indicate a substitute for a thing and a reserve regiment for the army—*Ersatz*. It is said that the substitute for copper has been found in a soft steel.

That it is not expected that a substitute for copper will be needed for a long time to come, however, is sufficiently proved by the fact that the copper mines of Germany are not being worked nearly as intensively as they might be, if the situation were considered serious. I visited the other day the Rammelsberg mine in the Harz Mountains, which belongs to the state. I found that it has had its working force materially reduced since the outbreak of the war and that there are only one and a half shifts a day, of eight hours each. The fact that in spite of this it now produces considerably more than before the war is due to a concentrating on the production of copper and cutting down materially on the mining of lead, of which, in peace times, four thousand tons was annually produced from ores taken from this mine.[2]

Romance of an Old Mine

The story of this oldest copper mine in Germany is full of romance. History has it that the mine was discovered and worked by the Franks in those distant days before the Germans understood the art of fashioning copper. But the tradition is that it was one of the knights of Emperor Otto First—the Ritter Ramm—whose horse laid bare some ore with a beat of its hoof. Traditions die hard in the Harz Mountains. The very price fixed by Emperor Otto for the carting of a wagonload of ore—nine pfennigs—holds to-day. And the miners of these days are said to be the direct descendants of the miners then. They cling to their peculiar superstitions, to their bizarre costume, to their custom of assembling in church every Monday morning before going into the mine, to pray for their safety while in the bowels of the earth, and to their ancient form of salutation *Glückauf!* which is a pious hope that you may return safely to the surface of the earth.

In the market place of Goslar, half a mile from the mine, and itself a thousand years old, is a great bell, on which the citizens used to beat whenever there was danger of attack, to call the miners out of the depths of the Rammelsberg mine to help in the defense. The bell is no longer rung. But the same obligation to give up their work at a moment's notice to help in the national defense is still on the men who work in this mine. Nor does the fact that this mine belongs to the state—a three-sevenths share belongs to the province of Brunswick, the remaining four-sevenths to Prussia—nor that these men are doing work essential to the defense of Germany make any difference. When the war broke out, every miner of the specified age, who could pass the physical examination, had to go. And only the fact that this mine happened, at the time, to be employing a large number of men past fighting age, saved it from serious embarrassment. I have been told that the miners are well thought of in the field. Most of them are assigned to pioneer regiments; but I have heard of one who—no doubt for variety's sake—joined the flying corps.

A German Mining Town

To speak of Goslar as a mining town might give a wrong impression, since it reminds one of a scene from "Meistersänger" or "Faust" rather than of the grimy streets of Butte or the abandoned shacks of Virginia City. But the city has lived for a thousand years from the steady flow of metal from this one mine; its history has largely consisted of battles between rival nobles for the possession of the mine; its fine old monasteries and churches were due less to a particularly religious spirit in the town itself than to the desire of the clergy to make quite sure of receiving their full tithe from the mine, by being on the spot. In the Middle Ages it was one of the most strongly fortified towns in Germany, completely walled, and defended by 180 towers (of which three are still standing) which could not have been built but for the wealth that the Rammelsberg mine brought into the coffers of the city. And the defense was carried on by nobles who had made the city their residence in order to seize some of the precious metals from the mine and—in a literal sense—make money out of them. For the mine still turns out as much as 75 kilos of gold and a hundred times that quantity of silver every year.[3]

The story of this German mining town is a sufficient answer to those Americans who claim that it is our "commercialism" that keeps us from being as "picturesque" as Europe. Goslar has attained its present distinguished appearance through the fact that it has been doggedly commercial for ten centuries. The very Kaiserhaus on the hill above the town, of which the Germans are so proud, would not have been built there had it not been for the mine, whose riches were the determining factor with Henry II (despite his sobriquet, "the Saintly") in fixing on Goslar as the capital of the "Holy Roman Empire" in the eleventh century.

I went into the mine itself, 450 yd. below the surface. No horses are used in the interior to carry out the ore—and no boys under 19, the German law fixing this age as the minimum for underground employment being strictly observed even in war time. [Some lines here have been cut out by the censor.] We went through miles of passages roofed by ore containing lead which looked like flashes of silver, copper which looked like streaks of gold, and zinc which looked like deposits of copper, past men boring into the sheer rock with compressed-air drills, past elevator shafts and emergency shafts.

As we were down below the very center of the mountain, one of the men from another mine who accompanied us, asked the manager of the mine whether he believed in the *Wünschelrute* (the divining rods by which, according to an old belief, it is supposed that one can tell where the rich deposits are). He himself, he said, was

[2]The Rammelsberg mine, a famous and interesting ore deposit, has never been aught than an insignificant producer of copper in modern times.—Editor.

[3]The author is here describing the mining customs of the Harz, an extensive and picturesque district, rather than of the Rammelsberg mine alone. That mine is in the lower Harz. Goslar and Oker are the nearest towns. In the upper Harz the best-known town is Clausthal, where there are numerous mines, the ore being taken to Lautenthal and Langelsheim in the lower Harz for smelting. All of these are classic names in mining and metallurgy, but like that of Freiberg in the Erzgebirge, their industrial importance waned many years ago.—Editor.

absolutely convinced that it has properties that are as good as magical. But the manager laughed.

"I believe only in my Bible," he said.

"Your Bible?" I asked.

"I mean the American *Mining Journal*," he said, smiling. "We all read it religiously. For years the rates cited in it, rather than the prices listed in the German journals, have been the basis of the German mining trade. Since the outbreak of the war, the English have kept all other American mining products from us."

The shoot of ore in this mine is wider than anywhere else in the world, is extremely rich in copper, in some cases yielding as much as 22% metal. But it is a comparatively small mine, employing, together with the Oker smelteries, with which it is affiliated, only about 2,000 men. This is far less than the Clausthal mine, in the Upper Harz, to say nothing of the mine at Mansfeld, the largest copper mine in Germany, and the one at Eisleben, in Halle, which also produces an enormous quantity of zinc and employs 10,000 men.

When we came up to the surface the "Mr. Mountain Inspector"[4] (as the manager of a mine is quaintly called), after showing me the various safety devices insisted upon by the German government, took me into a building where there was an apparatus which had been insisted upon—more or less indirectly—by the British government. It was a plant, just completed, for the manufacture of liquid air, which, as I learned, is being substituted for dynamite in all the principal mines of Germany, now that the supply of Chile saltpeter has been cut off.

Liquid Air for Explosive

The use of liquid air as an explosive has been known ever since the famous Professor Linde took out the first patent in 1895. It was used in the building of the Simplon Tunnel, and has been tried in a number of countries, notably France. But until very recently it was regarded as still in the experimental stage. Immediately upon the outbreak of the war it was put into practical operation throughout the German mining industry. The results have proved so successful that it is now certain that it will continue to be used in place of dynamite even after the war.

In the first place it is peculiarly safe. You can take a cartridge—as they call the little black mouselike bags—put it into the bucket of liquid air which, literally, steams with cold, until the cartridge has soaked up 90 gr. of it, and then, with the assurance that you are dealing with an explosive more than half again as powerful as the ordinary charge of dynamite, you can put it down and step on it, and the only result is a fizz as of so much steam. I saw five of these cartridges jammed with a stick into the holes drilled in the rock, just as if they had been so many wet rags. And then I saw the men running like mad, when the electric current was turned on and the pieces of rock began to fly.

The cheapness is another advantage. Over against 20 pfennigs, the approximate cost of a dynamite cartridge, one cartridge saturated with liquid air costs, at this Rammelsberg mine, only 12 pfennigs. And where it is made in larger quantities, the cost is even less. A whole new industry is in the process of development in Germany to manufacture and handle liquid air; and the principal firm, the Marsit Corporation, declares the cost of liquid air to be just one-half that of dynamite.[5]

[4]Berginspektor = mine inspector. The literal translation is more humorous than accurate, whatever be the derivation of the term.—Editor.

[5]The use of liquid air was described in recent issues of "Stahl und Eisen."—Editor.

Revision of Mining Laws

The meeting of the Mining and Metallurgical Society of America in collaboration with the American Institute of Mining Engineers, the American Mining Congress, the Idaho Mining Association, the Montana Society of Engineers, the California Metal Producers' Association, the Spokane Mining Men's Club, the Nevada Mine Operators' Association and the Colorado Scientific Society, together with representatives from several chambers of commerce and many operating mines, was well attended. Many delegates came from distant states, including South Dakota, Montana, Idaho, Oregon, California, Utah, Arizona and Colorado. Organizations unable to be represented communicated resolutions in approval of the purpose of the meeting.

The first session was called to order by W. R. Ingalls, president of the Mining and Metallurgical Society of America, who briefly stated the purpose of the meeting. The idea was to impress upon Congress the earnest wish of the mining industry that the archaic mining laws of the United States be revised; that a commission be promptly authorized for this purpose. In this program all of the mining societies and the mining press of the country had united. While the present meeting was being held under the auspices of the Mining and Metallurgical Society of America, the other national organizations and the several state societies had been invited to collaborate and were doing so; also the chambers of commerce in the mining towns of the public-land states; moreover, through the medium of the Bureau of Mines, every mine operator of the United States had been invited to participate.

The rules for the conducting of the meeting were then read and approved, and the appointment of the following committees was made: Credentials—J. F. Callbreath, George Collins and George C. Stone. Rules—J. Parke Channing, S. W. Mudd and Frank A. Ross. Resolutions—H. V. Winchell of Minneapolis, Minn.; E. B. Kirby, of St. Louis., Mo.; Hennen Jennings, of Washington, D. C.; Walter Douglas, of Bisbee, Ariz., and John Kirchen, of Tonopah, Nev.

The chair was then taken by Carl Scholz, president of the American Mining Congress, who introduced the first speaker, E. B. Kirby, of St. Louis. Mr. Kirby made a general presentation of the bad situation that has come to pass under the mining law of 1872, which for 43 years has stood unrevised, although the knowledge of ore deposits has increased enormously during that time.

Following Mr. Kirby, Hon. Franklin Lane, Secretary of the Interior, made some graceful remarks extolling the importance of the mining industry, welcoming the mining men to Washington, and in concluding stated that he would anticipate his forthcoming annual report by informing the meeting that he recommended a revision of the mining laws. "The old code," he said, "is so elaborate and complicated that the best of brains cannot tell what the law is. The truth seems to be that between mining engineers and mining lawyers the rules of the game

have been refined into obscurity; and if Congress were to say to the President that he might select three men familiar with mining laws and miners' difficulties to suggest a new mining code to Congress, it would, I believe, be giving in earnest a new freedom to the mining industry."

The next address was by Hon. E. T. Taylor, member of Congress from Colorado, who read the bill that he had introduced in the House of Representatives on Dec. 6 (H. R. 18) and explained its provisions. Mr. Taylor remarked that the total representation in Congress from the public-land states was but a small proportion of the membership: that the representation from the Eastern, Southern and Middle States is not much interested in such a question as mining law revision; that he is the only member of the committee on mines and mining who is from a mining state. Congress, he said, is becoming more and more averse to the creation of commissions. In his bill he had provided for an unpaid commission, considering that the House of Representatives would be more likely to agree to that than to a paid commission, and he for his part being hopeful that five men sufficiently patriotic to give their services to the Government would be found. The exemption of coal, oil, phosphate and potash lands from the scope of his bill was introduced at the request of the Administration, which has a well-defined program respecting them.

Mr. Taylor made a very excellent impression, both on account of his sincerity of purpose and his thorough knowledge of his subject. For the purpose of discussion the bill introduced in the Senate by Senator Smoot was also read.

A lively debate respecting the merits of the two bills ensued, especially with regard to the composition of the proposed commission and the having a general revision or having a revision with certain classes of mineral lands excluded. The general opinion appeared to be that the revision ought to be of the broadest character and that the commission should consist of mining men rather than mining lawyers.

F. F. Sharpless, secretary of the Mining and Metallurgical Society of America, introduced the resolutions that were to be offered by that society. By agreement of the meeting, other resolutions were read by title and referred directly to the committee on resolutions. That committee was also authorized to frame and introduce resolutions at a subsequent session.

The second session was opened at 2:30 p.m. with William L. Saunders, president of the American Institute of Mining Engineers, in the chair. The first speaker was the Hon. Reed Smoot, United States Senator from Utah, who made an impassioned address, voicing the demand of the mining industry that the archaic mining laws be revised. He explained the provisions of the bill that he had introduced in the Senate and announced that on that day it had been reported favorably by the committee on mines and mining and had been put at the head of the Senate calendar.

Following Senator Smoot, an address upon the need of revising the mining laws in the light of modern knowledge of ore deposits was made by Dr. George Otis Smith, director of the United States Geological Survey. J. Parke Channing then gave a talk, illustrated by lantern slides, upon the conditions existing in the Miami district of Arizona, illustrating a case where the law of the apex is utterly inapplicable and was abolished for the district by the common consent of the mining companies.

Horace V. Winchell then offered, in behalf of the committee on resolutions, the following that had been agreed upon by that committee:

1. The mining law of the United States should be revised, not piecemeal, but thoroughly, so as to coördinate and harmonize its various provisions.

2. For the purpose of giving the fullest consideration to the needs of every branch of the mining industry and every section of the country as affected by the mineral-land laws of the United States, it is desirable that a Government commission be created by Act of Congress, whose duty it shall be to investigate by every proper means the questions and interests here referred to, and to make recommendations as to a basis for the proposed mining-law revision.

3. That in order to represent the classes of men whose interests will be affected, the proposed commission should consist of five members: One representing the legal profession, one representing the Department of the Interior, and three men actively interested and experienced in mining and the acquisition and handling of mineral lands.

4. That this commission shall be selected and appointed by the President of the United States.

5. That this conference believes that the services of such a commission are deserving of compensation, as well as reimbursement for all necessary expenses, but is more concerned with the actual establishment of the commission and its character than with the question of emolument, and will gladly see the work done through an honorary commission if Congress deems it advisable.

6. That this conference expresses itself in favor of the creation of a permanent committee on mining-law revision, such committee to consist of five members from the Mining and Metallurgical Society of America, five from the American Institute of Mining Engineers and five from the American Mining Congress, and be appointed by these organizations. Such committee to have the power to select its own chairman and secretary and to add to its membership not to exceed 10 additional mining men or others interested in the subject for which the committee is created. The work of this committee shall be to further the interests of the mining industry through congressional action in accordance with the resolutions adopted at this conference; and its joint report shall be presented to each of the societies formally represented in its make-up.

There was a lively discussion upon the recommendation that one member of the proposed commission should be a representative of the Department of the Interior. Ravenel Macbeth, speaking for the Idaho State Mining Association, was violently opposed to this, saying that Idaho did not want any bureaucratic interference with the mining industry; that it had already had enough of it. Mr. Macbeth was supported by E. Percy Smith, of Wallace, Idaho. The other side was taken by J. Parke Channing, of New York, and by E. B. Kirby, of Missouri. Frank A. Ross, of Spokane, Wash., supported the views expressed by Mr. Channing and Mr. Kirby. When put to vote, the recommendation of the committee on resolutions was upheld by a large majority.

In the evening session the chair was taken by W. R. Ingalls, president of the Mining and Metallurgical Society of America. The first speaker was Horace V. Winchell, who delivered an exhaustive and scholarly address on the subject of ore deposits and the inapplicability of the extralateral law to many of them. He pointed out, moreover, many other failures of the law of 1872. Hon. Charles S. Thomas, United States Senator from Colorado, then made a brief but pertinent address from the standpoint of the mining lawyer, but one who is thoroughly in accord with the purpose sought by this meeting. In conclusion Senator Walsh of Montana delivered a carefully prepared speech in support of the need of revision of the mining laws on even broader grounds than the mischief of the law of the apex and the prerequisite of discoveries where honest discoveries cannot be made.

Editorials

Revision of the Mining Laws

The convention, or conference, of mining men that was held in Washington on Dec. 16 under the auspices of the Mining and Metallurgical Society of America was a noteworthy event, especially for its exhibition that all of the mining organizations of the country—both national and state—could and would unite for a common purpose; next for the unanimity of opinion respecting the particular object of the meeting that was displayed; and finally for the effectiveness that the meeting promises to have. The hall in which the several sessions were held was so commodious that the attendance did not appear to be so large as it really was. Yet it was really remarkable that so many mining men came to it from distant parts of the country. As the reports are carried home the after-effects will become even more important than the immediate ones. The debates in the Washington meeting were less spirited than they would have been if there were less unanimity of opinion.

It is known now, beyond peradventure, that the men engaged in the mining industry in the public-land states want the mining laws revised and codified as a whole; that they want this to be done by Congress upon recommendations by a competent commission after thorough study of the subject. These points were embodied in resolutions offered by the Mining and Metallurgical Society of America. The American Institute of Mining Engineers had previously adopted the same resolutions. The American Mining Congress had formally expressed itself to similar effect. The resolutions had also been officially approved by several state mining societies.

It was made clear, moreover, that the mining men of the United States in great majority want abolition of the law of the apex and of the law making discovery a prerequisite to location. Many of the state mining societies had also followed the Mining and Metallurgical Society in those particulars, but the council of the latter had decided not to press its own action in those matters, regarding it as being incompatible with the major purpose; that is, the securing of a commission to revise and codify the mining laws as a whole. It was not deemed fitting to ask for such a commission and say in advance what it was expected to do. The expressions of opinion on these subjects that have previously been made will surely have great weight, however, in the minds of any commission that may be appointed.

The bills that have already been introduced in Congress by Senator Smoot of Utah (Senate, 52) and Mr. Taylor, of Colorado (H. R. 18), crystallize the issue. Both of these bills provide for the preparation of a tentative code of laws governing mining lands and rights by a commission to be appointed by the President, but they differ in important particulars. Senator Smoot's bill provides for a paid commission of three members, "two of whom shall be lawyers of large experience in the practice of mining law and one a mining engineer who shall have had practical experience in the operation of mines," and the scope of the commission is unrestricted. Mr. Taylor's bill provides for an unpaid commission of five members, "who shall be selected because of their recognized experience in, or knowledge of, the mining industry and mining law;" and the laws relating to coal, oil, phosphate and potash lands are excluded from their consideration.

Both Senator Smoot and Mr. Taylor said frankly that certain of their provisions were framed out of considerations of policy and did not necessarily exemplify their personal views. Therefore criticism of these points may be made without any fear of hurting the feelings of their sponsors. Indeed, Senator Smoot declared from the platform that his chief desire was to have revision, and that no controversy over the way of going about it should be permitted to defeat the purpose. He was of the opinion, however, that the Government of the United States should not make it impossible for any man to serve upon such a commission owing to inability to give the time to do so; nor should it ask of any citizen such a favor as the gift of his time. Mr. Taylor, on the other hand, is of the opinion that the House of Representatives will not agree to a paid commission. However, both his bill and Senator Smoot's provide for $25,000 for expenses in the aggregate. Senator Smoot would have the commission draw $18,000 in salaries, leaving $7,000 for traveling, clerical and printing expenses, etc., while Mr. Taylor would have $25,000 available for those purposes.

With regard to the composition of the commission, Senator Smoot provides for a membership of three, two of them mining lawyers, which he said was in conformity with the ideas of Senator Walsh, chairman of the Senate's Committee on Mines and Mining, while Mr. Taylor would simply have five mining men.

These subjects and others were debated in the Washington meeting. The committee on resolutions made the recommendations that the commission should consist of five members, of whom one should be a mining lawyer, one a representative of the Department of the Interior and three men experienced in mining. As to remuneration the committee was of the opinion that whatever Congress could agree upon would be satisfactory to the mining industry, or at least that difference in ideas over that matter should not stand in the way of action. This report was adopted by a large majority, although there was dissent by the Idaho delegates respecting representation of the Department of the Interior. The action of the convention in these matters was broad-minded and rational, whatever might be the individual views.

On one matter neither the committee on resolutions nor the convention as a whole expressed itself so clearly as it might have done, namely, the question of the scope of the commission. It had previously been pointed out in discussion that the exclusion of coal lands and phosphate lands would create uncertainty and dispute with respect to cases where coal and phosphate rock occur in

connection with metalliferous minerals, while moreover, it is illogical—and probably not intended—to exclude potash deposits and not to exclude soda deposits. The convention confined itself to the opinion that the mining laws should be revised in whole, wherefore, it is to be deduced that the review by the commission should comprise all sorts of mineral deposits—iron, copper, coal, oil, alkali and everything—but this opinion was not clearly defined.

Speaking for itself, the *Journal* is of the opinion that Mr. Taylor's bill is a better bill than Senator Smoot's. It provides for a commission of five mining men. If the men engaged in the mining industry should speak out without any considerations of politics, diplomacy and the getting of what they want by giving up something different, we think they would say that this is purely a mining question. Let it be attended to by mining men. They can employ lawyers for the legal advice that is necessary. With the commission recommended by Mr. Taylor, we should probably get a better piece of work than by the commission recommended by Senator Smoot. The most objectionable part of Mr. Taylor's bill is the exclusion of coal, phosphate, oil and potash lands from general mining-law revision. Such exclusion is in deference to the Administration, which has another program with regard to those lands. If such exclusion there must be, the language that effects it ought to be carefully considered. We know of gold placer deposits occurring above coal seams, of gold occurring with alunite (a potash mineral), and of mines that are worked both for metals and for apatite (a phosphate mineral). One of the greatest mining litigations in this country, one that was longer drawn out than any of the apex cases and was more costly than most of them—we refer to the Franklin Furnace litigation in New Jersey—arose from the deeding of one kind of mineral to one man and another kind to another man, both occurring in the same vein. The Administration and Congress ought to be exceedingly careful about excluding certain kinds of mineral deposits from a general revision of the laws.

Villa Gives Up the Fight

Villa's admission that he is beaten and his proposal to seek refuge in the United States is the most hopeful thing for Mexico that has happened in many years. Heretofore as soon as any patriot has succeeded in casting out the usurper, one of his followers has risen to repeat the process. So it was with Villa, but instead of carrying on the thing indefinitely, he gives in at last and lets his country have a chance for peace. In so doing, he will make a greater name for himself in history than he would as a bandit. Already he gets such recognition as this from the *Evening Post:*

> Villa's acknowledgment that the game is up is formal recognition of a fact that has been patent for some months. It marks the end of an epoch and the beginning of another which will be signalized with due pomp when Carranza enters Mexico City and sets to work at the reconstruction of Mexico with the good will of the nations. For the moment our interest attaches to the flitting from the contemporary stage of one of its most picturesque characters. "Pancho" Villa, the outlaw, who came within striking distance of the Presidency of Mexico, the bandit who developed into a military genius, represented in his own person the raw capacities of the Mexican people for good and evil. He was the peon to whom the policies of Diaz denied the opportunity for developing into a contented and prosperous citizen of his country. It has been a romantic career. Yuan Shi-Kai, who has won an emperor's crown, set out from the high position of governor of one of China's greatest provinces, and has traversed the interval in 15 years. If we measure the distance from Villa's starting point to where he stood at the height of his power, the record is no less impressive. Nor does the picturesque record suffer from the fact that the outlaw Villa rose to fame on the crest of a great cause, that he will go down in history as one of the avengers of Francisco Madero and a vindicator of the cause of Mexican democracy.

In this there is a good deal of truth, although we have some doubts about the "cause of Mexican democracy." However, the great thing is the prospect that warfare in worn-out Mexico, is ended, in spite of the unregeneration of Zapata and the silly plotting of Felix Diaz. Let us hope that Don Venustiano will be reasonable in his decrees and will not tax the miners more than they can bear or compel the bankers to redeem their current notes with gold before they have any gold to do it with. American mining men are already hurrying back to Mexico, and without any doubt they will soon be active in their operations.

Tungsten and Molybdenum

One of the most spectacular advances in commodity prices occasioned by the war has been in tungsten, both metal and ore. This has been due to the extraordinary demand for tungsten steel—an essential constituent in making high-speed tool steel. The manufacture of immense quantities of military material has required greatly increased quantities of tool steel, and consequently corresponding quantities of tungsten: hence the advance in price for it.

Before the war high-speed tool steel was worth about 70c. per lb., tungsten about 60c. per lb. and tungsten ore about $6 per unit. At present high-speed tool steel fetches about $3 per lb., tungsten about $5 per lb. and tungsten ore about $50 per unit. Even at the enhanced prices supplies are scarce.

The fabulous price for tungsten ore has stimulated prospecting for it throughout North America and South America. This ore is not known to occur in large deposits. The annual production of concentrated ore in the United States previous to the war was only about 1,400 tons. However, this ore has now become so valuable that the discovery of a deposit that affords a single carload is the finding of a fortune. A ton of ore assaying 60% tungsten trioxide—the standard commercial grade—at $50 per unit is worth $3,000: a carload of 40 tons would be $120,000. So precious is this ore that the assay offices are being scoured for specimens. Brokers do not sneer at trade in one-pound lots. The purchasing agent of the Crucible Steel Co. is very grateful if somebody can give him 100 lb.

A contributory factor in the production of this situation was the utter stupidity of the British authorities. They fought the advance from the beginning. When they were offered some tungsten ore, they came back with a lower bid—trying to dicker in what was not a dickering market—and naturally failed to get what they wanted. Then they practically commandeered the supply of tungsten ore in the British Empire, appointing official brokers and fixing a price of 55s. per unit, or about $800 per 2,000 lb. of 60% ore if exchange be figured at 4.86. Previous to the war that would have been regarded as a fine price, but the producer in Australia, Burma, Malaya and elsewhere does not think very much

of it when the same grade of ore is fetching $3,000 or so per ton in America. Patriotism does not go quite so far as that. His policy appears to be to restrict production until such time as the authorities may raise the price, which he believes they will have to do. In so forecasting the future he is a better economist, we are inclined to think than is the bureaucrat in London.

In the meanwhile there is relief immediately at hand if the manufacturers of tool steel would only avail themselves of it. We mean the substitution of molybdenum steel for tungsten steel. It is well known that molybdenum steel has excellent qualities of more or less the same character as tungsten steel. There is an extensive literature on this subject to which the tool-steel maker may refer. It is indeed claimed by some authorities that molybdenum steel is superior in certain respects to tungsten steel. The chronic reluctance of manufacturers to get out of the beaten tracks is offered as an explanation of their blindness to the merits of molybdenum steel. But even if it were not preferable with tungsten at 60c. per lb., it might be when that metal is more than eight times as high.

The point is that molybdenum ore and the products thereof are now a drug in the market. While the tungsten mines are being worked at the limit of their capacity, the molybdenum mines have had to be closed, and the smelters of molybdenum ore are carrying large unsold stocks of the products that probably they would be glad to sell at cost. The manufacturers of tool steel and the British authorities are recommended to give some attention to this situation.

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According to an evidently inspired article in one of the financial papers, the Alaska Gold Mines Co. is going to stop increasing the tonnage sent to the mill at the expense of grade of the ore and for a while will make tonnage secondary to a grading of the ore. By February it is hoped to have the mill running on $1.50 ore. The delivery of the ore to the mill will be increased later as rapidly as the development of the mine will permit it. The experience of the Alaska Gold Mines Co. is another example of the principle that the opening of a mine so as easily to furnish 10,000 tons of ore daily is more of a job than the building of a mill to treat it.

BY THE WAY

An unusual consignment of gold from China was received recently at the Assay Office in New York City, says the New York *Times*, consisting of a single bar of fine gold worth about $600 in a bamboo covering. It came from the agency of the Guaranty Trust Co. in Shanghai and was credited to that institution. The hollow of a length of bamboo was utilized as a natural safety carrier for the 4-in. bar, one end being sealed by the joint and the other with wax. The valuable package came by registered mail. There have been numerous shipments of gold from China to this country this year, but most of them have been directed to the San Francisco Mint.

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Roland was green but willing. His resolve to "follow mining" led him to Colorado, where he obtained a job as assistant to a deputy mineral surveyor. The first day out he was informed that the work immediately in hand was to "tie" certain indicated tunnels and assessment pits to a mineral-monument base line. Whereupon he gazed mournfully up toward the summit of Republican Mountain and then toward the village of Silver Plume, meanwhile fumbling a ball of plumb-bob twine that he fished out of the kit, remarking, "Then I better hurry down to the store, hadn't I?" "What for?" inquired his employer. "Well," rejoined Roland, "it will take a damned sight more string than I can find in this bag."

⁂

The safety-first movement has reached the stage of education through slogans, says the Boston *News Bureau*. Safety-first literature teems with them. The walls of workshops are covered with them. Among the following, drawn from the Inland Steel Co. and other sources, employers might select an assortment:

Keep out of debt and danger. Both are alluring, yet poor friends to make.

Peace, prosperity and good health depend on the selection and proper preparation of normal food material.

The difference between a wise man and a fool is the fool's mistakes never teach him anything.

The thinker will not drink. The drinker cannot think.

Any fool can take a chance. It takes brains to be careful.

It takes only a moment of carelessness to cause a lifetime of suffering.

When hurry interferes with safety, cut out the hurry.

⁂

Two powerful American trench-digging machines, says the *Scientific American*, have been in operation for some time at the Canadian camps, where men who will ultimately be sent to the fighting front are being trained. These men are already thoroughly acquainted with life in the trenches, but the trenches have been dug for them by the American machinery referred to, thus relieving them of the hard shovel-work. This innovation was originated by General Sam Hughes, commandant of the Canadian militia, and has proved to be quite successful. At one of the camps two of these machines dug seven miles of trench, 5½ ft. deep, with a 2-ft. bottom, in 10 days. They are readily moved about under their own power and dig trenches of any reasonable depth or width with straight or sloping sides.

⁂

Many contradictory tales have been heard concerning the unobtrusive woman who, in 1885, discovered the principle of oil flotation, in Denver. Since her invention has attained fame, technical men have sought to establish her identity and to give her proper recognition. Recently such efforts—especially those of Howard C. Parmelee, secretary of the Colorado Scientific Society—have brought tangible returns, and it is now established that this lady was not a spinster school teacher, as commonly stated, but the wife of a practicing physician. Her full married name was Carrie Jane Everson, and she occasionally undertook nursing cases in her husband's practice. Since the discovery that she was the wife of a scientific man, it has been assumed that the doctor was largely responsible for the flotation invention, but a telegram received in Denver recently from the son, John L. Everson, of San Anselmo, Calif., reads: "Mother alone invented flotation process. Father assisted in securing patents." While the application of this process has been world-wide, Colorado is coming in for such pronounced benefits from it that there exists a local desire to perpetuate the name of Mrs. Everson.

PERSONALS

J. R. Finlay has returned from Missouri.

B. B. Thayer has returned from Montana.

The offices of Philipp Brothers are now at No. 29 Broadway, New York.

Kirby Thomas, of New York, is examining mines in the Casa Grande district in Arizona.

L. L. Middlecamp superintendent of the Ellamar Mining Co., Alaska, is in the States for the holidays.

H. A. Guess has returned to New York after an extended visit to the Braden and Chiquicamata mines in Chile.

Richard Roelofs, general manager Cresson mine, Cripple Creek, Colo., has returned there from Oatman, Arizona.

J. W. McKim, formerly of Salt Lake City, but for some years back in the Transvaal, has arrived in San Francisco.

W. L. Cumings, of the Bethlehem Steel Co., has returned to South Bethlehem after spending four months in Chile and Peru.

E. A. Cappelen-Smith has been elected a director of the Chile Copper Co. and the Chile Exploration Co. He has gone to Chile.

W. R. Van Evera consulting engineer for the Hill Mines Co. on the Cuyuna Range, has returned to Virginia, Minn., after a visit to New York.

S. D. Bridge, who for the past 26 years has been interested in mining in Mexico, returned to Monterey Dec. 11 after an absence of over two years.

J. H. Plummer, president of the Dominion Steel Corporation, who has had a severe attack of illness, has recovered sufficiently to attend to business.

J. Norman Sherer, of Bellefonte, Penn., has been made superintendent of the blast furnaces of the Reading Iron Co., Reading, succeeding Albert Broden.

L. W. Trumbull is now in the oil fields of southern Illinois. He will be at the Raleigh, Washington, D. C., during the meeting of the Geological Society of America.

Alfred B. Iles, of the Alaska Copper Corporation and Iles Power, Water and Light Co., is in the States on his vacation. He is located at Strelna on the Copper River Ry. in Alaska.

Charles A. Sulzer has taken over the lease of the Alaska Industrial Co. at Sulzer and in future will handle the mine personally. This copper mine has been a continuous producer for 14 years.

Charles Andrews, a well known prospector has returned to Winnipeg from the Gold Lake district where he made important discoveries and staked a number of claims for the Harris syndicate of Winnipeg.

Col. Thomas Cantley, president of the Nova Scotia Steel and Coal Co., who has been prominent in connection with the work of the Canadian Shell Committee, will shortly leave for England and will probably make a six months' stay.

Frederick Peiter has severed his connection as coke oven engineer with the Gas Machinery Co., Cleveland, Ohio. For the past three years he has been engaged in the designing and development of the company's top burner regenerative coke oven.

Among the western mining men attending the conference on revision of the mining laws at Washington on Dec. 16 were George A. Collins, of Denver; John Kirchen, of Tonopah; E. Percy Smith and Ravenel Macbeth of Wallace, Idaho, and S. W. Mudd, of Los Angeles.

Lorne A. Campbell has been appointed Minister of Mines in the newly formed administration of British Columbia. He is one of the leading business men of the interior of the province and has had a wide practical experience in connection with mining and power development.

Henry M. Payne, left London on Dec. 11, on his way to Petrograd, where he expected to arrive about Dec. 20. He will attend further sittings of the Committee of Technical Experts to the Lena-Lenskoie controversy, and expects to return to London and sail for America in January.

Charles E. Duncan, who has been superintendent of the old Cambria works at Johnstown, Penn., has been appointed general superintendent of the Donner Steel Co. and has entered upon his duties at Buffalo. He went to Johnstown from the Carnegie Steel Co. and previously had been superintendent of the Algoma Steel Co. plant at Sault Ste. Marie.

Secretary Lane has ordered the transfer of R. B. Marshall, chief geographer of the Geological Survey, to the position of superintendent of the National Parks, effective at once, and to continue during the balance of the fiscal year. Sheldon Tatum has been designated acting chief geographer, and he will continue to serve as geographer in charge of the Rocky Mountain Division.

W. L. Smith, manager of the Mountain King Mining Co., Valdez, Alaska, went to the property with a companion late in October to inspect workings. His companion returned a few days afterward and Smith was expected to follow in five days. On Nov. 17, three weeks later, nothing had been heard of him and searching parties are now looking for him.

OBITUARY

Frank Howard Bailie died in Pittsburgh, Penn., Dec. 14 aged 44 years. He was born in Freeport, Penn., but spent most of his life in Pittsburgh. He had been for 27 years past connected with the H. K. Porter Co., of which concern he was assistant sales manager at the time of his death. He leaves a widow and one son.

Sidney E. Bennett died in Denver, Colo., Dec. 11, aged 33 years. He was graduated from Colorado College and in 1903 established offices in Denver. He was born in Brookfield, Mo., but went to Colorado when a young man. He was widely known among mining men in that state and throughout the Rocky Mountain region, in which he traveled extensively. For several years he represented the Hill Publishing Co. in Colorado.

Abraham Overholt Tinstman died at Turtle Creek, Penn., Dec. 14, aged 81 years. Born and brought up at Broad Ford, Penn., he was one of the first to enter into the coke business in the Connellsville region 50 years ago. He was a partner with Henry Frick in starting in the coke business at Broad Ford and Mt. Pleasant, and later he organized the Connellsville Coal and Iron Co. He continued in the coke business until a few years ago when he retired.

Richard Henry Lee died at Lebanon, Penn., Dec. 8, aged 56 years. He was born in Pennsylvania and graduated from Lehigh University. Soon afterward his father put him in charge of the cold-blast charcoal furnaces of the Logan Iron and Steel Co., at Burnham, Penn., where he remained for six years. Later he was in charge of blast furnaces for the Colorado Fuel and Iron Co., the Tennessee Coal, Iron and Railroad Co., the Alabama Steel and Iron Co., the Lackawanna Steel Co., and the Shenandoah Iron Co. For three years past he had been superintendent of Lebanon furnaces of the Pennsylvania Steel Co., and consulting engineer for Dunbar Furnace of the American Manganese Manufacturing Co. He was a close student of blast-furnace operations and a successful experimenter, solving many problems in the management of the blast furnace. He was noted for his kindness, especially to younger men, and made many warm friends among his associates. He was a member of the American Institute of Mining Engineers, the American Iron and Steel Institute and the Engineers' Society of Western Pennsylvania. He contributed many valuable papers to the technical press and to the "Transactions" of the Institute of Mining Engineers. He leaves a widow and one son.

SOCIETIES

Teknik Club meeting, Denver, Dec. 14, was addressed by J. M. Simpson on "The Calcination of Zinc Carbonate," and by H. B. Barnes on "Excessive Costs of Caring for Mental Defectives."

Society of Chemical Industry—The regular meeting of the New York section was a joint meeting with the Chemists' Club held at Rumford Hall, New York. The evening was devoted to a lecture on "The Production of Radium from Carnotite," by Dr. Charles L. Parsons, of the Bureau of Mines, Washington, in which he gave an account of the plant which has been erected in Denver, for this work.

Colorado School of Mines has begun the publication of a monthly press bulletin, containing items of interest to the readers of mining publications. During the president's visit to San Francisco he arranged for the purchase of numerous new pieces of equipment for the school's ore-testing plant, including a 10-ton Oliver continuous filter. A Flowers viscosimeter for testing flotation oils has also been purchased.

Geological Society of America—The annual meeting of this society will be held jointly with the Association of American Geographers in Washington, Dec. 28-Jan. 1. Dr. T W

Vaughan, of the Geological Survey, is chairman of the committee on arrangements. A. H. Brooks, F. L. Ransome and P. S. Smith are chairman of subcommittees under Dr. Vaughan. This committee has gone to a considerable amount of work to arrange for a successful meeting.

University of Idaho—The School of Mines will offer during the months of January and February, 1916, a short course for prospectors, miners and millmen. The subjects treated will include prospecting, mineralogy, mining geology, mining, metallurgy, ore dressing and concentration, and milling. There are no fees in connection with any of these courses, and instruction is free. The work is laid out especially for mature men who desire to make the most of their time during this brief period.

Iron and Steel Institute—A circular from the London office says that the Council announces that the annual meeting has been fixed to take place on May 4 and 5, and the autumn meeting on Sept. 21 and 22, 1916. Both meetings will be held at the rooms of the Institution of Civil Engineers, Great George St., Westminster, London. Sir William Beardmore will be inducted into the chair as the new President of the Institute, in succession to Dr. Adolphe Greiner. The Bessemer Gold Medal for 1916 will be presented to F. W. Harbord, honorary consulting metallurgist to the Ministry of Munitions. It has been decided not to hold an annual dinner next year.

Colorado Scientific Society held its regular monthly meeting Dec. 4. The attendance and interest in the society is better this fall and winter than it has been for several years past. Prof. Herman Fleck, of the chemistry department, Colorado School of Mines, read a paper on "Molybdenum," this being the second in a series of four lectures on rare metals to be delivered by him this season. He covered the technology and development of this metal. The series will be eventually published as a bulletin. This was the meeting at which nominations for officers were made and the following were duly nominated for 1916: President, Howard C. Parmelee; first vice-president, Thomas B. Stearns; second vice-president, Frank E. Shepard; treasurer, John W. Richards; secretary, Arthur J. Hoskin. S. A. Ionides and Victor G. Hills were nominated on the executive committee.

University of Illinois—To extend and strengthen the field of its graduate work in engineering, the University of Illinois has since 1907 maintained 10 research fellowships in the Engineering Experiment Station. These fellowships, for each of which there is an annual stipend of $500, are open to graduates of approved American and foreign universities and technical schools. Appointments to these fellowships are made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the master's degree will be granted. Not more than half of the time of the research fellows is required in connection with the work of the department to which they are assigned, the remainder of the time being available for graduate study. Nominations to fellowships, accompanied by assignments to special departments of the Engineering Experiment Station, are made from applications received by the director of the Station each year not later than Feb. 1. These nominations are made within the month of February by the station staff, subject to the approval of the faculty of the Graduate School and the president of the University. Appointments are made in March, and they take effect the first day of the following September. Vacancies may be filled by similar nominations and appointments at other times. Nominations to these fellowships are based upon the character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following their undergraduate work. The Engineering Experiment Station, an organization within the College of Engineering, was established in 1903 for the purpose of carrying on investigations in the various branches of engineering, and for the study of problems of importance to engineers and to the manufacturing and industrial interests of the State. Research work may be undertaken in architecture, architectural engineering, chemistry, civil engineering, electrical engineering, mechanical engineering, mining engineering, municipal and sanitary engineering, physics, railway engineering, and in theoretical and applied mechanics. The work of the Station is closely related to that of the College of Engineering, and the heads of departments in the College constitute the administrative station Staff. Investigations are carried on by the members of the staff and other members of the instructional force of the College of Engineering, by special investigators employed by the Station, and by the Research Fellows. By action of the Board of Trustees on Mar. 9, 1915, four additional research fellowships were created in the Engineering Experiment Station, making 14 in all.

INDUSTRIAL NEWS

Among the orders recently booked by the National Transit Pump and Machine Co. is one for three of its new type of Diesel oil engines. These are to be installed in the Joplin zinc district and will be an innovation in prime movers in that field. The Flannery Zinc Co. of Sareoxie, Mo., will use a 200-hp. Diesel oil engine to drive its mill. Another of 150 hp. is to be direct-connected to a Sullivan air compressor. A third engine and pump are to be used in dewatering its mines and will be the first Diesel engine pumping unit to be installed in the Joplin district. The pump barrels will be 30 ft. below the surface while engine and pump will be above ground, a new method of installation in which the National Transit people are the pioneers.

The Diamond Power Specialty Co., manufacturer of Diamond soot blowers to suit every type of boiler, has announced an interesting prize article contest for the four best articles submitted on the subject of mechanical soot blowers. One hundred dollars in gold will be distributed, divided as follows: First prize, $50; second, $25; third, $15; fourth, $10. The contest is open to all consulting and operating engineers and to engineers-in-charge. Articles must be written on one of the following subjects: (A) What the mechanical soot blower has done toward greater economy and efficiency in the power plant; (B) The mechanical soot blower versus the hand method; (C) Why I indorse the use of mechanical soot blowers; (D) Why I have changed my attitude in favor of mechanical soot blowers. Only one article will be accepted from each contestant. No article less than 1,000 words in length will be accepted and articles should not be more than 5,000 words in length. Articles must be in the hands of the Diamond Power Specialty Co., Detroit, on or before Mar. 1, 1916. Articles must be written in ink, or typewritten, on one side of an 8½x11-in. sheet, or near this size. The Diamond Power Specialty Co. reserves the right to use any of the manuscripts in any way it chooses. The first four prize-winning articles will be published. No article accepted for competition unless proper entry is made before the article is submitted. Articles should be sent rolled or flat, not folded. Entry blanks and further particulars may be had by addressing the Prize Article Contest Department, care of Diamond Power Specialty Co., Detroit, Mich. Names of the prize winners will be announced in this publication.

NEW PATENTS

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

ALLOY—Metal Alloy of Iron, Cobalt and Manganese. Richard H. Patch, Philadelphia, Penn. (U. S. No. 1,162,186; Nov. 30, 1915.)

ALLOY of Copper, Nickel, Vanadium, Spelter, Tin and Aluminum. Charles Ramsden Denton, Sheffield, England. (U. S. No. 1,162,226; Nov. 30, 1915.)

BLAST-FURNACE SLAGS—Improvements in the Utilization of Blast-Furnace Slag and in the Recovery of Product Therefrom. T. Twynam, Redcar, Yorks., Eng. (Brit. No. 20,258 of 1914.)

CONCENTRATORS—Head-Motion for Concentrators. John F. Isbell, Los Angeles, Calif., assignor to Orren Allen, Denver, Colo. (U. S. No. 1,163,345; Dec. 7, 1915.)

DRILL-ROD EXTRACTOR. William Schildwachter, Walworth, Neb. (U. S. No. 1,163,560; Dec. 7, 1915.)

DRILLS—Improvements in Power-Driven Rock Drills. M. Kellow, Penrhyndeudraeth, North Wales. (Brit. No. 11,564 of 1915.)

ELECTRIC FURNACE. Carl Hering, Philadelphia, Penn. (U. S. No. 1,162,773; Dec. 7, 1915.)

ELECTRIC FURNACE. James M. Lohr and Horace W. Gillett, Ithaca, N. Y. (U. S. Nos. 1,162,178 and 1,162,179; Nov. 30, 1915.)

FUEL—Powdered-Fuel Feeder. Walter L. Caven, Cincinnati, Ohio, assignor of one-half to Walter Macleod, Cincinnati, Ohio. (U. S. No. 1,162,221; Nov. 30, 1915.)

FURNACE—Ore Furnace. Howard F. Wierum, Upper Montclair, N. J. (U. S. No. 1,162,894; Dec. 7, 1915.)

HEAT-INSULATING MATERIAL. Clarence P. Byrnes, Sewickley, Penn. (U. S. No. 1,162,450; Nov. 30, 1915.)

HOISTING—Locking Device for Hoisting Apparatus. William Rutan, New York, N. Y., assignor to Gillis & Geoghegan, New York, N. Y., a Firm. (U. S. No. 1,163,176; Dec. 7, 1915.)

LEACHING—Process of Treating Metallic Ores. Axel Estelle, Hagen, Westphalia, Germany. (U. S. No. 1,162,150; Nov. 30, 1915.)

MAGNETIC SEPARATION—Improvements in Magnetic Separation. Stephan Bruck, Charlottenberg, Germany. (Brit. No. 20,551 of 1914.)

Editorial Correspondence

SAN FRANCISCO—Dec. 15

Modoc County Miners are showing a persistence that should be rewarded. The Sunshine and the Modoc mines in Highgrade district have laid in winter supplies and are determined to proceed with development and extraction of shipping ore during the winter. Several other companies are getting their affairs in shape to resume active operation next spring. The miner who has faith enough in his mine to lay in a supply of provisions and material to keep his property going through a winter in Modoc county, is entitled to large returns on the investment of money and energy. Besides the operation in Highgrade district there is very little mining being carried on in Modoc county. When the district was first opened up three or four years ago a boom was started which was not warranted and which gave the camp a black eye and discouraged a number of investors who otherwise would have been of value to the camp. But some men who were pioneers in Highgrade are sticking to it with determination.

Amador County Merchants are proposing a bond issue of $250,000 for good roads. The county is paying out from $20,000 to $25,000 a year on roads, and as this amount would be sufficient to meet the interest on the bond issue, and provide for sinking fund, the bond plan would provide the needed highways without increase of taxes. The matter was considered at a meeting of the merchants at Plymouth and the recomendation was made by a former chairman of the board of supervisors. All the merchants present indorsed the plan and it is believed that the bond issue will be voted upon early in 1916. The annual payroll of the mines and other industries in Amador County amounts to $1,250,000. The transportation facilities are chiefly confined to the Amador Central Ry. running between Ione and Martell. This road is not available to all parts of the county, and supplies for the mines must be taken in by way of Ione or Latrobe and wagon-hauled to the mines. In some cases motor trucks are used. But the roads are not in good order for either motor trucks or wagons. With a good highway from Jackson, Sutter Creek, Amador City, Dry Creek and Plymouth, thence to Sacramento the merchants claim their transportation costs could be reduced by moving of water-borne freight from Sacramento by motor trucks. The proposed road work would include 13 mi. to connect with the Sacramento County line at which point connection would be made with the road leaving Sacramento by the way of Slough House. At present there are 15 mi. of this road beyond Walsh station in Sacramento County that would have to be paved before the highway could be completed and ready for use through from Sacramento to Jackson. There is little doubt that Sacramento would do this necessary work as direct haulage from Sacramento to the mines would be an important feature, well worth the expenditure.

BUTTE—Dec. 16

Increased Activity in the Philipsburg District following recent rise in silver is reported. Prominent among developing companies are Mondamin, which during past season has expended for equipment and mining over $22,000. Among leasers, Courtney Bros., operating Coyle property in Hasmark, has successfully exploited silver-lead deposit from which they have made several shipments of pay ore. McLure Bros. operating Sunrise property at Henderson, has recommenced shipment of copper ores from that property. Various leasers on ground of Philipsburg Mining company at the Hobo, Trout and other claims, have shipped cars of ore running as high as 10% copper and others as high as 100 oz. silver. Johnson and Thomas who have a lease on Gold Reef in South Boulder district have installed a cyanide plant that is successfully treating gold ores from that property. Granite Bi-Metallic Consolidated Co. has inaugurated campaign of surface and underground prospecting to disclose any heretofore unknown orebodies. During the last year company's property has been a continuous producer and has shipped over 300 cars of ore of all classes.

DENVER—Dec. 17

Cripple Creek District's Production for December is estimated at 83,550 tons, making year's output 982,697 tons of a gross valuation of $16,135,164. This means an average monthly production of about $1,345,000, which closely tallies with December figure. The lowest production for the year was in January when it was $1,121,884: The highest was in March, $1,986,493. The greatest tonnage in a single month was 92,175 for October.

A Reduction in the Treatment Rates at the two big custom mills at Colorado City—the Portland and the Golden Cycle will be announced soon, it is said. This will lessen the nominal treatment charge on low-grade Cripple Creek ores by $1 per ton, the new rate being $2. Heretofore, milling companies have paid the freight which averages about 50c. per ton; but, under the new terms, the shipper will pay his own freight, so that the proposed change really means a saving to him of about 50c. per ton, while the treatment rate is really lowered only the same amount.

Boulder County's Mineral Statistics for 1915 have been estimated by the Boulder Commercial Association and announcement is made that tungsten leads, by far, in the output of minerals—viewed from the standpoint of value. It is believed the year's production of this kind of ore will be about 1,440 tons with a valuation of $1,687,300. This ore, therefore, would appear to have averaged more than $1,170 per ton. A "dicker" between a miner and a purchaser of this class of ore last week resulted in the closing of a sale of a small lot of high-grade stuff at $60 per unit.

Breckenridge Used to be Famous as a producer of handsome specimens of free gold. Many remarkable pockets were encountered in the early days but not much has been heard of such bodies for a good while. Interest in them has been revived by the recent opening of a bonanza in the Dunkin mine on Nigger Hill, where leasers took out 240 lb. of stuff said to average $6% fine gold beside much second-grade material worth about $1,000 per ton. The pocket will probably show a production of $40,000.

Idaho Springs Shows More Activity than for a decade past. This pretty little mountain city has, recently, been much advertised as a summer and health resort because of its splendid hot and cold springs that are claimed to possess radioactivity. Indications are, however, that mining will again become the leading industry. In the "silver days," this town was lively: With the termination of high prices for silver, there came a slump. Owing to numerous shady mining deals that had disgraced the district, it was difficult, for a long time, to secure the attention of investors to its mineral merits. With interest again centering in the mining industry in general and the near-elimination of questionable financial practices, this district should thrive. Already several projects of significance have been financed. The McClelland Tunnel, started as a crosscut drainage, transportation and development adit toward the Lamartine part of the county and driven in about 1½ miles, has been newly re-financed and operations are about to resume. The Bellevue-Hudson, American Sisters, Boulder Nest, St. James, Tabor, Jo Reynolds and Commodore Tunnel are among other old properties that promise to resume operations in the near future.

SALT LAKE CITY—Dec. 16

Salt Lake Stock and Mining Exchange during November traded in 1,335,668 shares of stock, valued at $349,693; an increase of $109,662 over October. During 11 months of the year there were sold 15,461,931 shares of stock valued at $3,388,875 as compared with 3,387,020 shares valued at $693,472 during 1914.

A Sulphuric-Acid Plant is to be built in Salt Lake valley by the American Smelting and Refining Co. in the near future. The initial capacity is expected to be 100 tons per day, which can be increased as desired. Fumes from the smelters will be utilized. This crystallizes plans which have been under consideration for several years and have included almost every form of smoke consumer and utilizer.

Zinc Shipments continue from the Lakeview mining district on Promontory Point near Ogden. During November, the Lakeview Mining Co. made net earnings of $31,000, from the shipment of 19 cars of zinc ore, including four cars by lessees. This ore averaged 32% zinc. The first work as done in March of this year, and shipments were begun in May, from which time the property has been self supporting, and on a dividend-paying basis. In December eight cars or about 400 tons had been shipped up to the time that the dividend was paid.

WALLACE, IDAHO—Dec. 18

The Mineral Production of Idaho for the year 1914 was $24,976,706, and of this $23,607,604, or about 95% came from the Cœur d'Alene district in Shoshone County. State Mine Inspector Robert N. Bell, who spent several weeks in this district last month, estimates that the production this year will exceed $30,000,000. The large increase implied in his estimate will come largely from Cœur d'Alene mines, probably in about the same proportion as production in 1914. The tonnage for 1915 will probably not show much if any increase, the large increase in value being due to the high prices of lead and spelter. Two of the largest producers, the Hercules and the Morning, were shut down several months during the present year, otherwise there would have been a great increase in tonnage also. The dividend record for Cœur d'Alene mines will be far in excess of any year in the history of the district. Last year the total dividends amounted to $6,042,752 and was the highest record. This year dividends have now been declared amounting to $8,952,429. These figures are from official sources with the exception of the Hercules, which is estimated. The final figures will be in excess of $9,000,000 and possibly $10,000,000. Dividends for December already paid and to be paid before the first of the year amount to $1,377,985. This forecasts a Merry Christmas to many stockholders scattered all over the country and to thousands who receive good wages and steady employment through the operations of the mines.

The Golden Chest, in what is commonly referred to as the gold belt of the Cœur d'Alene district, has been the center of much interest the past few weeks. Many years ago the mine produced considerable gold, but questionable management and litigation long since forced it into idleness. The property has been quite extensively developed and has a 20-stamp mill. The company owns 37 patented claims and valuable water rights. After passing through many legal entanglements, the property is now owned by Samuel Green of New York. Mr. Green was here last week and coincident with his coming also appeared several mining engineers and geologists, all apparently bent upon examining the Golden Chest. There has been more or less mystery about the coming of these experts which time alone will solve. However, one highly interesting fact has been disclosed in connection with this famous old gold mine. In the old days when mining methods were more crude and less attention was given to careful analysis of ores, particularly free gold, much difficulty was experienced in saving the gold in Golden Chest ore on account of the heavy gangue, which was recognized as an unusual substance accompanying the quartz, but which no one appears to have taken the trouble to analyze. It is now learned that this troublesome stuff was scheelite (tungsten) and that it is found in combination with the quartz throughout the Golden Chest vein. Much of it was left in the stopes by the early day miners, while many tons went into the creek as tailings from the mill. At that time tungsten was worth about $300 per ton, while now, thanks to the war, it is worth over $3,000 per ton. This has infused new life into the long abandoned proposition. While Mr. Green was here he started men retimbering and generally repairing the underground works and tungsten ore is now being sacked for shipment. In addition to the tungsten, it is the opinion of capable mining men that under modern methods of mining and milling the Golden Chest may again come back as a gold producer.

BELLEVUE, IDAHO—Dec. 15

The Croesus Gold Mine has been taken over by a Spokane, Wash., group headed by Fred C. Robertson. Possession was given by Kilpatrick Bros., the owners, Dec. 1. This is the property purchased a year ago by Robert T. Tustin and associates, who contemporaneously with its purchase, also purchased the Old Vienna property. The bond was forfeited as to the Croesus, and the forfeit money abandoned, in favor of the Vienna property, on which property a large number of men have been working since early summer. The first car of ore from development, high-grade silver running as high as 1,500 oz. to the ton, is just now being loaded at Ketchum—the nearest railroad point.

The Old Red Elephant Mine, which was in early days one of the bonanza producers of the Bullion District, situated on the opposite side of the diorite flow whose eastern contract produced the famous Minnie Moore, Queen and other bonanzas in the '80s, struck the vein in the 2,600-ft. crosscut driven for the purpose. The pay streak was a few inches over 8 ft. wide—about one-third of the ore being first-class shipping, and the balance the regular grade of old Original Red Elephant mill rock. These ores average 70% lead and 130 oz. of silver. The Company celebrated the "melon" in Chicago last week, by ordering a 100-ton mill erected as soon as possible, together with a complete mining equipment. J. G. Sawyer is to be in charge of the work.

LOVELOCK, NEV.—Dec. 14

An Industrious Little Badger was unconsciously the cause, this week, of the discovery of a new antimony lead at Antelope Springs, about 25 mi. from here, which gives great promise. While digging his hole, the badger threw out small portions of float rich in antimony. J. H. Caustin noticed these specimens while prospecting. He made an investigation which resulted in the uncovering at the grass roots a lead that runs between 50 and 60% antimony. The vein is 5 ft. wide at the surface, and has been uncovered for a distance of 40 ft. Ten tons of this ore was removed in one day.

MORENCI, ARIZ.—Dec. 16

Strikers Held up and Searched two A. & N. M. trains few miles below Clifton last week. Contractors who had agreed to do Arizona Copper Co.'s assessment work were run out of town, although contractors offered wages that the strikers were asking for. If the union does not change its attitude about the assessment work the Detroit and Arizona companies will have 155 mining claims go by default.

LEAD, S. D.—Dec. 18

In the Black Hills, there has been comparatively little activity during the past year—except in tungsten, owing to the phenomenal rise in price of that metal. Several carloads have been shipped by Wasp No. 2 and one by Homestake, the latter being from the old Hidden Fortune ground. Selected high-grade ore as shipped is reported nearly 50% tungsten trioxide, but there is much of lower grade, and the Wasp is installing a concentrator to treat this. The ore is wolframite. No new deposits have been announced. The Wabel property near Hill City was sold during the year. Much prospecting has been done in a small way for other rare elements, but though molybdenum, vanadium, and uranium have all been found in the Hills, no occurrence of commercial importance is known. Changes at the Homestake consist in the remodeling of the B. & M. (or Old Abe) shaft, now equipped with a Nordberg hoist; an Edgemoor boiler plant supplies steam to this and a turbo-generator plant auxiliary to the Spearfish hydroelectric system, some current having hitherto been purchased. The Hanna pumping station has also been electrified. Metallurgical changes—in the direction of increasing the weight of stamps, using heavier heads, and casting mortars with open fronts and backs—have been made. Labor conditions are unchanged. The Homestake, following the practice of the past few years, has announced that a 7% addition to the year's wages will be paid to all employees on the December payroll. Trojan, Golden Reward, and Mogul continue running on the same scale as last year.

HIBBING, MINN.—Dec. 18

Shortage of Labor being keenly felt in this district. At the Bangor and Mohawk mines difficulty was experienced in securing enough men for third shift. Several hundred more men could be given full winter's work here this season. In Virginia District the situation is not so acute. Virginia & Rainy Lake Lumber Co. has established 17 camps, employing upward of 3,000 men, at wage increase of 50% over last season. The various mining companies centering at Virginia will keep 2,000 men at work through the winter, while an equal number are employed at Chisholm. Outlook is that labor costs will keep pace with advanced ore prices for 1916. With the European sources of labor closed, if the prediction of a 55,000,000-ton production is to be realized, it seems that laborer will participate in war profits.

TORONTO—Dec. 18

The King Dodds Vein, the discovery of which occasioned the Kowkash gold rush, has pinched out a few feet below the surface, according to information received at the Ontario Bureau of Mines. The report of Percy E. Hopkins, who investigated the district some weeks since, is stated to be satisfactory especially as regards other veins found further west along the line of the National Transcontinental Railway, but is not being published—as it was considered that sufficient development had not been carried on to permit examination as a basis for determining the extent of the orebodies.

There Is Much Complaining among the mining men of Manitoba as to the operation of the provincial mining law which requires a mining company to be on a dividend-paying basis before stock can be offered to the public. It is asserted that this provision makes it very difficult to secure capital for legitimate development purposes, and that it has the effect of giving the control to American capitalists, who buy up claims at a low price and organize companies in the United States. Prof. Wallace, of Manitoba University, who has been delivering a series of lectures on the gold deposits of the province, has made the suggestion that sales of stock in non-dividend-paying companies should be permitted on the condition that the money so secured should be placed in the hands of trustees, who would see that it was properly expended for the development and equipment of the mines.

The Mining News

ARIZONA

Cochise County

DRAGOON TUNGSTEN (Dragoon)—Arizona's biggest tungsten producer. Shipping 6 tons concentrates daily to reduction works at Rochester, N. Y.

Mohave County

ORPHAN (Secret Pass)—O. T. James is milling about 1 ton every 8 hr. with 2-stamp mill and is saving $10 per hour.

LEVIATHAN COPPER (Cedar)—Has shaft down 200 ft. and has opened up large deposits of ore, carrying copper and molybdenum.

AMERICAN MOLYBDENUM (Cedar)—Company has built oil flotation and concentration plant of about 25 tons capacity for experimentation purposes. Ore assaying from 2% to 25% in molybdenum has been found in shaft on 12-ft. ledge.

UNION BASIN (Golconda)—Operating Golconda mine, 20 mi. north of Kingman, has declared $85,000 dividend, second of the same size since present owner, N. L. Amster, of Boston, acquired control, June 1, 1915. Company is building oil flotation plant and an electric power line from Kingman. The main shaft is now 300 ft. deep.

Pima County

CALERO (Twin Buttes)—Green, Adams and Page have bought this mine and have begun to ship 4½% copper ore.

CACILLO (Tucson)—This property, 40 mi. west of Tucson, is reported bonded for $150,000. Julian Johnson has developed mine, hauling ore to Tucson for shipment to El Paso smelter.

MARY JANE (Nogales)—A. D. McGhan is building wagon road to this property, 14 mi. north of Nogales. He intends to drive tunnel into hill, which has several veins of gold, silver and copper on surface.

NEW VENTURE PLACER (Amado Station)—Company is taking out about 100 cu.yd. per day, average $1.25 per yd. Recently installed Clark dry machines. Property is 60 mi. southwest of Tucson and 20 mi. west of Amado. L. C. Friend, manager. Estimated 4,200 acres of gravel, averaging $1 per cu.yd. Papago Indians and Mexicans have known and worked placers for many years.

Yavapai County

MORE LOCATION NOTICES were filed in first 11 months of this year in Yavapai county than in whole of 1914. Up to first of December 1115 notices had been filed as compared with 850 for year 1914. November was record-breaking month exceeding all records since the spring of 1907.

COPPER QUEEN GOLD (Mayer)—Is preparing to resume operations after several months' idleness.

BLACK CHIEF (Prescott)—Plans for refinancing completed; active operations will begin at once. New pumping plant to be installed.

CALIFORNIA

Amador County

KELLY (Jackson)—Tunnel being retimbered at portal and other repairs being made. Property situated about 3 mi. south of Jackson; formerly operated by Owen Kelly. After his death property purchased by Charles Vicini.

JOE DAVIS (Amador City)—William J. McGee, United States subtreasurer, has secured control of property known as North California and Joe Davis Mines. Former directors resigned and following have been elected: W. J. McGee, Ralph McGee, C. R. Downs, Charles Gillis, Emma Parrow. Assessment of 5c. per share levied. Office of company removed to Sutter Creek.

Calaveras County

PIONEER CHIEF (San Andreas)—Three new transformers installed. Development showing good results; day and night shifts being worked. Joseph E. King is superintendent.

TULLOCH (Angels Camp)—Property taken over by Thomas Lane. Was formerly producer; been idle number of years. The 200-ft. shaft will be deepened to 800 ft.

ROBBERS ROOST (Nimshew)—Pay gravel is being worked and company has done large amount of development including construction of reservoir and drain tunnel half-mile long.

Eldorado County

GEORGIA SLIDE (Georgetown)—Property being developed under bond taken by Eastern men, represented by Robert E. Cranston, of San Francisco. Teams and motor-trucks are hauling in supplies. Air compressor and other machinery will be installed.

Inyo County

POWELL'S CAMP west of Randsburg is showing a great deal of activity. Roschl, Lawrence, Watchman, Sanderson and Powell are extracting large amounts of low-grade tungsten ore.

CERRO GORDO (Keeler)—Contract made with Southern Sierras Power Co. for electric power for mine and camp purposes. Transmission by pole line from Keeler.

SKIDOO (Skidoo)—An oil-fired boiler has been installed for heating cyanide solution.

Nevada County

GOLDEN CENTER (Grass Valley)—New hoist put in operation Dec. 1. The 10-stamp mill will be doubled and cyanide plant installed.

UNION (North Bloomfield)—Tunnel will be driven 40 ft. further where it will intersect bottom of old incline shaft that was sunk to gravel channel.

Sierra County

OXFORD-GOLD BLUFF (Downieville)—Aërial tramway being installed to transport ore from Oxford ground to Gold Bluff mill. Both mines operated by Cliff Leasing Co., of Salt Lake City.

TWENTY-ONE (Alleghany)—Following judgment for $25,000 and costs by Federal Court at San Francisco, in favor of U. S. Senator William Flynn, of Pittsburgh, Penn., against officers and stockholders, on charge of selling him "salted" mine, comes information of strike of bonanza ore of same character as that produced by Tightner, Oriental and other famous mines on same serpentine belt. F. M. Phelps in charge of operations.

COLORADO

Summit County

TONOPAH PLACERS (Breckenridge)—Is operating three boats full time.

FRENCH GOLD DREDGING (Breckenridge)—Operating the Reiling boat is making average recovery of $1,300 per day. When digging along south bank many good sized nuggets are found, while few are found on north bank, indicating apparently the chief enrichment came originally from mountains to the south.

IDAHO

Shoshone County

STANLEY (Burke)—Shipped car of gold-antimony ore from near surface. Driving crosscut to gain depth.

NORTHERN LIGHT (Pine Creek via Kingston)—Main shaft will be sunk 200 ft. from 200 level. Lead, zinc and silver have been found in upper levels. B. G. Harmon is manager.

NEVADA-STEWART (Pine Creek via Kingston)—Will be equipped with compressor and drills. Crosscut will be driven to cut vein at depth of 400 ft.

BIG CREEK LEASE (Kellogg)—W. R. Hughes is driving crosscut from Big Creek vein to Polaris vein, which traverses Yankee Boy ground as parallel vein system.

WISCONSIN (Moon Gulch)—Mine has been unwatered to 90-ft. level and crosscut started to vein, supposed to be about 50 ft. from shaft. After driving on this level, will sink to 200.

HIGHLAND-SURPRISE (Kellogg)—Alterations and additions to mill have been completed with exception of flotation plant, which will be completed by first of year, when regular shipments of concentrates will begin. Ore is lead-zinc and mine has large reserve.

NATIONAL (Mullan)—After two weeks try out, National mill now in good working order; running on full time. Was first in district to introduce flotation. New 1,200 level in ore of better grade than levels above. Ore is copper and management is quoted as stating that an average of 1½% will pay, although higher average is expected.

POLARIS (Kellogg)—Polaris Development and Mining Co. organized this week, preparing to begin operations on Polaris taken under bond. Was developed many years ago by drift and shaft 160 ft. deep. Ore is gray copper running high in silver; extensive shipments were made in early days. Three-mile wagon road has been rebuilt, new building erected, and compressor, hoist and pump ordered. Colonel W. E. Mann is in charge.

PATUXENT (Wallace)—Important strike made at depth of 550 ft. Property on Nine Mile joins Rex on north, being explored by crosscut from Rex tunnel No. 2. Vein proved to 50 ft. wide. Along hanging wall there is 6 ft. of lead-zinc ore about equally divided and of good milling grade. Control of Patuxent owned by James F. Callahan, original owner of Callahan mine and largest individual stockholder in Consolidated Interstate-Callahan.

MICHIGAN

Iron

VOLUNTEER (Palmer)—One hundred and fifty men now employed. One hundred and sixty thousand tons of ore sold for 1916 delivery.

ODGERS (Crystal Falls)—Shaft work started two weeks ago. Quicksand encountered at 15 ft. passed through successfully. Ledge struck at 26 ft. Rock drills are now being used. Believed that mine will be in shape for hoisting next summer.

SPEIS (Iron River)—This is name of new Cleveland-Cliffs Iron Co. property. Twelve forties are under option. Two have been leased. Shaft work will start shortly. Sixteen buildings to be erected. Contract has been awarded. Drilling was done three years ago. Good body of ore developed; lies 51 ft. below sand and gravel. Spur line being surveyed.

CLEVELAND-CLIFFS (Ishpeming)—Stockholders at a special meeting just held, authorized an increase in the capital stock from $5,000,000 to $10,000,000 and authorized directors to make disposition of the new stock, which they will do some time this year. Company resumed dividend payments in October after discontinuance about a year, the resumption being on a 10% basis. Stockholders have been notified of plan to issue $3,500,000 of collateral trust 6% bonds to reduce floating indebtedness and provide for future requirements.

MINNESOTA

D. & I. R. RY. (Two Harbors)—An appropriation has been made for the construction of new car and paint shops, 275x310 and 50x184 respectively. The changes are necessitated because of anticipated heavy tonnage of ore next season.

Duluth

CUYUNA-SULTANA (Ironton)—Planned to start stripping operations and construction of concentrator immediately after Jan. 1.

MINNESOTA STEEL (Duluth)—Actual steelmaking has begun at plant; operation thus far being confined to billets. Rail mill is ready for operation but is not being used.

FERRO (Manganese)—A 75x40 boiler house under construction, with space for four boilers. Compressor plant will have capacity for 15 drills. Company reports having contracted for sale of entire 1916 output, planned to be 150,000 tons.

Mesabi Range

HULL-RUST (Hibbing)—This pit produced 2,294,405 tons during past season, being leading producer in Lake Superior district.

MONTANA

Fergus County

BARNES-KING DEVELOPMENT (Kendall)—Estimated returns from 4,206 tons of ore treated at North Moccasin mine during November show $8.51 per ton. At Piegan-Gloster property near Marysville, 2,670 tons of ore treated during November, yielded $4.98 per ton.

Silver Bow County

BUTTE DULUTH (Butte)—Negotiations for sale of property are still going on.

BUTTE-ZENITH CITY (Butte)—Will begin unwatering 670-ft. shaft, and as soon as unwatered it will be sunk to 1,000-ft. level.

BUTTE & SUPERIOR (Butte)—Official estimate of net profits for current year $9,000,000 derived from concentrates approximating 150,000 tons. Working capital on Jan. 1, 1916, after payment of $2,200,000 in dividends, Dec. 31, should amount to $5,000,000.

DAVIS-DALY (Butte)—Annual report of company for year ended June 30, 1915, together with quarterly report for three months ended Sept. 30 of this year just issued. Operating charges for year were $204,455; total income $24,411; excess charges over income $180,043. Unofficial announcement made that receipts from ore for October and November will be between $35,000 and $40,000. Mining costs for these months estimated at less than $15,000. Faulted extension of Hesperus vein has been picked up, insuring addition of large orebody to the company's reserves.

NEVADA

Esmeralda County

GRANDMA (Goldfield)—As result of November annual meeting, it is announced that company will be reorganized for purpose of financing deep development. Ground lies east of Kewanas, north of Spearhead, and contiguous to both.

ATLANTA MINES (Goldfield)—Stoping above 1,580-ft. and 1,620-ft. levels continues to yield small tonnage of shipping ore while exposing considerable tonnage of lower grade ore not amenable to profitable treatment by present local milling facilities.

SANDSTORM-KENDALL (Goldfield)—Winze from long east crosscut on 500-ft. level, started on the vein, passed into foot wall at about 80 ft. and was continued to 200-ft. point where a station was cut. From here an east crosscut has progressed 120 ft. without encountering vein, indicating a decided flattening of vein between 500-ft. and 700-ft. levels.

FLORENCE (Goldfield)—Dumps leased to Nevada Metal Extraction Co., which will erect flotation plant on site of old Florence mill. New 75-ft. headframe is completed and in commission. Drifting is in progress on 250-ft. level for purpose of exploring old Reilly Lease and vicinity, while on 530-ft. level west crosscut will be driven beyond old Rogers-Syndicate lease.

NEVADA METAL EXTRACTION CO. (Goldfield)—Company formed of Nevada mining men for purpose of treating refractory ore by flotation process. Extensive tests on Goldfield base ores resulted in their acquiring three-years' lease on Florence dumps, estimated to contain 50,000 tons. Ground for 150-ton plant being cleared on site of old Florence mill; part of machinery is on ground. Expect to be running in February. F. A. Mead, superintendent.

Humboldt County

ROCHESTER MINES (Rochester)—Mill resumed operations after brief shutdown caused by disabling of freight engine on Nevada Short Line, which transports ore from mine to mill, a distance of about two miles.

Nye County

TONOPAH ORE PRODUCTION for week ended Dec. 11 was 10,114 tons; estimated value, $208,012, compared with 9,747 tons for week previous. Producers were, Tonopah Belmont, 3,133 tons; Tonopah Mining, 2,825; Tonopah Extension, 1,850; Jim Butler, 1,100; West End, 756; Halifax 128; North Star, 50; miscellaneous leases, 212 tons.

NORTH STAR (Tonopah)—In stope above 900 level, ore has narrowed and appears to be approaching cap rock, although considerable tonnage is still available. New stope has been started above 950-ft intermediate level on about 2½ ft. of good ore. Regular development continues on 850 and 1,250 levels.

MIDWAY (Tonopah)—At new shaft on 1,350 level, in drift 50 ft. off main north crosscut, winze has been started on vein. Will be put down to 1,450 level and vein crosscut at that point. Several sets of leasers continue operations in old workings and make frequent shipments of ore.

RESCUE-EULA (Tonopah)—Eula crosscut, projected to crosscut width of Eula claim on 950 level just east of endline of Occidental claim of Belmont company, being advanced about 40 ft. per week. Announced that shaft will be sunk additional 150 ft. to 1,100 level, where lateral work will be started, development continuing meanwhile on 950 level.

Storey County

MEXICAN (Virginia)—Advanced east and west crosscuts No. 2A on 2,500 and 2,700 levels, through porphyry and quartz of low assay value. Mexican mill treated 444 tons custom ore, average assay value $22.01 per ton.

OPHIR (Virginia)—Saved 361 cars of ore from Central tunnel stopes and shipped 320 tons to mill. Exploration continued and prospecting from southwest drift on 2,500 level discontinued. Jointly with Con. Virginia west crosscut on 2,700 level advanced 30 ft., to 141-ft. point through vein porphyry and quartz stringers.

NEW MEXICO

Grant County

ERNESTINE (Mogollon)—Has completed construction of new machine shop; and installation of centrifugal pump at mine.

BURRO MOUNTAIN COPPER (Tyrone)—Capitalization of company has been increased from $200,000 to $8,000,000. Preparations still being made for 1,000-ton mill.

BONNEY (Lordsburg)—John M. Sully, general manager of Chino Copper, Mr. Thorne, of Santa Rita, and F. R. Jones, of Silver City, have closed deal for this property and, it is understood, will begin development on large scale.

Lincoln County

PARSONS MINE (Parsons)—Supt. A. B. Anderson remodeling mill and installing new machinery. Power line will soon be finished and milling is to be started by next March.

Santa Fé County

SANTA FÉ GOLD AND COPPER (San Pedro)—J. H. Wood is working about 300 men and installing extensive machinery.

UTAH

Beaver County

BEAVER GOLD ZONE (Beaver City)—New hoist will be installed at 40-ft. shaft. A. E. Rykert is general manager.

MOSCOW (Milford)—Installation of new electric hoist has been completed, and shaft sinking from 800 to 1,100 level will soon be started.

RED WARRIOR (Milford)—Efforts being made to resume operations at this property near Moscow. Ore has been produced in past, but greater depth is needed.

MAJESTIC (Milford)—Stockholders have received statement from J. M. Dick, of Boston, president of company, giving settlement assays on 19 cars of ore recently shipped from the Old Hickory; these averaged 1½ oz. silver; 3% copper and 36% iron. Net operating profit for November was $2,450. Shaft at Hoosier Boy, being sunk below 400, has reached depth of 600 ft. Two shifts are working.

Juab County

TINTIC SHIPMENTS for week ended Dec. 10 amounted to 134 cars.

IRON BLOSSOM (Silver City)—Copper orebody below 900 is being developed.

Salt Lake County

UTAH COPPER (Bingham)—October production amounted to 16,004,607 lb. copper, which is the high record. Stripping operations being carried on at usual rate; according to D. C. Jackling these will be decreased rapidly within year.

Summit County

PARK CITY SHIPMENTS for week ended Dec. 10 amounted to 3,485,051 lb.; estimated value of $59,000.

SILVER KING CONSOLIDATED (Park City)—Shipments during the first 10 months of year averaged 48.67 oz. silver, and 29.7% lead.

NAILDRIVER (Park City)—Owns claims in eastern part of Park City district; has had its stock listed on Salt Lake exchange. Capitalization is 300,000 shares, par value $2, with 12,550 shares remaining in treasury. There is no indebtedness, and $5,000 cash on hand. W. Mont Ferry is president. Ore carrying silver, lead, copper and gold was shipped during 1903, 1904 and 1905. Six men are working.

Tooele County

BULLION COALITION (Stockton)—Drifting being done on 200 level to cut orebodies opened above Honorine tunnel. Electric pump recently installed; capacity, 600 gal. per min.

CANADA

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for the month of November, 1915. From Cobalt proper; Beaver, 111 tons; Buffalo, 61; Cobalt Comet, 65; Coniagas, 104; Crown Reserve, 101; Kerr Lake, 58; La Rose, 130; McKinley-Darragh, 161; Mining Corporation of Canada, Cobalt Lake, 92, Townsite City, 114; O'Brien, 25; Penn Canadian, 73; Peterson Lake, 130; Temiskaming, 88; from New Liskeard; Casey Cobalt, 42; total silver ore shipments, 1,409 tons; from Porquis Junction, Alexo Mine (nickel), 1,305 tons.

MEXICO

Durango

ESPERANZA (El Oro)—A. C. Savage has left El Paso with several carloads of cyaniding and other mining supplies for El Oro. Esperanza, which has been shut down for several months, is starting up.

The Market Report

Metal Markets

NEW YORK—Dec. 22

The outstanding feature of last week was the sharp advance in th eprice for copper. Lead and tin also advanced. Spelter too was stronger.

Copper, Tin, Lead and Zinc

Copper—About the beginning of our last week of record, domestic manufacturers, especially some who have ammunition contracts, began to exhibit signs of nervousness. The storm of Dec. 13-14 and the disorganization of telephone and telegraph communication throughout New England, and the consequent inability to keep in touch with the market, played a part in this. However, the basic factor was the manner in which numerous manufacturers let themselves go short of the market, having failed to contract for the metal that they needed for their own products already sold. These manufacturers required copper for early delivery and in the first quarter of 1916. When they attempted to cover their shorts they found that copper was not easy to get; they had to hunt for it. One of the largest producers was so well sold ahead that it had none to offer. Another one withdrew from the market pending the negotiation of a spectacular piece of business. With these conditions the price was driven up sharply on business that was in no way extraordinary. Having risen to the level of about 20c., r. t., the market opened at 19.95@20c. on Dec. 20 and closed on that day at 20¼c., r. t. On Dec. 21 the opening was at 20¼c., r. t., and the closing at 20½c., r. t. On Dec. 22 the market opened at 20½c., r. t., and before the end of the day sales were made at 20¾c., r. t., with leading producers then asking 21c., r. t. Sales in England were made at £97½@101½ during the week.

On Dec. 22 was announced the consummation of a spectacular transaction whereby the British government purchased 60,000 long tons of copper from two leading American producing interests for delivery during 1916. The price was in the neighborhood of 20c. This copper was taken for delivery month by month during 1916.

Copper Exports from the United States in the week ended Dec. 4 are reported by the Department of Commerce at 20,332,109 lb.; the larger items being 7,871,554 lb. to France; 6,098,675 lb. to Great Britain; 2,581,374 lb. to Russia and 1,725,041 lb. to Italy. Imports for the week were 104,951 lb. metal and 1,777,888 lb. in ore and matte; 1,882,839 lb. in all, chiefly from Chile and Canada.

Tin—On Dec. 16 the market rose sharply on news that the British government intended to curtail exports until such time as a safe working stock should be accumulated in Great Britain. When it was learned, however, that the idea of a safe stock was about 4,000 tons, about 75% of which was already on hand, the buyers here refused to become excited, and toward the end of the week the price declined a little.

Lead—Business in this metal was very active and about Dec. 20 independent producers began to be able to realize premiums over the price of the A. S. & R. Co. on good round lots. Inquiries became brisk with indications that further large business will be consummated. There was some gossip as to whether ammunition manufacturers might not be short of lead, as they were of copper. If that were the case, a sharp advance in price for lead might be looked for, the unsold stocks in the hands of producers being very small.

Spelter—This market was extraordinarily confused. Several producers reported an entire absence of demand and no business done. Others reported a considerable aggregate of transactions, representing a fair demand from galvanizers, and a larger demand from brass makers. The supply of metal available for prompt delivery is very small, although a moderate tonnage is to be had, of course at substantial premiums. In this position brokers and dealers are playing a considerable part, and producing much confusion. Sales of prompt spelter by producers were reported at 17@17¼c. The aggregate of these sales was, however, relatively insignificant. The bulk of the business done by producers last week was for first-quarter delivery, for which the average appeared to be about 15½c. in the early part of the week, and 15¾c. in the latter part. At the close first-quarter spelter was offered at 16c., while 15½c. was bid for it. On the other hand, smelters are free sellers of second-quarter spelter at 13@14c., without finding much interest in that delivery on the part of buyers. The situation may be summarized as follows: Prompt spelter is very scarce. Producers are pretty well sold for the first quarter of 1916, but still have liberal quantities to offer for that delivery, sales of which at present represent the bulk of the business. Most producers are eager sellers for the second quarter.

Arrivals at Baltimore for the week included 6,527 tons zinc concentrates from Port Pirie, Australia.

Zinc Sheets, base price remains at $22 per 100 lb. f.o.b. Peru, Ill., less 8% discount. Business has been steady, with good sales forward.

DAILY PRICES OF METALS IN NEW YORK

Dec	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Spot, Cts. per Lb.	Lead New York, Cts. per Lb.	Lead St. Louis, Cts. per Lb.	Zinc St. Louis, Cts. per Lb.
			19 45			5 30	14.50
16	4.7194	54⅛	@19.55	39	5.40	@5 32½	@16 50
			19 50			5 30	14 50
17	4 7188	54⅛	@ 19 55	40	5 40	@5 32½	@16 50
			19 70			5 30	14 50
18	4 7200	54⅛	@ 19 80	40	5 40	@5 32½	@16 50
			19 70		5 40	5 30	15.00
20	4.7194	54⅛	@ 20 00	40	@5 45	@5 32½	@16.50
			20.00		5 40	5 30	15.00
21	4 7225	54⅛	@ 20 25	39½	@5 45	@5 32½	@16.50
			20.25		5 40	5 30	15 00
22	4 7275	54⅛	@ 20 50	39	@5.45	@5.32½	@ 16 50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Dec.	Silver	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic £ per Ton	Copper Electrolytic Cts. per Lb.	Tin Spot	Tin 3 Mos.	Lead £ per Ton	Lead Cts. per Lb.	Zinc £ per Ton	Zinc Cts. per Lb.
16	25⅛	79½	79¼	97½	20.53	165	165½	28¼	6.06	90	18.96
17	25⅛	80½	81¼	98	20.65	167⅜	168½	28¼	6 05	90	18.95
18	26	..	.....	..	..	..	..	..	..	..	..
20	26 1/16	82⅜	83¼	99½	21.07	168½	169	28⅝	6 08	90	18 96
21	26 1/16	84¼	84¼	100½	21 18	167¼	168½	29	6 11	90	18 97
22	25⅛	82½	82½	100½	21 19	166	167	29	6 12	90	18 98

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21c.

Other Metals

NEW YORK—Dec. 22

Aluminum—The market is not so stiff, there being less pressure to buy, while supplies are a little better now, with a prospect of more to be had before long. Prices are a little easier, current quotations being 57@58c. for No 1 ingots, New York.

Antimony—The market shows little change from last week, but is not specially active. Quotations are a shade easier. Chinese and other ordinary brands are held at 38@39½c. per lb., according to size of order. Cookson's is scarce and such as is available is held at 55c per lb., New York.

In the "Journal" of Dec. 4 ordinary brands of antimony were quoted at 40c. per lb. for large lots, but it was mentioned that 42½c. had been named on some small business. Replying to an inquiry, we consider that the average price for antimony, ordinary brands, at that time was 40c., and so quote.

Quicksilver—The market is strong and active, sales being limited by supplies, which are still restricted. New York price is $130 per flask of 75 lb. for large orders, $135 per flask for smaller lots. San Francisco reports by telegraph an active market; sales earlier in the week at $115@120 per flask, with some dealers holding today at $130 per flask. London price is unchanged at £16 12s. 6d. per flask, with no discount from second hands.

Nickel—Business is good, with about the usual demand. Quotations for ordinary forms are 45@50c. per lb., according to size and terms of order. A premium of 5c. per lb. is charged for electrolytic nickel.

Gold, Silver and Platinum

NEW YORK—Dec. 23

Platinum—The market is excited and uncertain, supplies being still very limited and the future not all clear. It is difficult to fix prices, and dealers decline to make quotations except to regular customers. Sales are reported all the way from $90 up to $100 per oz. for refined platinum.

Our Russian correspondent writes that the market is very firm. A further increase of prices for the last fortnight is to be noted, partly owing to the rise in foreign exchange, partly in connection with the persistent demand both for internal markets and for abroad. Dealers abstain from sales, expecting yet higher prices. The quotations are: In Petrograd, 57,000@58,000 rubles per pood; at Ekaterinburg, 15 rubles per zolatnik, for crude metal, 83% platinum. These are equivalent to $56.40 and $56.35 per oz., respectively.

Silver has been fairly steady the past week. The approach of the holidays has brought on dullness in the general trading. Continental coinage demand may revive at any moment, and then there should be some improvement in price.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Dec. 18

The best price paid this week for 60% zinc ore was $88@100 per ton. The base price paid for 80% lead ore was $70 per ton. Shipments were curtailed by shortage of electric-drive power, occasioned by improvements being made at the central power plant of the Interstate Light and Power Co.

SHIPMENTS WEEK ENDED DEC. 18

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,999,000	566,400	463,300
Year	202,210,750	7,195,540	29,088,510

Shipped during week to separating plants, 3,604,000 lb. zinc ore.

JOPLIN, MO.—Dec. 18

Blende, high price, $106.60; base per ton, 60% zinc, premium ore, $105; medium, $104@95; lower grades down to $85; calamine, base 40% zinc, $70@65; average selling price, all grades of zinc, $90.30 per ton. Lead ore, high price, $74.40; base per ton 80% metal content, $70@73; average selling price, all grades of lead, $71.66 per ton.

SHIPMENTS WEEK ENDED DEC. 18

	Blende	Calamine	Lead	Values
Totals this week...	9,819,400	919,220	2,162,970	$562,300
Totals this year...	567,310,780	44,629,950	$9,263,810	$26,320,850

Blende value, the week, $455,420; 51 weeks, $22,737,530.

Calamine value, the week, $29,370; 51 weeks, $1,156,290.

Lead value, the week, $77,510; 51 weeks, $2,427,030.

Last week's week-end buying, with some early buying this week, on a little higher price level than the general price of last week, was sufficient to create an excitement that advanced premium ores this week $15 per ton. The purchasers of premium ore are looking ahead a little, too, as a vacation of two weeks during the holidays will be observed by producers of high-grade ores more certainly than by producers of medium- or lower-grade ores. A light tonnage is reported, mainly because general buying was so late.

Iron Trade Review

NEW YORK—Dec. 22

The iron and steel markets continue to show unprecedented activity for this season of the year. The mills are being pressed with orders which they will have much difficulty in filling in anything like the time wanted. Domestic business is increasing, while export orders, after hesitating for a time, are coming in again rapidly.

The pressure for materials for car building, ship building and structural work is becoming strong. Structural business, which was rather slow for a time, is increasing rapidly. Fabricators in the East have taken large contracts and are urging deliveries of steel to prevent delays.

The pig-iron market is strong and active. Foundries, which have not contracted far ahead are finding difficulty in getting iron except at an advanced price.

Freight congestion has been increased by bad weather and is presenting serious difficulties. Some furnaces have been hampered by trouble in getting coke as they need it.

Some progress has apparently been made with the organization of the new combination which is to include the Cambria Steel, the Lackawanna Steel and the Youngstown Sheet and Tube companies. Options have been taken on the stock, but no definite details has been given out. The Republic Iron and Steel Co. is not concerned in the merger.

Pig-iron production in Alabama in November is reported at 212,000 tons.

Iron and steel exports for which quantities are reported are given by the Bureau of Commerce in October at 351,251 long tons, against 147,293 tons in October, 1914. For the 10 months ended Oct. 31 the total so reported was 1,291,018 tons in 1914, and 2,818,679 tons in 1915; an increase of 1,527,661 tons.

PITTSBURGH—Dec. 21

In point of new buying finished steel products are much less active this week. While with such a rush to buy in the past few weeks, and mills now so thoroughly sold up, a decrease in activity was unavoidable, the sharpness of the decrease is attributed to the arrival of the holiday season. There is as great a disposition as ever to specify on current contracts, but the volume of this business is somewhat reduced, as many buyers had already specified their full quotas to Dec. 31.

Steel prices show as sharp an advancing tendency as ever. Wire products are up today $2 a ton, making nails $2.10. Bars, plates and shapes advanced last week from 1.70c., a price quoted by a few sellers on certain business, to a general minimum of 1.80c., and a further advance is predicted for early next month. Hoops are up $2 a ton to 2c., and black sheets a like amount, to 2.60c. for 28 gage.

The Pennsylvania R.R. has placed an embargo on all iron and steel destined east for lighterage at Jersey City or Waverly, while the movement to line consumers is greatly congested. The coal and coke movement east is largely embargoed. The Baltimore & Ohio restrictions are almost equally severe. Railroad officials who a few weeks ago expressed confidence that the situation would soon improve now admit that it is not only worse, but may grow still worse in the next two or three weeks, particularly if bad weather intervenes.

In the circumstances iron and steel shipments for export are practically cut off. The mills are shipping correspondingly more material to the domestic trade, which is very glad to have the additional material. Total shipments of steel for export, direct and indirect, probably represent no more than about 20% of the total shipments at the present time.

Pig Iron—Inquiry for pig iron is by no means heavy, but small buying sends prices upward. There have been small sales of bessemer at $19.50, with no $19 iron in sight, and most sellers holding for $20. In foundry iron $18 is no longer heard, and $18.50, which was done a fortnight ago in the case of some deliveries, is now the minimum. Several small sales of basic iron are reported at $18, the quotation named in last week's report. Producers evidently expect a shortage of pig iron, and are predicting much higher prices. Consumers have all covered to an extent, but some are expected to require additional tonnages through their consumptive requirements having increased. There is some inquiry for foundry iron for third quarter, for which delivery furnaces quote 50c. higher than for early delivery. We quote: Bessemer, $19.50@20; foundry, $18.50@19; gray forge, $18@18.50; malleable, $18

@18.50; basic, $18, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market is much stronger. At least one English producer is quoting $110 on contract, Baltimore, instead of $100, while some domestic producers quote as high as $125 on contract. Prompt lots generally bring $100@105. Consumers have been buying steadily in the past few weeks and are probably fairly well covered for the next six to nine months.

Steel—After several weeks of a practically nominal market in billets there have been open-market sales of ordinary soft openhearth billets to the extent of several thousand tons at $35, maker's mill, Pittsburgh district, $4 a ton above the nominal quotation which some mills have lately mentioned as probably representing the market. It would appear that more openhearth steel could be sold at $35. Bessemer billets are quotable at about $32. Sheet bars would not be offered at lower prices than billets, but sheet mills could not afford to pay such prices, and must be content with their contract tonnages, which cover them fairly well. Forging billets are $52@55 and rods nominally $40 at mill.

FERROALLOYS

Ferrosilicon is in demand and firm. For high-grade, 50% up, the quotation is $83@85 per ton at furnace in the Pittsburgh District. Bessemer ferrosilicon is also firm, prices varying from $28 at furnace for 10% up to $38 for 16% alloy.—**Ferrotungsten** remains high with some variations in price.—**Tungsten** metal is a little easier; a sale is reputed this week at $6.50 per lb. for a lot of 1,000 lb., 98% pure.—**Molybdenum** metal is reported sold at $1.50 per lb. Most of the metal now offered is high in sulphur, and good metal is scarce.

FOREIGN IRON TRADE

British Foreign Trade in Iron and Steel and in manufactures thereof 10 months ended Oct. 31, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£32,736,119	£8,853,825 Exp.	£23,882,294
Hardware, etc.	24,254,232	12,350 392 Exp.	11,903,840
Totals	£56,990,351	£21,204,217 Exp.	£35,786,134
Totals, 1914	79,449,681	21,524,575 Exp.	57,925,106

The total tonnage of iron and steel exported, 3,441,157 tons in 1914, and 2,640,569 tons in 1915; imported, 1,502,648 tons in 1914, and 995,297 tons this year.

Pig-Iron Production in Germany in October is reported by the German Iron and Steel Union at 1,076,343 metric tons; which is 40,265 tons more than in September and about two-thirds of the normal output. For the 10 months ended Oct. 30 the total make was 12,746,729 tons in 1914, and 9,741,871 tons in 1915; a decrease of 3,004,858 tons this year.

Steel Production of Germany nine months ended Sept. 30, as reported by the German Iron and Steel Union, in metric tons:

	Basic	Acid	Total
Converter	4,829,819	118,003	4,947,822
Open hearth	3,883,319	177,922	4,061,241
Direct castings	321,553	124,931	446,484
Crucible	.....	75,441	75,441
Electric	.....	87,262	87,262
Total	9,034,691	583,559	9,618,250
Total, 1914	11,716,855	508,022	12,224,877

The total number of works in operation on Sept. 30, or at any time during the nine months, was 231, against 242 last year.

Swedish Iron Production for the seven months ended July 31 is reported as follows:

	1914	1915	Changes
Pig iron	432,000	426,500	D. 5,500
Wrought iron blooms	78,300	65,200	D. 13,100
Converter steel	63,000	52,200	D. 10,800
Openhearth steel	254,800	282,400	I. 27,600

The production of finished iron and steel in all forms for the first half of 1915 was 218,300 tons.

IRON ORE

Some large sales of Eastern iron ore have been made, doubtless stimulated by the Lake activity. Among these are heavy sales of Port Henry ore at 8¼@9c. per unit, delivered, which is about 75c. per ton over last year. Some lump ore is reported sold at $4 per ton at mine. A good tonnage of other New York and New Jersey ores has been sold at 8¼@8¾c. per unit, delivered.

Of the total shipments of Lake iron ore in November, 4,308,295 tons, or 97%, went to Lake Erie ports.

Imports at Baltimore for the week were 8,650 tons manganese ore from India and 5,600 tons from Brazil.

Imports of manganese ore in the United States in September were 29,959 tons. For the nine months ended Sept. 30, the imports were 215,271 tons in 1914 and 173,992 tons in 1915; a decrease of 41,282 tons, or 19.2%, this year.

An interesting table, published by the "Iron Trade Review," gives the season prices of Lake Superior iron ore for 27 years. The highest quotations were in 1890, when Old Range ore brought $5.50 for bessemer and $5.25 for non-bessemer; no Mesabi ore was then being shipped. Since that year the highest prices were in 1899, when $5.50 was paid for Old Range and $4.50 for Mesabi bessemer; $4.20 for Old Range and $4 for Mesabi nonbessemers. Other high years were 1906 and 1909, when the rates were $5 for Old Range and $4.75 for Mesabi bessemers; $4.20 and $4 for nonbessemers. The rates for 1916 are higher than in 16 out of 27 years.

to foreigners as well as to Spanish subjects.

OTHER ORES

Some trial shipments of antimony ore have been made from Honduras to New York. The mine has been known for some time, but has been little worked on account of transportation difficulties. The ore shipped is mined in the vicinity of the interior village of Yoro and has to be transported six days by pack mule to the Sulaco River, thence two days by canoe down the river to Pimienta, where rail connection is made for Puerto Cortes.

Señor D. Domingo Orueta, who recently discovered in Spain deposits of platinum, chromium and nickel, has relinquished his claims to the Spanish Government. By royal decree, published Nov. 17 in the "Gaceta de Madrid," official organ of the Spanish Government, the territorial limits of the mines are defined. Concessions to exploit the mines are obtainable from the Spanish Government by foreigners as well as natives.

COKE

Coke production for the week in the Connellsville region is reported by the "Courier at 451,896 short tons; shipments, 451,175 tons. Shipments of Greensburg and Upper Connellsville districts, 40,967 tons. No material increase is probable until labor conditions improve.

Coal Production of Austria nine months ended Sept. 30, in metric tons:

	1914	1915	Changes
Coal mined	11,700,541	12,088,961	I. 388,420
Brown coal	18,337,727	16,367,481	D. 970,246
Coke made	1,771,938	1,374,770	D. 397,168
Briquettes made	301,763	345,797	I. 44,034

Of the briquettes reported this year 190,047 tons were made from brown coal, or lignite.

Chemicals

NEW YORK—Dec. 29

The general market is fairly active with rather a strong tone. Business is for the most part good for this season of the year.

Arsenic—Business is quiet, but very steady and there is no change. Prices are $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Stocks are low and some large producers are out of the market for the time being. The quotations are unchanged at $10 per 100 lb. for carload lots and $10.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Imports have been smaller recently and stocks not at all excessive. Prices continue firm at $3.20 per 100 lb. for spot and January; $3.15@$3.20 for futures.

Sulphuric Acid—The spot market is nominal with dealers' stocks very small. Large makers are in a position to name shipment figures and business is being booked for 1916, according to the "Oil, Paint and Drug Reporter." Contract shipments are quoted at $27@35 per ton in tanks for 60 deg., according to quantity and time of delivery. Contracts for 66 deg. $45@50 per ton for prompt, $37 per ton for first half of next year and $40 per ton over the year in tank cars. Smaller quantities in carboys command premiums according to size.

Imports and Exports of Fertilizing Chemicals in the United States nine months ended Sept. 30, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Kainit	229,041	6,646	...	...
Manure salts	157,710	13,647	...	...
Other potash salts	154,258	56,881	2,746	900
Nitrate of soda	430,136	669,383	7,384	16,846
Sulphate of ammonia	59,054	27,193	150	1,204
Phosphates	...	...	915,360	271,584

Exports include reëxports of foreign material. Some phosphates are imported, but are not given separately in the returns.

Assessments

Company	Delinq.	Sale	Amt.
Alpha, Nev	Jan. 5	Jan. 26	$0.03
Argenta, Ida	Dec. 20	Jan. 22	0.001
Basalt, Nev.,	Nov. 29	Dec. 30	0.0025
Beaver Butte, Utah	Dec. 11	Jan. 3	0.0025
Buffalo, Con., Utah	Dec. 18	Jan. 8	0.002
Cedar Creek, Ida	Dec. 30	Jan. 29	0.01
Clear Grit, Ida.	Dec. 14	Jan. 5	0.0015
Columbus Ext., Utah	Dec. 11	Jan. 3	0.02
Confidence, Nev.	Dec. 24	Jan. 14	0.10
Demijohn Cons., Nev	Jan. 7	Jan. 27	0.005
Dry Canon Cons., Utah	Dec. 18	Jan. 17	0.001
E. Hercules Ext., Ida. (post.)		Jan. 11	0.0015
Eureka M & M., Ida	Nov. 26	Dec. 27	0.001
Federal Ely, Nev.,	Dec. 16	Jan. 17	0.005
Four Timbers, Wash..	Dec. 24	Jan. 20	0.001
Golden State M & M., Calif	Dec. 6	Dec. 28	0.005
Hancock Cons., Mich.	Jan. 3		1.00
Hypotheek, Ida	Dec. 20	Jan. 20	0.005
Ida. & L. Angeles, Ida., (post.)		Jan. 27	0.005
Laclede, Ida....	Dec. 6	Dec. 27	0.003
Lucky Calumet Cop., Ida	Dec. 27	Jan. 28	0.005
Lynn Big Six, Nev.,	Nov. 30	Jan. 3	0.005
M & P Gold, Utah	Dec. 13	Jan. 3	0.0025
Murray Copper, Utah	Dec. 18	Jan. 10	0.001
Nevada-Anaconda, Utah	Dec. 29	Jan. 29	0.002
Nevada-Douglas, Nev	Nov. 30	Dec. 31	0.10
New Baltic, Mich	Jan. 15	....	0.50
Nyala Metals, Nev	Dec. 17	Jan. 8	0.01
Old Veteran, Ida	Jan. 6	Jan. 29	0.002
Oreano, Ida	Dec. 18	Jan. 18	0.001
Phoenix, Mich.	Jan. 1	....	1.00
Rescue Eula, Nev	Dec. 6	Jan. 10	0.01
Rio Grande Grub Stake, Utah	Dec. 25	Jan. 15	0.006
Seg. Belcher & Midas, Nev..	Dec. 12	Jan. 6	0.02
Selma, Utah	Dec. 15	Jan. 2	0.002
Sheba Gold, Utah	Dec. 6	Jan. 8	0.05
Sunset Dev., Ida	Dec. 8	Jan. 3	0.002
Tar Baby, Utah			0.005
Tarbox, Ida	Dec. 24	Jan. 15	0.003
Tintic Standard, Utah	Nov. 29	Dec. 27	0.005
Tonopah Midway, Nev.	Dec. 11	Jan. 11	0.01
Uvada, Utah	Nov. 22	Dec. 27	0.02
Utah-Arizona, Ariz	Dec. 14	Jan. 6	0.004
Victoria, Utah	Dec. 28	Jan. 29	0.01
Western Star, Ida	Jan. 10	Jan. 31	0.001
West Toledo, Utah	Dec. 16	Jan. 3	0.01

Stock Quotations

COLO SPRINGS Dec. 20 Name of Comp	Bid.	SALT LAKE Dec. 20 Name of Comp	Bid
Acacia	02	Beck Tunnel	.07½
Cripple Cr'k Con.	009	Black Jack.	.08½
C. K. & N.	‡ 02	Colorado Mining	.08
Doctor Jack Pot	09¼	Crown Point	.01
Elkton Con...	30¾	Daly-Judge	7.50
El Paso	76	Emma Cop	.17
Findlay	03½	Gold Chain	.60
Gold Dollar	‡ 02	Grand Central	.53
Gold Sovereign.	06	Iron Blossom	98
Golden Cycle	1 96½	Lower Mammoth	.05
Isabella	19	May Day	.18½
Jack Pot	.06¼	Opohongo	.00½
Jerry Johnson..	.04½	Prince Con	.79
Lexington	.005	Seven Troughs	.01¼
Mary McKinney..	44⅛	Silver King Coal'n	3.35
Pharmacist	005	Silver King Con	2.10
Portland	1.78¾	Sioux Con..	02½
Raven B. H....	.03	Uncle Sam	07½
Vindicator	1.96	Yankee	32½

SAN FRANCISCO Dec. 20			
Alta	10	Belmont	4.40
Andes	06	Jim Butler	1.00
Best & Belcher	04	Lone Star	03
Caledonia	40	MacNamara	03
Challenge Con	‡.04	Midway	15
Chollar	‡ 04	Mont.-Tonopah.	30
Confidence	12	North Star	14
Con. Virginia	17	Rescue Eula	07
Gould & Curry..	02	West End Con.	75
Hale & Norcross	03	Atlanta	21
Jacket-Cr. Pt.	15	Blue Bell	02
Julia	01	Booth	39
Mexican	26	C.O.D. Con	03
Occidental	75	Comb. Frac.	.06
Ophir	17	D'field Daisy	03
Overman	06	Jumbo Extension	1.17½
Potosi	‡ 02	Pitts.-Silver Peak	06
Savage	05	Round Mountain	40
Sierra Nevada	31	Sandstorm Kendall	07½
Union Con.	62	Silver Pick	05
Utah Con	‡ 01	Central Eureka	05

TORONTO Dec. 20			
Bailey	.05	Dome Exten	.39½
Chambers Ferland	.30½	Dome Lake	26
Coniagas	4.75	Foley O'Brien	‡.50
La Rose	65	Hollinger.	28.75
Peterson Lake	.36½	Imperial	04¾
Right of Way	05	Jupiter	18½
Seneca Superior.	.60	McIntyre	1.06
T. & Hudson Bay.	23.00	Porcu. Crown	.89
Temiskaming	60	Preston E. D.	06½
Trethewey	.16	Vipond	64
Wettlaufer-Lor	08	West Dome	15½

LONDON Dec. 5			
Alaska Tre'dwell	£6 12s 6d	Mexico Mines.	£4 3s 9d
Burma Corp..	1 13 9	Nechi, pfd.	0 12 6
Cam & Motor..	0 15 0	Oroville	0 14 3
Camp Bird	0 8 6	Santa Gert'dis	0 10 6
El Oro	0 10 3	Tomboy	1 4 0
Esperanza..	0 10 9	Tough Oakes	0 12 6

N. Y. EXCH. Dec. 20 Name of Comp.	Clg.
Alaska Gold M.	26½
Alaska Juneau	10½
Am.Sm.&Ref.,com	102
Am. Sm. & Ref., pf	111¼
Am. Sm. Sec., pf. A	88½
Am. Sm. Sec., pf. B	84½
Anaconda	86½
Batopilas Min.	3¾
Bethlehem Steel..	474
Bethlehem Steel, pf	145
Butte & Superior	65½
Chile Cop.	24
Chino	53¾
Colo. Fuel & Iron	51
Crucible Steel	73½
Dome Mines	28½
Federal M. & S.	28
Federal M. & S., pf.	52¾
Great Nor., ore., ctf.	48¾
Greene Cananea.	47½
Guggen. Exp.	77½
Homestake	121½
Inspiration Con.	44½
International Nickel	197
Lackawanna Steel.	81
Miami Copper.	33½
Nat'l Lead, com.	63½
National Lead, pf..	109½
Nev. Consol.	15½
Ontario Min	10½
Quicksilver	4½
Quicksilver, pf	4¾
Ray Con.	24¾
Republic I&S, com..	54½
Republic I&S, pf..	110½
Sloss-Sheffield	63
Sloss-Sheffield, pf	96½
Tennessee Copper..	57½
Utah Copper	78¾
U. S. Steel, com.	85½
U. S. Steel, pf.	116½
Va. Iron C. & C..	65

N. Y. CURB Dec. 20	
Alta Con	.15
Am. Zinc	66½
Beaver Con	41
Big Four.	05
Braden Copper.	16
Buffalo Mines	1.10
Butte & N. Y.	3
Butte C. & Z.	6½
Can. Cop. Corpn	2 1/16
Cashboy	07
Cerro de Pasco	37
Con. Ariz. Sm.	1¾
Con. Coppermines.	1½
Con. Nev.-Utah.	5/16
Dia. Black B.	03
Florence	38
Goldfield Con..	1 3/32
Goldfield Merger	15
Hecla Min	3½
Howe Sound	4½
Kennecott Cop.	52¾
Kerr Lake.	4½
Magma	15
Majestic.	1 1/16
McKinley-Dar-Sa	55
Mines of Am	3¾
Mother Lode	28
Nevada Hills	.19
New Utah Bingham	5
Nipissing Mines	7½
Oro	05
Ray Hercules	3¾
St. Joseph Lead	13¾
South Utah	37
Stand'd Oil of N.J.	554
Standard S. L.	1¾
Stewart	¾
Success.	.63
Tonopah	6 13/16
Tonopah Ex.	3⅞
Tonopah Merger.	.55
Tribullion	.75
White Knob, pf.	2
Yukon Gold	2¾

BOSTON EXCH Dec. 20 Name of Comp.	Clg.
Adventure	1½
Ahmeek	392½
Algomah.	1¾
Allouez	57½
Ariz. Com., ctfs.	7½
Bonanza	.35
Butte Alex. Scott	9½
Butte-Ballaklava	2½
Calumet & Ariz.	67½
Calumet & Hecla	540
Centennial	16½
Copper Range	57
Daly West.	3½
East Butte.	15½
Franklin.	9½
Granby	79½
Hancock..	15½
Hedley	29
Helvetia	40
Indiana	5
Island Cr'k, com.	48
Island Cr'k, pfd.	90
Isle Royale	27
Keweenaw	2¾
Lake.	18½
La Salle.	5
Mason Valley.	2½
Mass	11½
Mayflower	3¾
Michigan	1¾
Mohawk	89
New Arcadian.	9½
New Idria	10½
North Butte..	31½
North Lake.	2½
Ojibway.	1½
Old Colony.	3
Old Dominion	57
Osceola	85
Quincy	85½
St. Mary's M. L.	58
Santa Fe.	3¾
Shannon	7½
Shattuck-Ariz..	33¾
So. Lake	5¾
Superior	25
Superior & Bost.	2¾
Tamarack	48½
Trinity.	9¾
Tuolumne.	.33
U. S. Smelting	47½
U. S. Smelt'g, pf..	48⅞
Utah Apex	2¾
Utah Con	11½
Victoria	2½
Winona	3½
Wolverine	58
Wyandot	1¾

BOSTON CURB Dec. 20	
Bingham Mines.	8
Boston Ely..	.28
Butte & Lon'n Dev	33
Calaveras	2¾
Calumet-Corbin.	07
Chief Con.	1 3/16
Cortez	.45
Crown Reserve	.65
Davis-Daly	1½
Eagle & Blue Bell.	1¾
First Nat. Cop	6
Houghton Copper	2
Iron Cap Cop., pf	6¾
Mexican Metals	.36
Nat. Zinc & Lead	3¾
Nevada-Douglas.	.75
New Baltic	2¾
New Cornelia	‡9¾
Ohio Copper..	.20
Oneco	1
Raven Copper	.10
Rex Cons	.35
Smokey Dev.	.30
Tonopah Victor.	‡.35
United Verde Ext.	5½
Utah Metal	10¾

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	49.385	28.083	23.199	23.925
November	58.995	49.082	51.714	27.263	22.703	25.094
December	57.760	49.375	......	26.720	22.900	......
Year	59.791	54.811	.....	27.576	25.314	......

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

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Electrolytic 1914	London Electrolytic 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March.	14.131	14.787	64.276	66.152	69.170	*
April.	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October..	*	17.686	‡	72.601	‡	88.000
November.	11.739	18.627	53.227	77.744		93.273
December.	12.801		56.841		*	..
Year	....		......		......	.....

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33.080	‡	151.554
November	33.304	39.224	139.391	167.670
December	33.601	..	147.102	.
Av. year	34.301		....	..

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.603	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3.384	4.499	‡	23.994
November	3.683	5.155	3.586	5.078	18.500	26.278
December	3.800	....	3.662	......	19.097	..
Year	3.862	...	3.737	......	......	....

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	12.800	4.750	12.596	‡	66.536
November	5.112	15.962	4.962	15.792	25.016	88.409
December	5.592		5.430	....	27.369	....
Year	5.213	.....	5.061	....	....	....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59	18.26	13.43	17.30	13.83	17.20
December	14.70	......	13.45	......	13.83	......
Year	$14.88	......	$13.78	......	$14.01	......